TORONTO

City of Toronto
Pedestrian Collision Study

Transportation Services Division
Traffic Data Centre and Safety Bureau

January 2007

EXECUTIVE SUMMARY

Pedestrian safety is a primary concern for the city of Toronto (City). In order to increase safety for pedestrians, we need to better understand pedestrian/motor vehicle collisions.

To determine the patterns and the trends, the City undertook this pedestrian/motor vehicle collision review to identify the most common types of collisions that occur between pedestrians and motor vehicles.

The source of the collision information used for this study was from Motor Vehicle Accident Reports (MVARs) provided by the Toronto Police Service and compiled in the City's collision database (CRASH). The MVARs were manually reviewed to develop the database for this study. For the purposes of this study, 4,775 pedestrian/motor vehicle collisions from 2002 (2,428) and 2003 (2,347) have been analyzed.

Findings - Global Review

When considering the various variables – age, gender, weather and time of collision – some significant trends emerged:

- 83% of pedestrian/motor vehicle collisions resulted in either minimal or minor injuries.
- 12% of pedestrian/motor vehicle collisions resulted in major injuries or fatalities.
- Pedestrians within the age of 15-54 were more involved in pedestrian/motor vehicle collisions.
- 50% of fatalities in pedestrian/motor vehicle collisions were seniors (aged 65+).
- 72% of pedestrian/motor vehicle collisions involved male drivers versus 28% for female drivers.
- Pedestrian/motor vehicle collisions occurred at a higher frequency during rush hour periods.
- Pedestrian/motor vehicle collisions occurred most during weekdays (Tuesday to Friday).
- Pedestrian/motor vehicle collisions occurred most during the autumn and winter seasons.
- Pedestrian/motor vehicle collisions occurred more often in the downtown area.

- Pedestrian/motor vehicle collisions occurred more often along arterial roads.
- Pedestrian/motor vehicle collisions distributed as follow: at intersections (47%), at non-intersections (37%), and other/unknown (16%).
- Relatively equal distribution of pedestrian/motor vehicle collisions between locations with and without traffic control devices.

Findings – Collision Types

A key requirement of this study is to develop a collision type system, known as a typology, to classify the collisions into specific types, based on a sequence of events or actions. Below is a list of the collision types developed in this study:

Table A – Pedestrian Collisions Percentage by Collision Types (Two-Year Combined)

	2002+2003	
Collision Types	**# of Cases**	**%**
Intersection		
1. Vehicle turns left while pedestrian crosses with right-of-way at intersection	632	13%
2. Vehicle turns left while pedestrian crosses without right-of-way at intersection	196	4%
3. Vehicle turns right while pedestrian crosses with right-of-way at intersection	422	9%
4. Vehicle turns right while pedestrian crosses without right-of-way at intersection	117	2%
5. Vehicle is going straight through intersection while pedestrian crosses with right-of-way	232	5%
6. Vehicle is going straight through intersection while pedestrian crosses without right-of-way	654	14%
Total at Intersection	**2,253**	**47%**
Non-Intersection		
8. Pedestrian hit at mid-block location	1,042	22%
9. Pedestrian hit at private driveway	347	7%
10. Pedestrian hit at pedestrian crossover (PXO)	232	5%
11. Pedestrian hit on sidewalk or shoulder	163	3%
Total at Non-Intersection	**1,784**	**37%**
Other / Unknown		
55. Pedestrian hit in parking lot	508	11%
99. Other / Unknown	230	5%
Total at Other/Unknown Category	**738**	**16%**

The five most frequent collision types are as follows:

1. Pedestrian hit at mid-block location (Type 8)
    - 22% of all pedestrian/motor vehicle collisions
    - 95% of drivers had the right-of-way
    - Injuries were slightly more severe in this collision type than other collision types

- Weather and road conditions were not a major factor
- Higher frequency of collisions occurring during the month of June than other months

2. Vehicle is going straight through intersection while pedestrian crosses without right-of-way (Type 6)
   - 14% of all pedestrian/motor vehicle collisions
   - Injuries were slightly more severe in this collision type than in other collision types
   - The female pedestrian age groups of 25-54 and the driver age group of 65+ were under-represented in this collision type
   - Male pedestrians between the ages of 15 to 24 were over-represented
   - The after-school hours tended to be over-represented

3. Vehicle turns left while pedestrian crosses with right-of-way at intersection (Type 1)
   - 13% of all pedestrian/motor vehicle collisions
   - Rain and wet road conditions were relatively frequent variables
   - Winter months tended to be over-represented
   - This collision type occurred more frequently in the morning (6-7 a.m., 9-10 a.m.) and evening hours (8-9 p.m., 10-11 p.m.) than other types

4. Pedestrian hit in parking lot (Type 55)
   - 11% of all pedestrian/motor vehicle collisions
   - Injury severity tended to be minimal
   - This collision type occurred more frequently on Saturdays
   - 10 a.m. – 5 p.m. tended to be over-represented

5. Vehicle turns right while pedestrian crosses with right-of-way at intersection (Type 3)
   - 9% of all pedestrian/motor vehicle collisions
   - Male pedestrians age 75+ and female pedestrians age 15 to 19 were slightly over-represented
   - This collision type occurred more frequently at 9-10 a.m.

- Mondays tended to be over-represented

Driving is a multi-tasking job that requires extra attention. Often, motorists and pedestrians are not paying full attention when using the road network. Such inattentive behaviour can be a contributing factor in many pedestrian/motor vehicle collisions. Such is the case of when the motorists need to perform turning movements (e.g. turning left at the intersection), drivers tend to pay more attention to the oncoming traffic rather than looking for pedestrians crossing in the crosswalk.

Visibility is another variable that may be a contributing factor in pedestrian/motor vehicle collisions. The visibility issues can be caused by a range of actions such as, motorists driving during sunrise/sunset, inclement weather conditions such as rain and snow; pedestrians crossing from between parked cars, buildings or other obstructions; and pedestrians wearing dark clothing. All these actions can impede the driver's ability to spot crossing pedestrians, as well as the pedestrian's ability to react to approaching vehicles.

Safety Programs

A list of past/current pedestrian safety programs includes the following:

- 2002 Toronto Pedestrian Charter
- New City of Toronto Official Plan
- $20 million sidewalk construction
- Implementation of 17/year Audible Pedestrian Signals
- Conversion of 61 pedestrian crossovers to traffic signals
- Enhancements of 269 pedestrian crossovers (signs, pavement markings, and illumination)
- Installation of pedestrian countdown signals
- Installation of zebra crosswalk pavement markings at all signalized intersections
- "We're All Pedestrians" education campaigns
- "School Crossing Guard" program
- Toronto Police Services safety enforcement campaigns

The analysis described in this report can aid in the design, development and implementation of current and future safety programs to reduce pedestrian/motor vehicle collisions. Reducing pedestrian/motor vehicle collisions will require a comprehensive approach employing engineering, education and enforcement with the focus on both drivers and pedestrians.

TABLE OF CONTENTS

TABLES

FIGURES

1. INTRODUCTION

Safety of all road network users is a primary concern for the city of Toronto. Pedestrian safety is of particular concern since everyone is a pedestrian.

Annually, over 65,000 collisions occur within the city. Pedestrian/motor vehicle collisions make up approximately 3.5% of the total number of collisions. This is equal to an average of 2,300 pedestrian/motor vehicle collisions occurring yearly within the city. However, over half of the persons killed in collisions are pedestrians.

Our goal is to reduce the number and severity of collisions that occur within the city, including pedestrian/motor vehicle collisions. In order to increase safety for pedestrians and other road network users, we need to better understand why the collisions occur.

To determine the patterns and the trends, the City's Transportation Services Division undertook this pedestrian collision study to identify the most common types of collisions that occur between pedestrians and motor vehicles.

This report describes the technical procedures, and presents the analytical results. The study includes (1) a collection of data on vehicle and pedestrian collisions, and (2) identification of collision types and analysis of collision patterns.

Chapter 2 provides some background information on the increasing public concern about pedestrian safety in Toronto. **Chapter 3** describes the research approach, from data collection and collision type identification, to statistical analysis processes. **Chapter 4** summarizes the key findings of the results regarding all the pedestrian/motor vehicle collisions in Toronto. **Chapter 5** highlights the findings of each collision type individually. Appendix A includes the more detailed analysis results, collision configuration diagrams, and maps showing the spatial distribution for each collision type identified.

2. BACKGROUND

On average, about 2,300 pedestrian/motor vehicle collisions occur in the city of Toronto every year. These collisions represent about 3.5% of all motor vehicle collisions that occur in the city. In 2003, 74 traffic-related fatalities occurred, of which 43 were pedestrian related.

Table 1 – Pedestrian Fatalities and Injuries in Toronto (1994-2003)

Year	Fatal	Personal Injury	Total Pedestrian – Vehicle Collisions
1994	31	2,328	2,268
1995	37	2,350	2,281
1996	46	1,932	2,090
1997	40	1,939	2,277
1998	39	2,185	2,239
1999	45	2,073	2,068
2000	26	2,370	2,382
2001	32	2,455	2,484
2002	50	2,397	2,428
2003	43	2,326	2,347
Average	**39**	**2,236**	**2,286**

Table 1 shows that the number of pedestrian-related fatalities and injuries has been relatively constant over the past decade. The probability of a pedestrian being injured or killed is very high when pedestrian/motor vehicle collisions occur. Thus, it is paramount for us to understand the causes of these collisions. Ultimately, this information can be used to help improve our current transportation road network so that pedestrians and vehicles can share the roadway more safely.

2.1. Road Users Responsibilities under the Highway Traffic Act

The Highway Traffic Act has set out many rules for drivers and pedestrians, as there is a shared responsibility by drivers and pedestrians. Drivers have an obligation to have care and control of their vehicles as mandated by the Highway Traffic Act and properly respond to the presence of pedestrians. Also, pedestrians have an obligation to only enter the roadway when permitted by a traffic control device or in other locations only when it is safe to do so and is practical for drivers to yield the right-of-way.

There are two basic options facing a pedestrian when crossing the roadway. They can either cross the road at an uncontrolled location or walk to the nearest location with a traffic control device and cross from there. Under Section 1 of the Highway Traffic Act, a crosswalk is defined as either “the extension of the lateral lines of the sidewalks on opposite sides of a roadway or a location at the intersection; or, is any portion of a roadway at the intersection or elsewhere distinctly indicated for pedestrian crossing by signs or by lines or other markings on the surface.” The safety of any type of pedestrian crossing location is dependent upon the recognition of the dual responsibility for safety that is shared among pedestrians and drivers.

Many sections in the Highway Traffic Act set out the rules and penalties for drivers to follow; one must also recognize that many sections also set out rules-of-the-road for pedestrians. For instance, there are rules for pedestrians to cross at pedestrian crossovers (also known as crosswalks) in section 140(4), that is, “no pedestrian or person in a wheelchair shall leave the curb or other place of safety at a pedestrian crossover and walk, run or move the wheelchair into the path of a vehicle or street car that is so close that it is impracticable for the driver of the vehicle or street car to yield the right of way.” Also, there are rules for pedestrians at the traffic signal. According to the Highway Traffic Act, in section 144(22), it clearly states that “where portions of a roadway are marked for pedestrian use, no pedestrian shall cross the roadway except within a portion so marked.” In section 144(28) of the Highway Traffic Act, “every pedestrian who lawfully enters a roadway in order to cross may continue the crossing as quickly as reasonably possible despite a change in the indication he or she is facing and, for purposes of the crossing, has the right-of-way over vehicles.” **Table 2** provides a list of a few other rules for pedestrians as indicated in the Highway Traffic Act.

Table 2 – List of Rules for Pedestrians in the Highway Traffic Act

Section	Descriptions
Pedestrians at Pedestrian Crossover	
140(4)	No pedestrian or person in a wheelchair shall leave the curb or other place of safety at a pedestrian crossover and walk, run or move the wheelchair into the path of a vehicle or street car that is so close that it is impracticable for the driver of the vehicle or street car to yield the right of way.
Pedestrians at Traffic Signal	
144(22)	**Pedestrian crossing** Where portions of a roadway are marked for pedestrian use, no pedestrian shall cross the roadway except within a portion so marked.
144(24)	**Pedestrian – stopping at flashing green light** No pedestrian approaching a traffic control signal and facing a flashing circular green indication or a solid or a flashing left turn arrow indication in conjunction with a circular green indication shall enter the roadway.
144(25)	**Pedestrian – stopping at red or amber light** No pedestrian approaching a traffic control signal and facing a red or amber indication shall enter the roadway.
144(27)	**Pedestrian control signals – don't walk** No pedestrian approaching pedestrian control signals and facing a solid or flashing "don't walk" indication shall enter the roadway.
144(28)	**Pedestrian right of way** Every pedestrian who lawfully enters a roadway in order to cross may continue the crossing as quickly as reasonably possible despite a change in the indication he or she is facing and, for purposes of the crossing, has the right-of-way over vehicles
Pedestrians walk along the roadway	
179(1)	**Duties of pedestrian when walking along highway** Where sidewalks are not provided on a highway, a pedestrian walking along the highway shall walk on the left side thereof facing oncoming traffic and, when walking along the roadway, shall walk as close to the left edge thereof as possible.

2.2. Goals/Objectives of the Study

Every year the City's Transportation Services Division and Toronto Police Service (TPS) run a number of safety campaigns geared towards pedestrian safety. These campaigns promote pedestrian safety and educate the public about pedestrian safety.

While there have been a number of successful pedestrian safety campaigns (see **Section 6.2** for a listing of safety programs), the average number of pedestrian/motor vehicle collisions has not changed from year to year.

The goal of this study is to better understand why pedestrian/motor vehicle collisions are occurring. To do this, the City's Transportation Services Division decided to investigate these collisions. The approach was to develop and apply a pedestrian/motor vehicle collision typology

analysis, resulting in the identification of the more predominant pedestrian/motor vehicle collision types. The outcome of this study could be used to develop the future safety programs to reduce the number and severity of pedestrian/motor vehicle collisions.

3. RESEARCH METHODS

3.1. Data Collection

The City of Toronto maintains a database containing information on police-reported motor vehicle collisions that occur within the city boundaries. The collision database lists the date, time, and location of each incident, the age of the parties involved, the severity of any injuries sustained, as well as other basic information. Collision report numbers (ACCNB) are uniquely assigned to each entry, allowing for electronic retrieval of the associated Motor Vehicle Accident Report (MVAR). Most MVARs contain a diagram depicting the configuration of the collision and a brief synopsis of the sequence of events, written by the investigating police officer. Such information is vital to the analysis of each collision.

For the purpose of this study, collisions from the years 2002 and 2003 were analyzed. Based on the City's collision database, 2,428 pedestrian/motor vehicle collisions occurred within the city and were reported to Toronto Police Service in 2002. In 2003, 2,347 pedestrian/motor vehicle collisions were reported to the Toronto Police Service.

3.2. Collision Type Identification

A collision typology is a system for the classification of collisions into specified types to allow for comparative analysis of common characteristics.

Since little information on the sequence of events leading up to the collision can be obtained from the database, the diagram and accompanying description on the MVARs were reviewed to gain a better understanding of the potential causative factors and also which pedestrian/motor vehicle collision type that the MVAR would then be categorized into.

There are a number of previous studies that have focused on pedestrian/motor vehicle collisions. Federal Highways Administration (FHWA) released a report titled "Pedestrian and Bicycle Crash Types of the early 1990's" in 1996, and the City released a report titled "City of Toronto

Pedestrian Collision Pilot Project" in March, 2001. Most recently, the FHWA released a "Pedestrian Facilities Users Guide – Providing Safety and Mobility" in March, 2002.

In the late 1990s, Ryerson University was retained to do a pilot project on pedestrian/motor vehicle collisions. This project used the FHWA study of 1996 and the information available in the City's collision database as a basis for development of the pedestrian/motor vehicle collision typology. The defined pedestrian/motor vehicle collision types from the Ryerson Study were used as the foundation for this review. The collision typology developed for the Ryerson Report included 28 collision types under 8 groups. The typology is shown in **Table 3**.

Table 3 – Collision Types – Ryerson University Study

Type 1 – vehicle turning left at intersection
1.1 Vehicle turns left while pedestrian crosses with right-of-way at signalized intersection
1.2 Vehicle turns left while pedestrian crosses without right-of-way at signalized intersection
1.3 Vehicle turns left from major road while pedestrian crosses with right-of-way at stop controlled intersection
Type 2 – vehicle turning right at intersection
2.1 Vehicle is making right-turn-on-red while pedestrian crosses with right-of-way on near approach
2.2 Vehicle is making right-turn-on-red while pedestrian crosses with right-of-way on adjacent approach
2.3 Vehicle turns right with green signal while pedestrian crosses with right-of-way on adjacent approach
2.4 Vehicle turns right with green signal while pedestrian crosses without right-of-way on adjacent approach
2.5 Vehicle turns right from major road while pedestrian crosses with right-of-way at stop controlled intersection
Type 3 – vehicle going through intersection
3.1 Vehicle is going straight through signalized intersection while pedestrian crosses without right-of-way
3.2 Vehicle is going straight through signalized intersection while pedestrian crosses with right-of-way
3.3 Pedestrian crosses with right-of-way at stop controlled intersection
3.4 Pedestrian crosses without right-of-way at stop controlled intersection
3.5 Vehicle strikes pedestrian running onto roadway at signalized intersection
Type 4 – standing pedestrian
4.1 Standing Pedestrian hit at mid-block location
4.2 Standing pedestrian hit at private driveway / shoulder
4.3 Pedestrian struck at intersection
4.4 Standing pedestrian hit by backing vehicle
Type 5 – not on road
5.1 Vehicle strikes pedestrian in parking lot
5.2 Pedestrian struck at private driveway
5.3 Vehicle strikes pedestrian on sidewalk or shoulder
Type 6 – walking along / against traffic
6.1 Pedestrian walking on roadway against traffic at mid-block location
6.2 Pedestrian walking on roadway along traffic at mid-block location
Type 7 – vehicle strikes pedestrian at mid-block
7.1 Vehicle strikes pedestrian boarding / alighting vehicle
7.2 Vehicle strikes pedestrian coming from behind parked vehicle or object
7.3 Vehicle strikes pedestrian at mid-block crossing without right-of-way
7.4 Vehicle strikes pedestrian crossing with right-of-way with school guard on duty
Type 8 – vehicle strikes pedestrian at crossover
8.1 Pedestrian is crossing marked crosswalk without right-of-way
8.2 Motorist strikes pedestrian at crossover crossing with right-of-way

Table 3 shows the breakdown of collision types that were developed by Ryerson University. After reviewing the City data, it became apparent that the collision reports provided by Toronto Police Service had insufficient detail to allocate collision events into the very specific 28 collision types developed by Ryerson. Therefore, it was not possible to use the full 28 collision types identified by Ryerson. Rather, 12 collision types were identified from 95% of the MVARs which describe the collision impact and the parties involved with a great level of confidence. The collision types that were identified for this study are shown in **Table 4**.

Table 4 – Revised Collision Types – Pedestrian Collision Typology Study 2004

Intersection	
1.	Vehicle turns left while pedestrian crosses with right-of-way at intersection
2.	Vehicle turns left while pedestrian crosses without right-of-way at intersection
3.	Vehicle turns right while pedestrian crosses with right-of-way at intersection
4.	Vehicle turns right while pedestrian crosses without right-of-way at intersection
5.	Vehicle is going straight through intersection while pedestrian crosses with right-of-way
6.	Vehicle is going straight through intersection while pedestrian crosses without right-of-way
Non-Intersection	
8.	Pedestrian hit at mid-block location
9.	Pedestrian hit at private driveway
10.	Pedestrian hit at pedestrian crossover (PXO)
11.	Pedestrian hit on sidewalk or shoulder
Other / Unknown	
55.	Pedestrian hit in parking lot
99.	Other / Unknown

Note: Type 7 (Pedestrian hit at mid-block location with right-of-way) and Type 8 (Pedestrian hit at mid-block location without right-of-way) were combined into one type (Type 8 – Pedestrian hit a mid-block location), due to Type 7 consisted of a very small percentage of the whole sample size.

In order to test the application of 12 collision types, 200 pedestrian/motor vehicle collisions were reviewed and categorized. Once the pedestrian/motor vehicle collision types had been tested for applicability, an additional 200 pedestrian/motor vehicle collision MVARs were then reviewed to confirm the suitability of the identified pedestrian/motor vehicle collision types.

4,775 collisions with pedestrian involvement were then reviewed and categorized according to the identified pedestrian/motor vehicle collision type. The existing collision database provided information on locations where the collisions occurred (e.g. intersection, mid-block, etc.), when they occurred (e.g. time of day, day of week, etc.), and the pedestrians that were involved (e.g. age and gender, injury severity level, etc.)

Collision Types 1 to 6 are intersection-related collisions that involved pedestrians. For the purpose of this report, an intersection is defined as including cross streets with or without traffic control devices (traffic signal, stop sign or yield, etc.) and within a 20-metre radius of the intersection. Collision Types 8 to 11 and 55 are non-intersection-related (e.g. mid-block, driveway, sidewalk, etc.). Collision type 99 included collisions that did not fit into any of the predefined categories. A description of each collision type is discussed in **Chapter 5**.

Approximately 230, or 5%, of the MVARs reviewed did not have enough information to accurately attach a collision type to them; therefore they were placed in category 99.

3.3. Statistical Analysis Processes

The statistical analysis process involved a 3-step approach. First, a macro analysis of the entire collision data set was undertaken to identify any potential causative factors, trends or characteristics that may exist. Second, a micro analysis for each collision type was also analyzed for potential causative factors, trends and characteristics. Third, each collision type (micro) was compared against the entire data set (macro) to determine over- or under- representation.

Variables investigated included the severity of injury, age and gender of involved persons, road and weather conditions, and time of the collision. The analysis was undertaken in two parts. Part one involved examining the characteristics of the whole sample. Specifically, looking for global causes of the collisions. The results are detailed in **Chapter 4**. Part two involved categorizing the collisions into the pedestrian-vehicle types and then analyzing each type. These results are detailed in **Chapter 5**.

By analyzing the severity of injury of the persons involved, we have the ability to identify which collision category is the most hazardous to pedestrians. Age and gender provide a profile of the age groups most often involved. Road and weather conditions also have the potential to provide valuable insight into why pedestrian/motor vehicle collisions occur. The time that a collision occurred also provides valuable links to determine correlations between time-of-day, day-of-week, and the occurrence of collisions.

The main focus of our analysis is to compare the characteristics of the different collision types with the characteristics of the whole sample. The analysis was facilitated by the use of a series of histograms (bar charts) to compare the distribution of particular variables among different sub-sets.

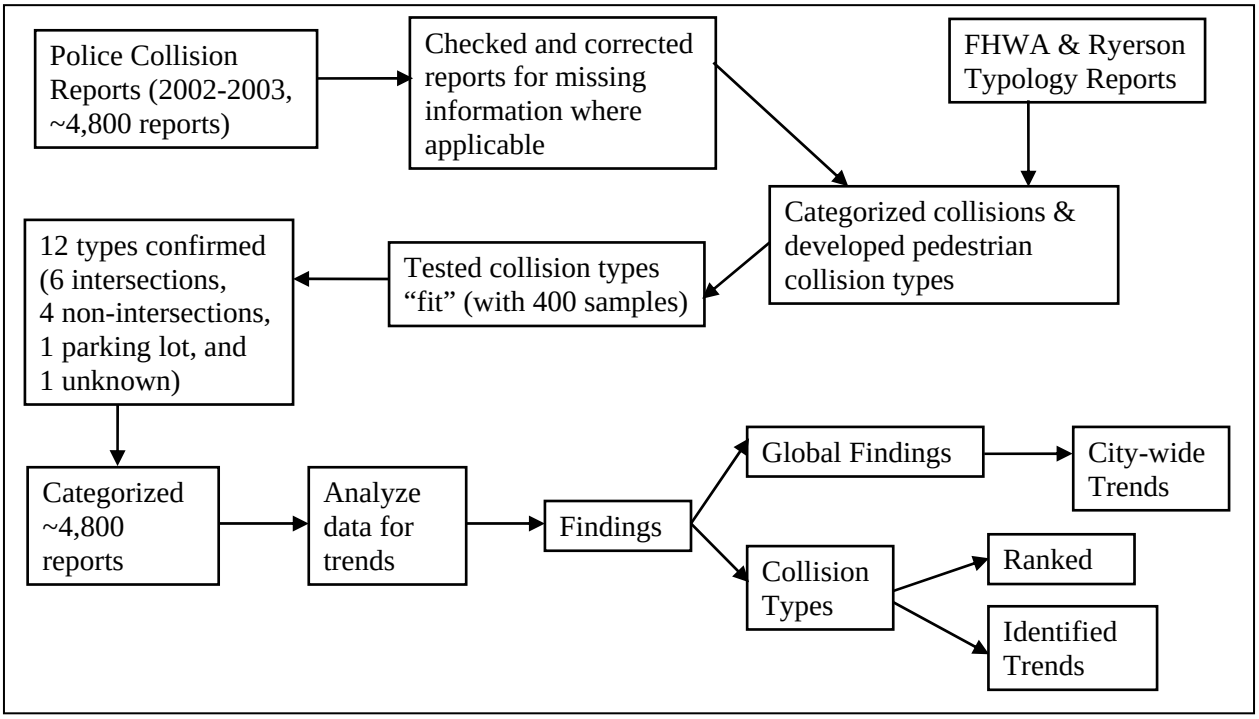
Plotting the frequency distribution of a variable over one type of collision against its distribution over all collisions facilitates visual comparison of data for two or more collision types, since they are presented in relation to the same 'base line'. In this manner, the likelihood that each variable might have played a contributing role in each collision type was assessed.

Histograms are particularly helpful for multi-category variables, like age and injury severity, and are used in this report to present detailed findings regarding these attributes, for every collision type. Histograms displaying environmental conditions have also been included, wherever an interesting result was found.

To use the variable "pedestrian's age" as an example, if the ages of all the pedestrians in any group are plotted in a histogram, it forms an "age profile." The age profile of the group of pedestrians involved in one type of collision can be plotted against the age profile for all the pedestrians in the entire study sample, to reveal age groups that are "over-represented" (i.e., more frequently involved) in that particular type of collision. This process was repeated with the other variables.

Figure 1 shows the process that was followed to analyze and categorize the pedestrian/motor vehicle collision data.

Figure 1 – Analysis Processes



3.4. Data Limitations and Reliability

The scope of this study was limited to the collisions that were reported to the Toronto Police Service and the collision database stored in the City's Transportation Services Division. Collisions resulting in no injury were less probably to be reported, and therefore may be under-represented in this data set.

MVARs are generally filled out by a police officer when an individual is injured, when a collision occurs on a public property, or when damage to vehicle is greater than $1,000.00. Generally, collisions that do not occur on the public right-of-way do not legally require an MVAR be filled out. In one such example, pedestrian/motor vehicle collisions that occur in parking lots may be frequent, but will likely be under-reported.

The MVARs were prepared either by police officers at the scene of the collision or by the involved persons at Collision Reporting Centres (CRC). When a police officer attends the scene of a collision, they are responsible for filling out the MVAR form from an unbiased point-of-

view. At CRCs, more than one MVAR form can be filled out for the same collision since the individuals involved are responsible for providing the information needed on the MVAR. This can lead to conflicting statements and data.

For the purpose of this study, the MVARs were reviewed to check for errors, to code missing information and to record additional pertinent information, such as gender (gender is not an attribute that was included in the database after 1995.). The intent of the review was to assign a collision type to each collision.

4. GLOBAL FINDINGS

This chapter identifies and describes the variables which are common to all the collision analyses. These variables include the severity of injury, age and gender of involved persons, road and weather conditions, and time of collision. The purpose of this analysis is to try to identify any common elements that may contribute to pedestrian-related collisions.

It should be noted that measures of pedestrian exposure have not been factored into the findings. For example, the data examined revealed that 81% of all pedestrian-related collisions occurred on clear days. What has not been accounted for is the total number of days in the year that were clear and the number of pedestrians and motorists that were using the roadway on those days. Therefore, it cannot be assumed that clear days pose a higher risk, as there were probably more pedestrians and drivers on the roadway on clear days rather than on rainy days. This would have created a greater potential for conflicts between vehicles and pedestrians, rather than an increased danger associated with clear days.

4.1. Severity of Injury

MVARs have an "injury" field that helps to categorize injuries that are sustained by severity. **Table 5** provides the description of injury severity and **Table 6** shows a comparison of the city's injury distribution percentage to that of the Province of Ontario's.

Table 5 – Injury Severity Description

Severity of Injury	Severity Description
No Injury	No injuries sustained.
Minimal	This category includes minor abrasions, bruises and complaint of pain. Minor injuries sustained; did not require medical assistance.
Minor	Injuries required trip to hospital and treatment in the emergency room. Not admitted to hospital.
Major	Injuries required that person be admitted to hospital. This category includes person admitted for observation.
Fatal	Province of Ontario Definition: Death occurred as a result of injuries sustained within 30 days of the motor vehicle collision Toronto Police Service Definition: Death occurred as a result of injuries sustained within 366 days of the motor vehicle collision

Table 6 – Pedestrian Injury Severity in 2002, 2003, and Two Year Combined

Severity of Injury	Percentage Distribution[1]				Provincial Distribution[2]
	2002	2003	2002+2003 Average	City 5-Yr Average	
No Injury	5% (122)	4% (105)	5% (113)	5% (129)	4% (188)
Minimal	38% (976)	43% (1,000)	40% (988)	39% (971)	36% (1,937)
Minor	45% (1,159)	42% (983)	43% (1,071)	44% (1,079)	47% (2,480)
Major	10% (212)	9% (217)	10% (215)	10% (246)	11% (573)
Fatal	2% (50)	2% (42)	2% (46)	2% (38)	2% (131)
Total	**100%**	**100%**	**100%**	**100%**	**100%**

[1]City of Toronto collision database
[2]2002 Ontario Road Safety Annual Report

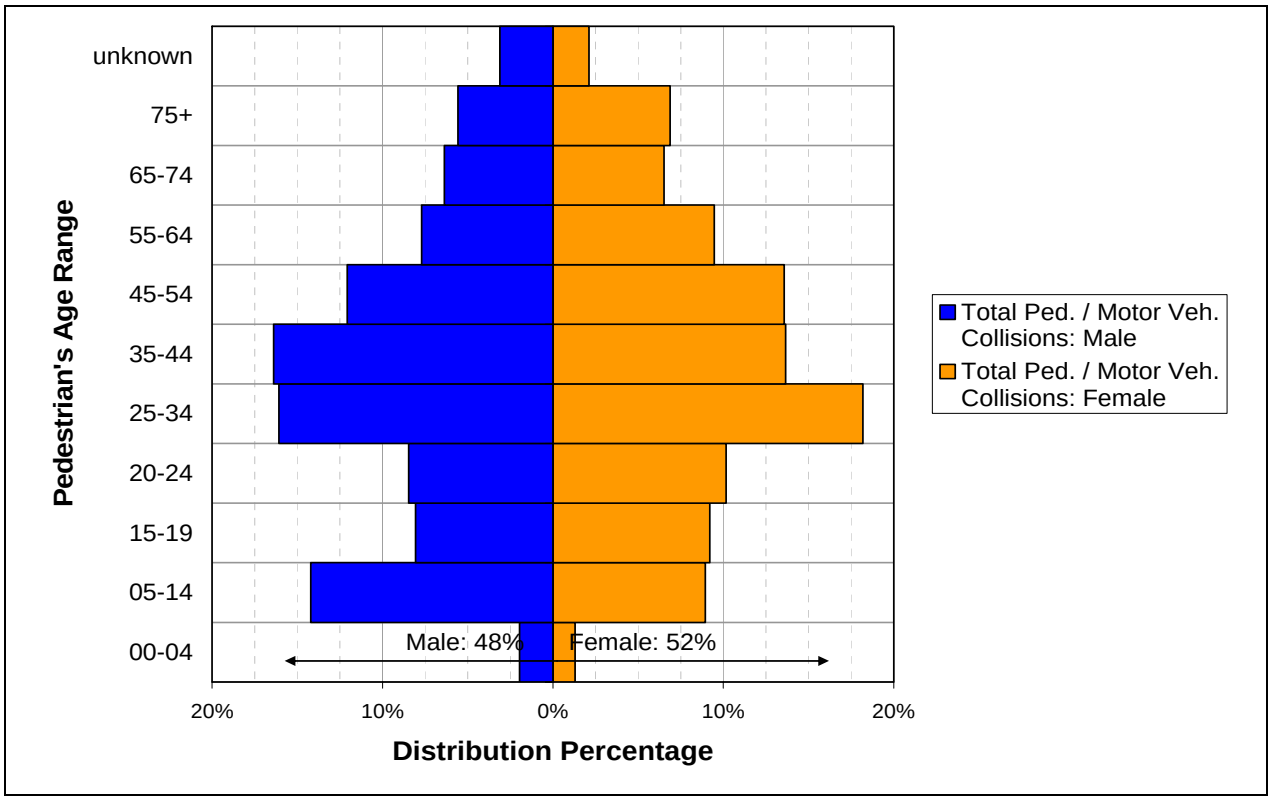
Minimal and minor injuries are the predominant severity type for the pedestrian/motor vehicle collisions. The distribution of injury severity did not change significantly over the study period. As well, the distribution of pedestrian collision injury severity in the city of Toronto is comparable to the entire province.

4.2. Age and Gender of Involved Persons

4.2.1. Age and Gender of Involved Pedestrians

The distribution of age and gender of the pedestrians involved in pedestrian/motor vehicle collisions is detailed in **Figure 2**.

Figure 2 – Pedestrian Age & Gender Distributions in Pedestrian/Motor Vehicle Collisions (Two-Year Combined)



Note that the distribution of gender involved in collisions is relatively equal. Pedestrians within the age of 15-54 were more involved in collisions. It is noted that male pedestrians involved in collisions were starting at a younger age of 5.

When looking at the age distribution of pedestrians involved in collisions, **Table 7** shows that the age distribution in Toronto is similar to Ontario's age distribution. Results indicated that both male and female pedestrians involved in collisions were equal. This distribution is also consistent with the gender distribution in the population of Toronto, where females make up 52% of the

population, while males make up 48%. The age groups of 15-24 were involved in 19% of all pedestrian/motor vehicle collisions, but they only account for 12% of the Toronto population. Pedestrians under the age of 4 account for 2% of all pedestrian/motor vehicle collisions, compared to 6% of the Toronto population. Also, the age group of 25-44 account for 34% of Toronto's population and were involved in 33% of the total pedestrian/motor vehicle collisions.

Table 7 – Percentage of Collisions Comparison in Toronto with Population by Involved Pedestrians' Ages

Pedestrian Age	% Pedestrians Involved in Pedestrian/motor vehicle Collisions (2002+2003)[1]			% Population[2]		
	Male	Female	Total	Male	Female	Total
00-04	1%	1%	**2%**	3%	3%	**6%**
05-14	7%	5%	**12%**	6%	6%	**12%**
15-19	4%	5%	**9%**	3%	3%	**6%**
20-24	4%	5%	**9%**	3%	3%	**6%**
25-34	8%	10%	**18%**	17%	17%	**34%**
35-44	8%	7%	**15%**			
45-54	6%	7%	**13%**	7%	7%	**14%**
55-64	4%	5%	**9%**	4%	5%	**9%**
65-74	3%	3%	**6%**	3%	4%	**7%**
75+	3%	4%	**7%**	2%	4%	**6%**
Total	**48%**	**52%**	**100%**	**48%**	**52%**	**100%**

1: The figures were derived from the collision database maintained by TDCSB. The age groups are adjusted to match the Statistics Canada data.
2: Statistics Canada (2001 census data).

Table 8 looks at the correlation between the pedestrians involved and the fatalities resulted in the pedestrian/motor vehicle collisions.

Table 8 – Pedestrian Fatalities in Toronto Collisions by Involved Pedestrians' Ages

Pedestrian Age	% Pedestrians Involved in Pedestrian/motor vehicle Collisions (2002+2003)			% Fatalities in Pedestrian/motor vehicle Collisions (2002+2003)		
	Male	Female	Total	Male	Female	Total
00-04	1%	1%	**2%**	1%	1%	**2%**
05-14	7%	5%	**12%**	1%	0%	**1%**
15-19	4%	5%	**9%**	2%	1%	**3%**
20-24	4%	5%	**9%**	0%	4%	**4%**
25-44	16%	17%	**33%**	10%	3%	**13%**
45-54	6%	7%	**13%**	10%	7%	**17%**
55-64	4%	5%	**9%**	4%	6%	**10%**
65-74	3%	3%	**6%**	12%	10%	**22%**
75+	3%	4%	**7%**	15%	13%	**28%**
Total	**48%**	**52%**	**100%**	**55%**	**45%**	**100%**

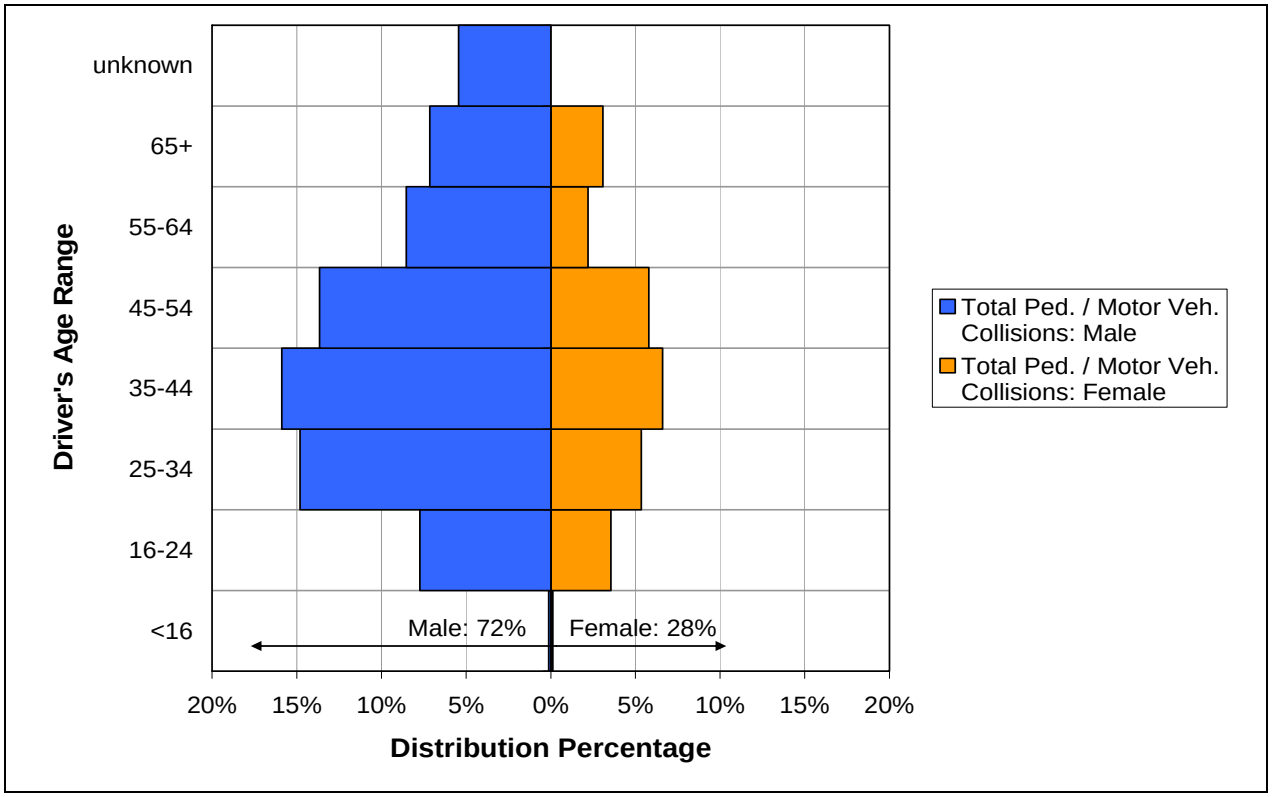
Source: The figures were derived from the collision database maintained by TDCSB.

While the age groups of 5-44 years were involved in 64% of all pedestrian/motor vehicle collisions, they were less likely to be killed or severely injured in the collisions. This is evident as they were involved in 22% of the fatalities that were recorded. On the other hand, while pedestrians over the age of 65 accounted for only 13% of the total collisions, they accounted for 50% of the fatalities where pedestrians were involved in the pedestrian/motor vehicle collisions. This can be attributed to the fact that when senior pedestrians (age 65+) are involved in collisions, they are less resilient and are therefore less likely to survive the collision.

4.2.2. Age and Gender of Involved Drivers

The distribution of age and gender of the drivers involved in collisions is detailed in **Figure 3**.

Figure 3 – Driver Age Distributions in Pedestrian/motor vehicle collisions (Two-Year Combined)



As can be seen from the graph, more male drivers were involved in pedestrian/motor vehicle collisions than female drivers.

Table 9 shows the number of drivers involved in pedestrian/motor vehicle collisions by age group and gender in detail and compares the findings with the percentage of drivers involved in collisions and the total number of licensed drivers in Ontario. It should be noted that gender is not an attribute that is included in the Toronto collision database. For the purpose of this study, gender was determined by reviewing the 4,775 MVARs.

Table 9 – Involved Driver's Comparison of Pedestrian Collisions Toronto vs. Ontario

	% Drivers Involved in Pedestrian/motor vehicle Collisions in Toronto[1]			% Drivers Involved in All Collisions in Ontario[2]			% Drivers Licensed in Ontario[2]		
	2002+2003			2002+2003			2002+2003		
Drivers Age	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**	**Male**	**Female**	**Total**
<16	0%	0%	**0%**	0%	0%	**0%**	0%	0%	**0%**
16-24	8%	4%	**12%**	13%	7%	**20%**	7%	6%	**13%**
25-34	16%	6%	**22%**	14%	8%	**22%**	10%	9%	**19%**
35-44	17%	7%	**24%**	16%	9%	**25%**	12%	11%	**23%**
45-54	14%	6%	**20%**	11%	6%	**17%**	10%	9%	**19%**
55-64	9%	2%	**11%**	6%	3%	**9%**	7%	6%	**13%**
65+	8%	3%	**11%**	5%	2%	**7%**	7%	6%	**13%**
Total	**72%**	**28%**	**100%**	**65%**	**35%**	**100%**	**53%**	**47%**	**100%**

1: The figures were derived from the collision database maintained by TDCSB.
2: MTO Ontario Road Safety Annual Report 2002 and 2003.

According to the combined results for 2002 and 2003 in the pedestrian/motor vehicle collisions, 72% were male drivers, 28% were female drivers. These percentages were strikingly different from what one would normally expect based on the licensed driver population alone (53% male, 47% female) in Ontario. In general, male drivers in collisions are over-represented when compared to the licensed driver population. However, there are variables that have not been taken into account; variables such as the amount of driving done by males and females. This finding cannot support the idea that male drivers tend to take more risks while female drivers tend to be more cautious; however, other research papers on aggressive driving and risk-taking support this idea.

Figure 4 – Involved Driver % in Toronto Collisions vs. Licensed Driver % in Ontario

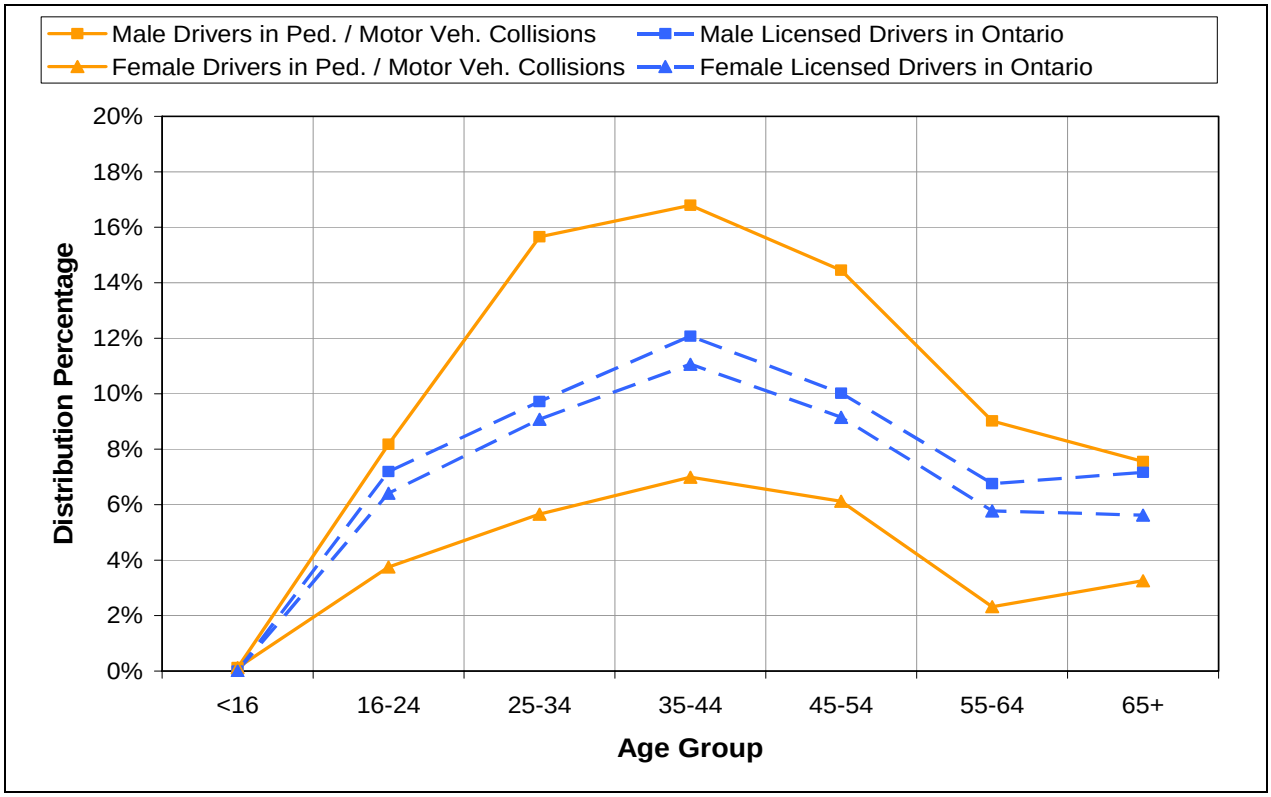


Figure 4 illustrates the proportion of drivers involved in pedestrian/motor vehicle collisions in the city of Toronto and the proportion of licensed drivers in Ontario, male and female respectively. When the data is broken down by gender, observations showed that all male age groups are over-represented and all-female age groups are under-represented in pedestrian/motor vehicle collisions, relative to the proportion of the licensed driving population. As discussed, the over-representation of males may be due to males driving more than females; however, the amount of driving done by males and females has not been accounted for in this study.

Due to the limitations of the City's database, a comparison of gender for all motor vehicle collisions could not be done. However the gender proportion of drivers involved in all collisions in Ontario is available for comparison as shown in **Table 8**.

4.3. Weather and Road Surface Conditions

Weather condition was examined as a variable in pedestrian/motor vehicle collisions. The distribution of weather conditions are detailed in **Tables 10** and **11**:

Table 10 – Pedestrian Collisions by Weather Conditions

Weather Condition	% Pedestrian Collision in Toronto			5-Yr Avg. (1999-2003) All Collisions
	2002	2003	2002+2003	
Clear	81%	82%	82%	81%
Rain	14%	13%	13%	10%
Snow	3%	3%	3%	7%
Other	2%	2%	2%	2%
Total	**100%**	**100%**	**100%**	**100%**

Table 11 – Pedestrian Collisions by Road Surface Conditions

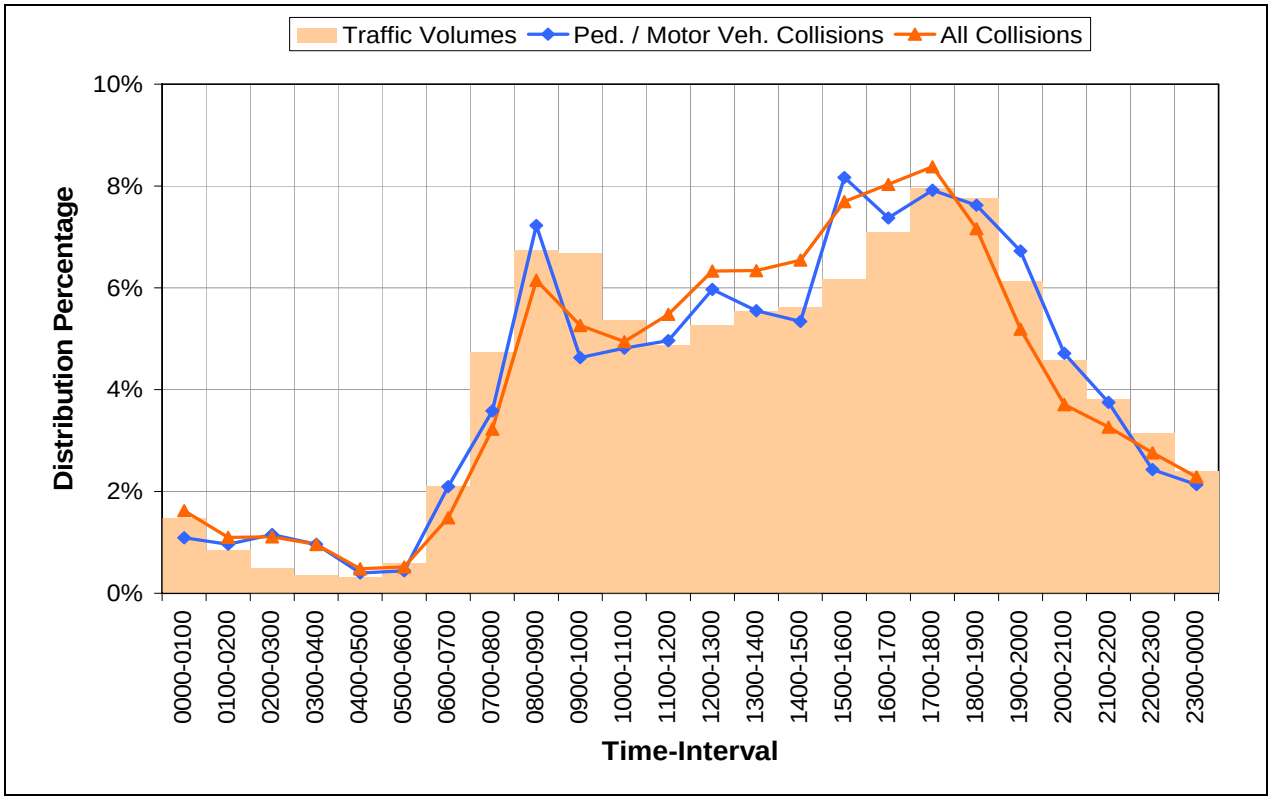
Road Surface Condition	% Pedestrian Collision in Toronto			5-Yr Avg. (1999-2003) All Collisions
	2002	2003	2002+2003	
Dry	74%	72%	73%	75%
Wet	23%	22%	23%	17%
Snow, Slush, Ice	2%	5%	3%	7%
Other	1%	1%	1%	1%
Total	**100%**	**100%**	**100%**	**100%**

As can be seen from **Tables 10** and **11**, pedestrian/motor vehicle collisions occur during all weather conditions and on all types of road surface conditions. In fact, the most frequent weather and road surface conditions for the pedestrian/motor vehicle collisions were a clear and dry day. This distribution did not change over the course of the study period. The weather and road surface conditions distribution of pedestrian/motor vehicle collisions is comparable to the 5-year average.

4.4. Time of Collision

Time of day, day of week and month of year are variables that were examined to determine if they are possible factors contributing to pedestrian/motor vehicle collisions. The distributions of these variables are detailed in **Figures 5, 6 & 7**.

Figure 5 – Time of Day Distribution of Pedestrian/Motor Vehicle Collisions

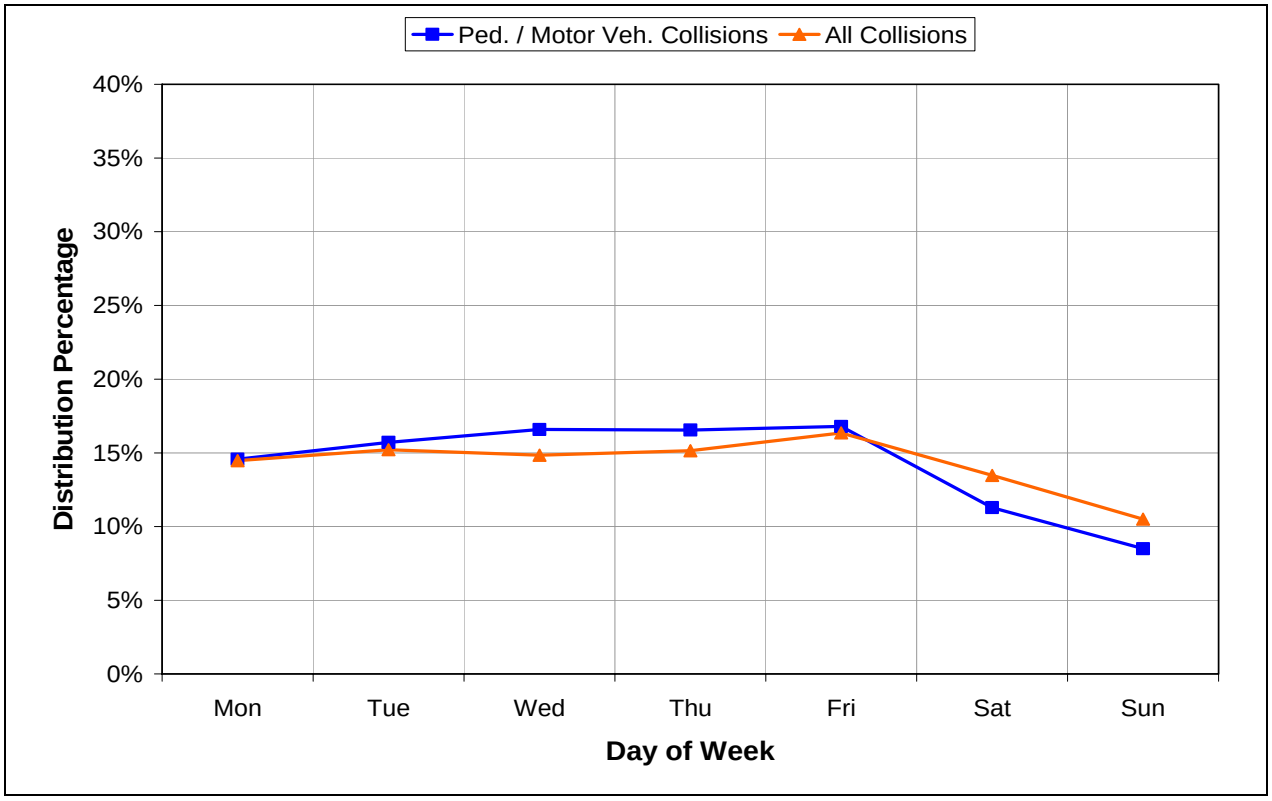


Note: Traffic volume counts are taken from TDCSB 24-hour screenline counts. The volumes do not include expressways.

Pedestrian/motor vehicle collisions occurred most frequently in the late afternoon/early evening hours between 3 p.m. and 8 p.m., when pedestrian and vehicle volumes are higher. There were also two small peaks, one during the morning peak hour (8-9 a.m.), and one during the lunch hour (12 noon-1 p.m.). The peak in the morning might be due to the heavy traffic when everyone is going to work and/or school. The high pedestrian/motor vehicle collision times correlate to higher volumes of traffic and also “peak periods” as well for school times (i.e. start and end) on the roadway.

When comparing vehicle-vehicle and pedestrian/motor vehicle hourly distribution, a similar trend occurs. They both seem to follow the volume pattern.

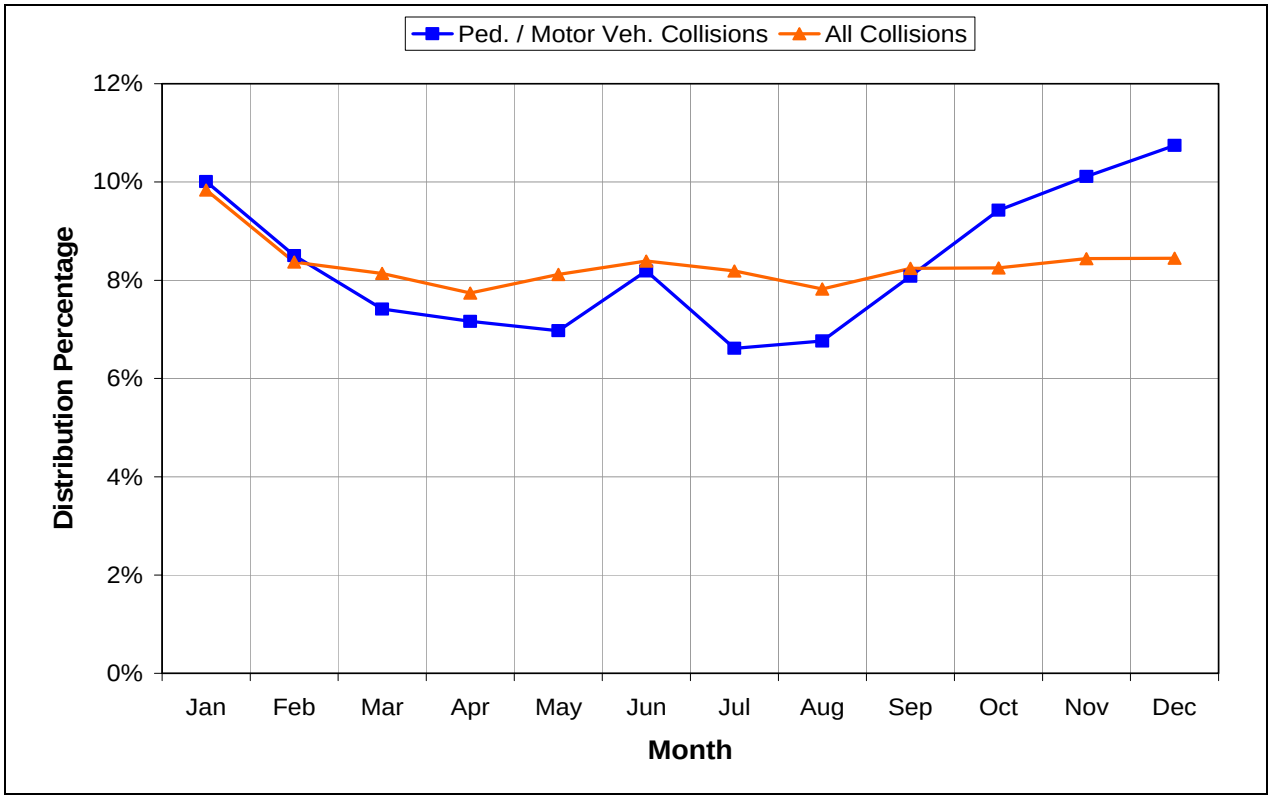
Figure 6 – Day of Week Distribution of Pedestrian/Motor Vehicle Collisions



On average, there were nearly twice as many collisions on weekdays than on weekends. These higher collision numbers may be attributed to the increased pedestrian and vehicle volumes during the weekday. Drivers and pedestrians may be more aggressive and take more risks as they are generally heading to and from work, school, etc.

Pedestrian/motor vehicle and motor vehicle collisions have relatively the same proportion of daily distribution.

Figure 7 – Month of Year Distribution of Pedestrian/Motor Vehicle Collisions



The frequency of collisions is higher in the autumn and winter seasons (from September to February). The decrease in collisions in the summer months might be linked to lower volumes of traffic during that time. Also, the increase in the number of pedestrian/motor vehicle collisions may be attributed to lack of visibility (shorter days of sunlight, snowfalls, etc) and adverse road conditions (especially wet road surfaces) in the winter period.

When comparing the monthly pedestrian/motor vehicle and motor vehicle collision distribution, there does not seem to be an close correlation. In fact, while the motor vehicle collision monthly distribution is relatively constant, the monthly distribution of pedestrian/motor vehicle collisions appeared to follow a seasonal distribution. That is, during the autumn/winter months pedestrian/motor vehicle collisions are higher than during the summer months. This can lead to the conclusion that visibility may be a more significant contributing factor in pedestrian/motor vehicle collisions.

4.5. Spatial Distribution

The spatial distribution of pedestrian/motor vehicle collisions, shown in **Figure 8**, revealed the following:

- Concentration in downtown area;
- Concentration along arterial roads; and
- A distribution of pedestrian/motor vehicle collisions between intersection and non-intersection (48% vs. 37%) (**Table 12**).

These observations may be linked to higher pedestrian activity and volume in the downtown area as well as a higher vehicle-pedestrian exposure along arterial roads.

Figure 8 – Geographic Distribution in Toronto (2002+2003)

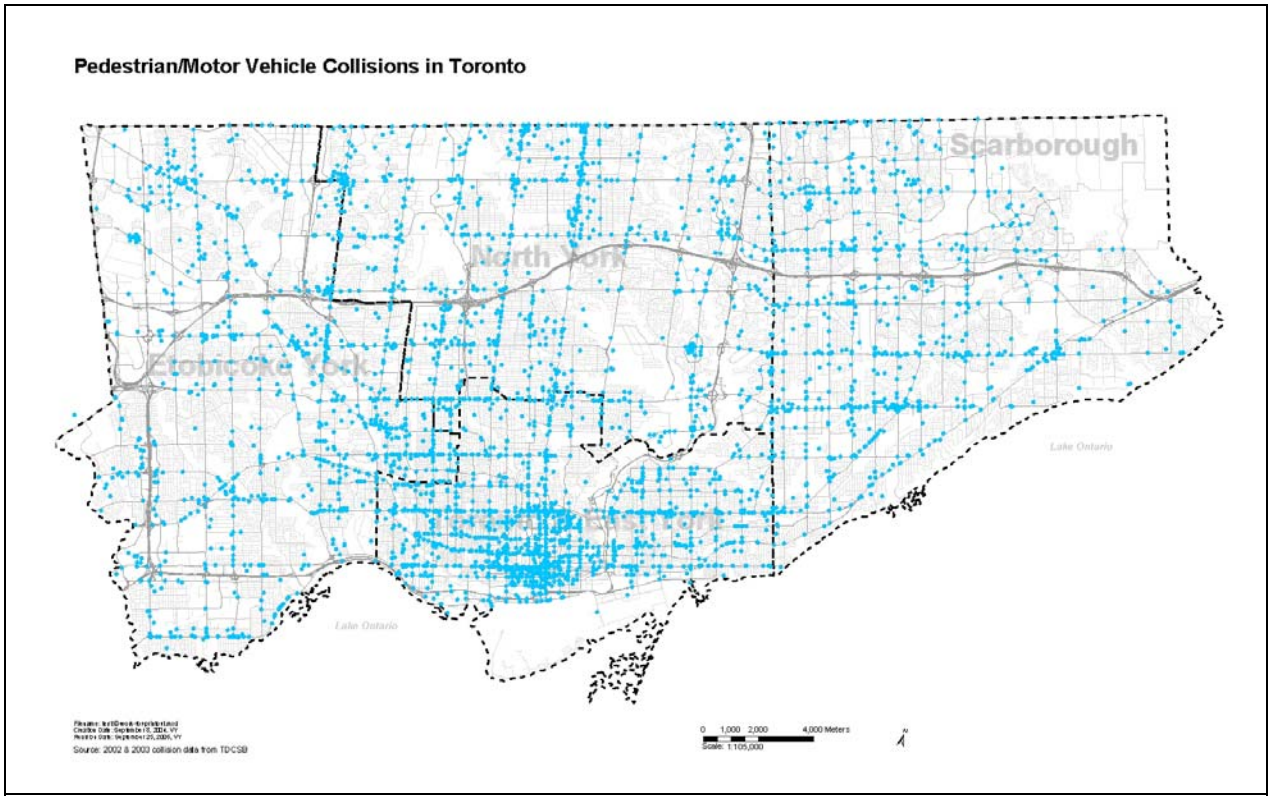
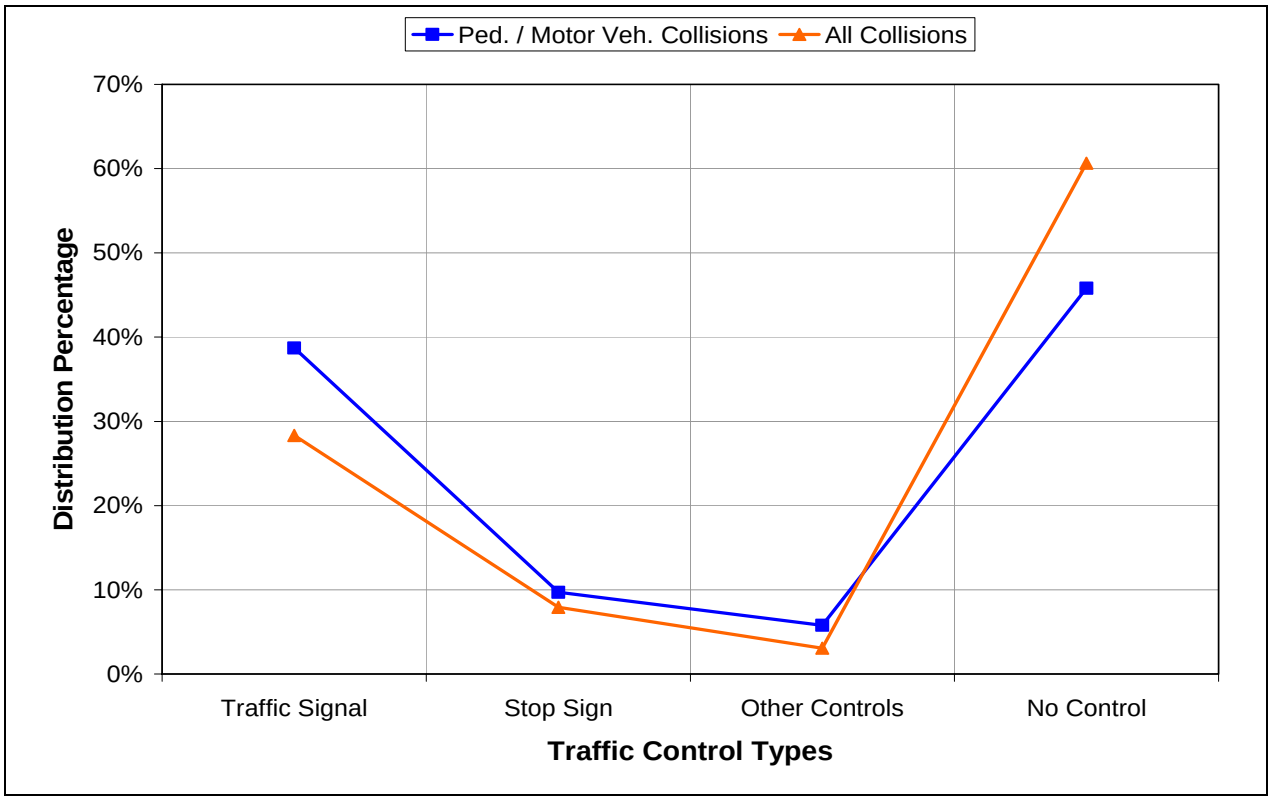


Table 12 – Pedestrian Collisions Percentage (Two-Year Combined)

	2002+2003	
Collision Location	**# of Cases**	**%**
Intersection	2,253	47%
Non-Intersection	1,784	37%
Other / Unknown	738	16%

4.6. Traffic Control Distribution

Figure 9 – Traffic Control Distribution (2002+2003)



When analyzing the pedestrian/motor vehicle collisions, traffic control device were reviewed. **Figure 9** clearly shows that pedestrian/motor vehicle collisions follow approximately the same distribution as the vehicle-vehicle collisions. Also, there is a relatively equal distribution of pedestrian/motor vehicle collisions occurring at locations with a traffic control device and without a traffic control device. Pedestrian/motor vehicle collisions appear to be more likely to occur at traffic signals and un-controlled locations than motor vehicle collisions.

4.7. Summary – Global Findings

When looking at the various variables – severity of injuries, age, gender, weather and time of collision, there are some significant emergent factors:

- 83% of pedestrian/motor vehicle collisions resulted in either minimal or minor injuries.
- 12% of pedestrian/motor vehicle collisions resulted in major injuries or fatalities.
- Pedestrians within the age of 15-54 were more involved in pedestrian/motor vehicle collisions.
- 50% of fatalities in pedestrian/motor vehicle collisions were seniors (aged 65+).
- 72% of pedestrian/motor vehicle collisions involved male drivers versus 28% for female drivers.
- Pedestrian/motor vehicle collisions occurred more frequently during rush hour periods.
- Pedestrian/motor vehicle collisions occurred most during weekdays (Tuesday to Friday).
- Pedestrian/motor vehicle collisions occurred most during the autumn and winter seasons.
- Pedestrian/motor vehicle collisions occurred more in the downtown area.
- Pedestrian/motor vehicle collisions occurred more along arterial roads.
- Pedestrian/motor vehicle collisions distributed as follow: at intersections (47%), at non-intersections (37%), and other/unknown (16%).
- Relatively equal distribution of pedestrian/motor vehicle collisions between locations with (40%) and without (60%) traffic control devices.

5. CITY OF TORONTO COLLISION TYPES

This chapter details the pedestrian/motor vehicle collision types that have been deemed significant. The FHWA Report "Pedestrian Facilities Users Guide – Providing Safety and Mobility" was also used as a reference in identifying the different collision types. **Appendix A: Detailed Analysis Results** provides the detailed summaries of the findings with tables and graphs.

When the various collision types are combined by intersection and non-intersection, the numbers of cases are relatively equal. 47% of all pedestrian/motor vehicle collisions occurred at an intersection, 37% occurred at a non-intersection location (driveway, mid-block, etc.), 11% occurred in a parking lot, and 5% unknown.

Table 13 – Pedestrian Collision Percentage by Collision Types (Two-Year Combined)

	2002+2003	
Collision Types	**# of Cases**	**%**
Intersection		
1. Vehicle turns left while pedestrian crosses with right-of-way at intersection	632	13%
2. Vehicle turns left while pedestrian crosses without right-of-way at intersection	196	4%
3. Vehicle turns right while pedestrian crosses with right-of-way at intersection	422	9%
4. Vehicle turns right while pedestrian crosses without right-of-way at intersection	117	2%
5. Vehicle is going straight through intersection while pedestrian crosses with right-of-way	232	5%
6. Vehicle is going straight through intersection while pedestrian crosses without right-of-way	654	14%
Total at Intersection	**2,253**	**47%**
Non-Intersection		
8. Pedestrian hit at mid-block location	1,042	22%
9. Pedestrian hit at private driveway	347	7%
10. Pedestrian hit at pedestrian crossover (PXO)	232	5%
11. Pedestrian hit on sidewalk or shoulder	163	3%
Total at Non-Intersection	**1,784**	**37%**
Other / Unknown		
55. Pedestrian hit in parking lot	508	11%
99. Other / Unknown	230	5%
Total at Other/Unknown Category	**738**	**16%**

The highest frequency pedestrian/motor vehicle collision type is "Pedestrian hit at mid-block location" (type 8) while crossing the road. When looking at collisions that occurred at

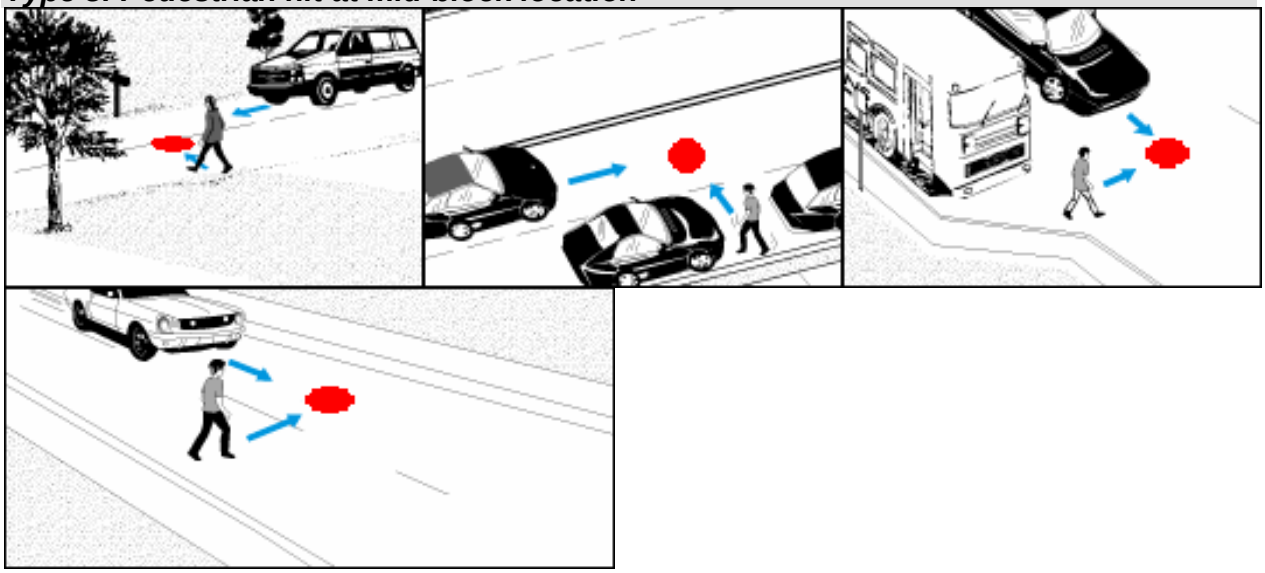
intersections, 43% occurred when the driver had the “right-of-way” (types 2, 4, 6) and 57% occurred when the pedestrian had the “right-of-way” (types 1, 3, 5).

To better identify why the pedestrian/motor vehicle collisions occurred and what caused them to occur, the different collision types were analyzed in more detail. The following pages provide the more significant factors for each collision type.

5.1. Findings of Each Collision Type

The following pages describe each collision type and provide details from the analysis of the collision type.

Type 8: Pedestrian hit at mid-block location



Description:

A pedestrian and a vehicle collided at a mid-block location. This collision type includes pedestrians who crossed with and without the right-of-way. Initially this collision type was split into two types: Pedestrian hit at mid-block location with the right-of-way (Type 7) and Pedestrian hit at mid-block location without right-of-way (Type 8). Since pedestrians with the right-of-way at mid-block was a very small sample size (35 cases of 4,775 samples), it was reasonable to combine the two types together as one collision type. Type 8 was renamed as “Pedestrians hit at mid-block.”

Frequency:

1,042 of 4,557 collisions 22% of all collisions Rank #1

Significant Collision Findings:

	Type 8	All Collision Types
Major Injuries & Fatalities	13% (135 cases)	12% (571 cases)
Male Pedestrians <14	23% (147 cases)	16% (363 cases)
Female Pedestrians <14	18% (71 cases)	10% (237 cases)
Female Pedestrians 25-44	27% (109 cases)	32% (737 cases)
12 noon - 1 p.m.	7% (76 cases)	6% (285 cases)
Saturday	13% (133 cases)	11% (539 cases)
April – June	38% (385 cases)	29% (1,382 cases)
December – February	25% (237 cases)	30% (1,397 cases)

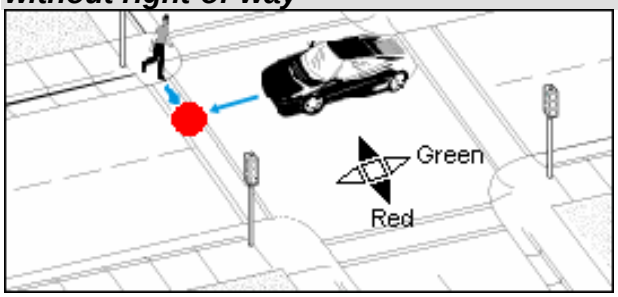
Findings:

The range of injuries sustained in this type of collision was slightly more severe than in other collision types. Pedestrians under age 14 were slightly over-represented. When looking at pedestrian and driver age groups, female pedestrians aged 25-44 were under-represented.

This collision type had a slightly greater frequency of occurring during 12 noon - 1 p.m. Given that this is the lunch hour, pedestrians and driver volumes may be higher during this hour. Also, these collisions seem to be less likely to occur during the months of November and December as these months were under-represented in the data analysis. Environmental conditions (road conditions, weather, lighting, etc.) were not a significant factor.

There can be many reasons why this type of collision occurs. Motorists may not be expecting to encounter a pedestrian crossing the road at mid-block. Also, visibility can be a factor if pedestrians are crossing in between parked cars, and the motorists are unable to stop in time.

Type 6: Vehicle is going straight through intersection while pedestrian crosses without right-of-way



Description:

A pedestrian and a vehicle collided at an intersection while the vehicle was proceeding straight ahead and the pedestrian was crossing without the right-of-way.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 6	66%	10%	1%	23%

Frequency:

654 of 4,557 collisions 14% of all collisions Rank: #2

Significant Collision Findings:

	Type 6	**All Collision Types**
Minor and Major Injuries	59% (404 cases)	54% (2,621 cases)
Minimal Injuries	33% (221 cases)	40 % (1,976 cases)
Male Pedestrians 15-24	24% (81 cases)	16% (371 cases)
3-4 p.m.	10% (64 cases)	8% (390 cases)
Thursday, Friday	38% (249 cases)	34% (1,592 cases)

Findings:

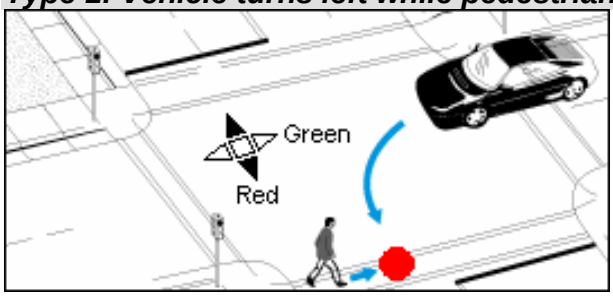
Injuries tended to be more severe than average in this type of collision.

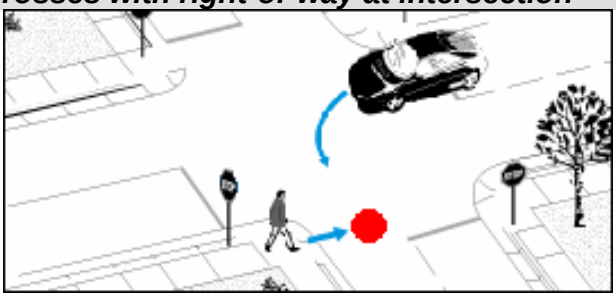
The female pedestrian age group of 25-54 was under-represented in this collision type as well as the driver age group of 65+. Male pedestrians between the ages of 15-24 were over-represented and this type of collision was most frequent in the after-school hours. It was also slightly more frequent than other types of collisions around 3-4 a.m.

The geographical distribution shows this collision type mostly occurring in the downtown area and on arterial roads.

Similar to collision type 8 (Pedestrian hit at mid-block location), motorists, with the right-of way, may not be expecting to encounter a pedestrian crossing the roadway at an intersection (i.e. the pedestrian does not have the right-of-way).

Type 1: Vehicle turns left while pedestrian crosses with right-of-way at intersection





Description:

A pedestrian and a vehicle collided at the intersection while the vehicle was preparing to turn left, in the process of turning left, or had just completed a left turn. The pedestrian was crossing with the right-of-way.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 1	82%	12%	1%	5%

Frequency:

632 of 4,557 collisions 13% of all collisions Rank #3

Significant Collision Findings:

	Type 1	**All Collision Types**
Male Pedestrians 55+	30% (65 cases)	20% (441 cases)
Female Pedestrians 25-44	39% (161 cases)	32% (737 cases)
Minor Injuries	48% (308 cases)	44% (2,142 cases)
Rain	28% (174 cases)	13% (635 cases)
Wet road surface	39% (247 cases)	23% (1,076 cases)
November - February	54% (340 cases)	40% (1,880 cases)

Findings:

Male pedestrians over age 55 and female pedestrians age 25-44 are over-represented. Pedestrian under the age of 19 were significantly under-represented in this collision type. Drivers within the age group of 25-44 were also under-represented.

This type of collision was more frequent than other types during the winter months (November to February) and also in the morning (6-7 a.m., 9-10 a.m.) and evening (8-9 p.m., 10-11 p.m.) hours. Rain and wet road conditions were relatively frequent variables. These findings suggest that visibility issues might often play a role in collisions of this type. Another significant factor might be that motorists are more acutely paying attention to oncoming traffic and are not looking for pedestrians crossing in the crosswalk.

Type 55: Pedestrian hit in parking lot

Description:

A pedestrian and a vehicle collided in a parking lot (most parking lots are private property).

Frequency:

508 of 4,557 collisions 11% of all collisions Rank #4

Significant Collision Findings:

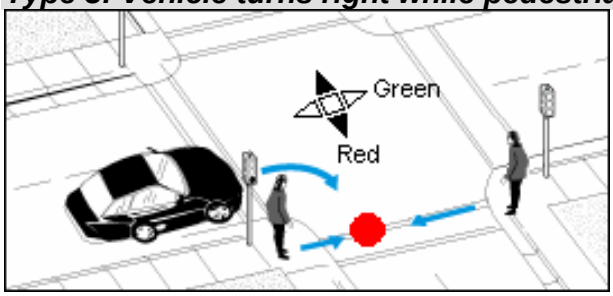
	Type 55	All Collision Types
Minimal Injuries	45% (234 cases)	40% (1,976 cases)
10 a.m. – 5 p.m.	54% (276 cases)	42% (2,014 cases)

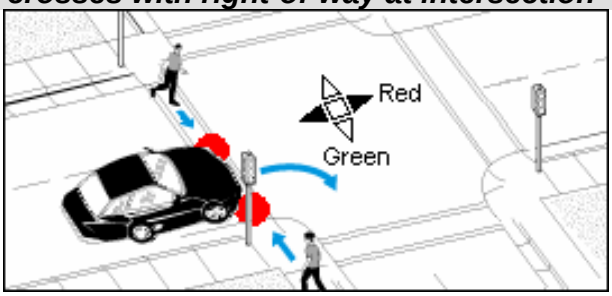
Findings:

This collision type accounted for 11% of the total pedestrian/motor vehicle collisions and ranks 4 in order of occurrence frequency. The injury severity tended to be minimal as drivers tend not to

drive very fast in parking lots. This collision type occurred more often on Saturdays than all other collision types. Also, 10 a.m.-5 p.m. was over-represented for this collision type. These statistics suggest that drivers should be more careful when they are in parking lots. The findings also suggest that the design of parking lots may need to be studied and to incorporate pedestrian-friendly designs.

Type 3: Vehicle turns right while pedestrian crosses with right-of-way at intersection





Description:

A pedestrian and a vehicle collided at an intersection while the vehicle was preparing to turn right, in the process of turning right, or had just completed a right turn. The pedestrian was crossing with the right-of-way.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 3	77%	18%	2%	3%

Frequency:

422 of 4,557 collisions 9% of all collisions Rank #5

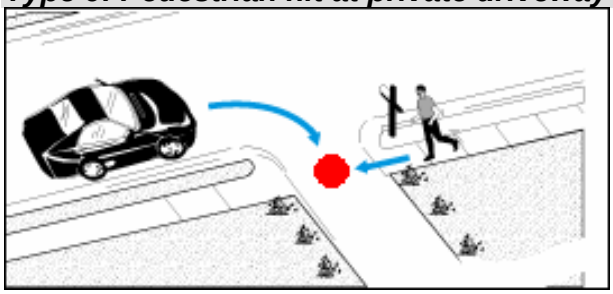
Significant Collision Findings:

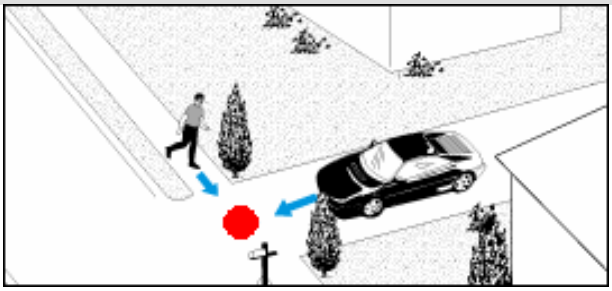
	Type 3	**All Collision Types**
Major Injuries & Fatalities	8% (36 cases)	12% (571 cases)
Minimal Injuries	44% (191 cases)	40% (1,976 cases)
Male Pedestrians 75+	10% (16 cases)	6% (125 cases)
Female Pedestrians 15-19	16% (39 cases)	9% (213 cases)
Monday	17% (72 cases)	15% (696 cases)
9-10 a.m.	7% (30 cases)	5% (221 cases)

Findings:

Female pedestrians age 15-19 were slightly over-represented. On average, this type of collision resulted in less severe injuries than most other types. Male pedestrians age 75+ had a slightly higher than average frequency in the collision type. Male drivers within the age group of 35-54 were under-represented in this collision type. The time period that this collision type is most frequent is during rush hour. This suggests that drivers may not be paying attention to pedestrians crossing the street. Drivers may forget to look both ways before proceeding with the right turn and therefore fail to yield the right of way.

Type 9: Pedestrian hit at private driveway





Description:

A pedestrian and a vehicle collided at a private driveway. The pedestrian was crossing the driveway and was hit by a vehicle entering or exiting the driveway.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 9	3.5%	3.5%	1%	92%

Frequency:

347 of 4,557 collisions 7% of all collisions Rank #6

Significant Collision Findings:

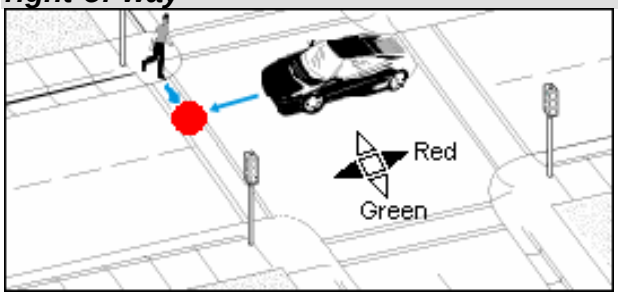
	Type 9	**All Collision Types**
Male Pedestrians 55-64, 75+	13% (21 cases), 10% (17 cases)	8% (173 cases) 6% (125 cases)
Female Pedestrians 75+	12% (20 cases)	7% (159 cases)
Male Drivers 45-54	23% (54 cases)	19% (585 cases)
3-4 p.m.	11% (38 cases)	8% (390 cases)
Sunday	12% (43 cases)	9% (406 cases)
June	12% (43 cases)	8% (391 cases)

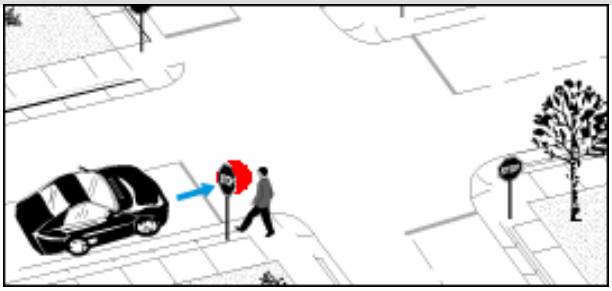
Findings:

Male pedestrians over the age of 55 seem to be slightly over-represented, while female pedestrians age 5-14 were under-represented.

These collisions tend to occur on a weekend and during the afternoon period. These collisions could be caused due to both pedestrians and drivers not paying attention to their surrounding environment. Also, visibility might be a factor since trees, shrubs, other buildings and obstructions can impede the driver's ability to see approaching pedestrians. Similarly, pedestrians may not be able to see vehicles leaving a driveway. This collision would be much less frequent if all drivers come to a complete stop before crossing the sidewalk (as per Toronto by-law.)

Type 5: Vehicle is going straight through intersection while pedestrian crosses with right-of-way





Description:

A pedestrian and a vehicle collided at the intersection while the vehicle was proceeding straight ahead. The pedestrian had the right-of-way to cross at the intersection.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 5	59%	38%	1%	2%

Frequency:

232 of 4,557 collisions 5% of all collisions Rank #7

Significant Collision Findings:

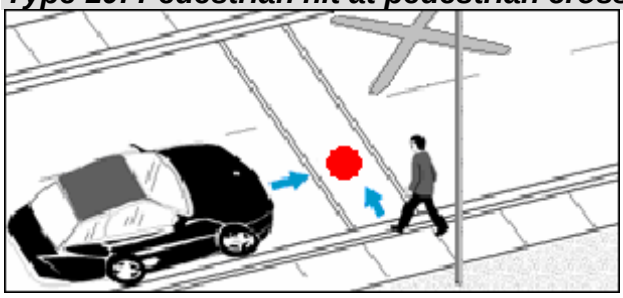
	Type 5	All Collision Types
Minimal Injuries	44% (105 cases)	40% (1,976 cases)
Male Pedestrians 15-19	12% (11 cases)	8% (181 cases)
Male Drivers 25-34	14% (19 cases)	20% (634 cases)
Female Drivers 65+	16 (11 cases)	11% (132 cases)
Female Drivers 25-34	15% (10 cases)	19% (229 cases)
5-6 p.m.	11% (25 cases)	8% (378 cases)
Friday	23% (54 cases)	17% (802 cases)
February, October	11% (25 cases), 12% (27 cases)	9% (406 cases), 9% (450 cases)

Findings:

Male pedestrians age 15-19 were over-represented, as were female drivers over age 65. Injuries showed a slight tendency towards less-severe than average.

The analysis shows that these collisions are occurring during the morning and evening peak periods. One reason for this can be that drivers are not paying attention to their surroundings or are in a rush to get to work or home and therefore might run red lights. Also, drivers may disobey other traffic control devices such as stop signs and fail to yield to pedestrians crossing the roadway.

Type 10: Pedestrian hit at pedestrian crossover (PXO)



Description:

A pedestrian and a vehicle collided at a pedestrian crossover.

Traffic Control Type:

	Pedestrian Crossover	Other Controls	No Control
Type 10	87%	11%	2%

Frequency:

232 of 4,557 collisions 5% of all collisions Rank #7

Significant Collision Findings:

	Type 10	All Collision Types
Minimal Injuries	35% (85 cases)	40% (1,976 cases)
Major Injuries	12% (29 cases)	10% (479 cases)
Male Pedestrians 5-14	40% (39 cases)	14% (319 cases)
Female Pedestrians 5-14	17% (22 cases)	9% (207 cases)
Male Pedestrians 25-44	18% (17 cases)	32% (729 cases)
Female Pedestrians 25-44	28% (36 cases)	32% (737 cases)
Rain	20% (48 cases)	13% (635 cases)
Wet road surface	35% (80 cases)	23% (1,076 cases)

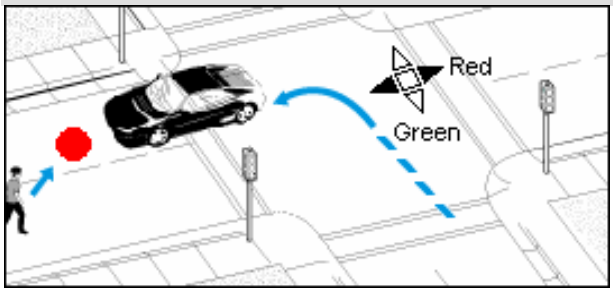
Findings:

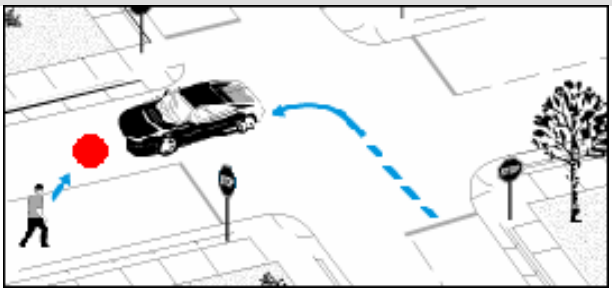
While pedestrians under age 14 were over-represented, male pedestrians age 5-14 were significantly over-represented (40% vs. 14%). Pedestrians 25-44 were under-represented. Drivers age 25-34 were over-represented. This type of collision was most frequent between 8 and 9 a.m. and between 5 and 6 p.m. Injuries tended to be more severe in this type of collision than in others. Rain and wet road conditions were other frequent variables.

There are some unquantified factors that can be attributed to this collision type. The driver's visibility of the traffic control device (PXO), the driver and pedestrian's understanding or lack thereof of how a PXO operates, and the pedestrian's false sense of security at PXOs. Both drivers and pedestrians may not be aware of the laws that govern driving and crossing at a PXO.

These statistics may suggest that the driver's ability to detect pedestrians is more difficult under dark and rainy conditions, particularly when the pedestrian may not activate the amber beacons before beginning to cross the roadway. Also, pedestrians may not be looking for oncoming traffic before beginning to cross the roadway.

Type 2: Vehicle turns left while pedestrian crosses without right-of-way at intersection





Description:

A pedestrian and a vehicle collided at the intersection while the vehicle was preparing to turn left, in the process of turning left, or had just completed a left turn (this includes the 20m buffer zone outside the intersection). The pedestrian did not have the right-of-way to cross at the intersection.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 2	59%	23%	3%	15%

Frequency:

196 of 4,557 collisions 4% of all collisions Rank #9

Significant Collision Findings:

	Type 2	**All Collision Types**
Minor Injuries	47% (96 cases)	44% (2,142 cases)
Major Injuries	7% (14 cases)	10% (479 cases)
Male Pedestrians 5-14	9% (8 cases)	14% (319 cases)
Female Pedestrians 5-14	5% (5 cases)	9% (207 cases)
Male Pedestrians 25-44	24% (21 cases)	32% (729 cases)
Female Pedestrians 25-44	26% (27 cases)	32% (737 cases)
Rain	21% (42 cases)	13% (635 cases)
Wet road surface	36% (70 cases)	23% (1,076 cases)
November - January	48% (95 cases)	31% (1,474 cases)

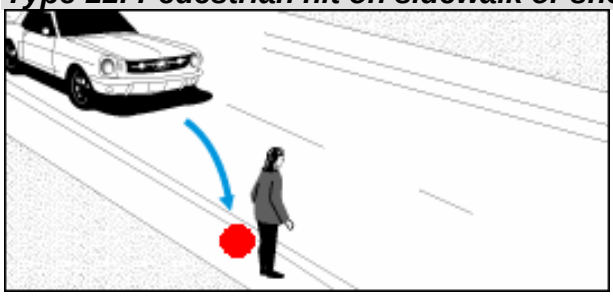
Findings:

This type of collision was more frequent than other types in winter months (November to January) and also in the morning (8-9 a.m.) and evening (7-8 p.m.) hours. Rain and wet road

conditions were relatively frequent variables. These findings suggest that visibility issues may have played a role in many collisions of this type.

The visibility issue in the winter months can be attributed to the fact that there are less daylight hours. The problem can be exacerbated for pedestrians wearing darker clothing. Also, the wet road conditions may make it harder for drivers to stop when spotting a pedestrian crossing the roadway.

Type 11: Pedestrian hit on sidewalk or shoulder



Description:

A pedestrian and a vehicle collided on a sidewalk or shoulder.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 11	35%	9%	4%	52%

Frequency:

163 of 4,557 collisions 3% of all collisions Rank #11

Significant Collision Findings:

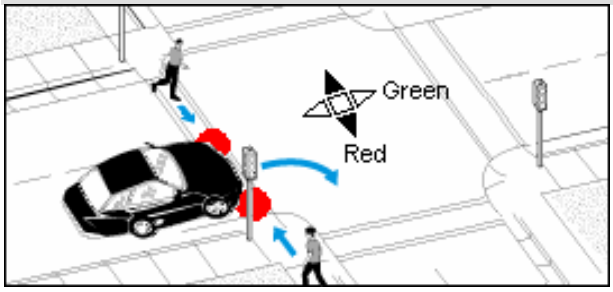
	Type 11	All Collision Types
Major Injuries	17% (29 cases)	10% (479 cases)
Male Pedestrians 25-44	38% (30 cases)	32% (729 cases)
Female Pedestrians 25-44	36% (27 cases)	32% (737 cases)
Male Drivers 16-24, 35-44	15% (17 cases), 28% (32 cases)	11% (331 cases), 22% (680 cases)
Female Drivers 16-24	19% (7 cases)	13% (152 cases)
Male Drivers 25-34	16% (19 cases)	20% (634 cases)
Female Drivers 25-34	14% (5 cases)	19% (229 cases)
1-3 p.m.	18% (29 cases)	11% (520 cases)
Friday	20% (33 cases)	17% (802 cases)
June	13% (21 cases)	8% (391 cases)

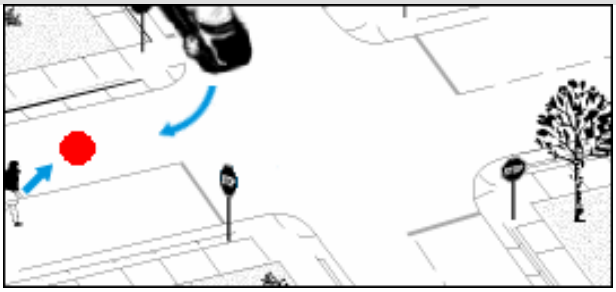
Findings:

Pedestrians within the age group of 25-44 were involved in this type of collision more frequently. Male and female drivers between the age of 16 and 24 were over-represented. While this was one of the least frequent types of collision, when it did occur, the resulting injuries tended to be more severe than average.

The most common reason for this collision to occur may be loss of control of the vehicle.

Type 4: Vehicle turns right while pedestrian crosses without right-of-way at intersection





Description:

A pedestrian and a vehicle collision at an intersection while the vehicle was preparing to turn right, or in the process of turning right, or had just completed a right turn (this includes the 20m buffer zone outside the intersection). The pedestrian did not have the right-of-way to cross at the intersection.

Traffic Control Type:

	Traffic Signal	Stop Sign	Other Controls	No Control
Type 4	69%	21%	2%	8%

Frequency:

117 of 4,557 collisions 2% of all collisions Rank #12

Significant Collision Findings:

	Type 4	**All Collision Types**
Minimal Injuries	44% (52 cases)	40% (1,976 cases)
Major Injuries	4% (5 cases)	10% (479 cases)
Male Pedestrians 25-44	40% (17 cases)	32% (729 cases)
Female Pedestrians 25-44	39% (28 cases)	32% (737 cases)
Male Drivers 25-34	12% (10 cases)	20% (634 cases)
Female Drivers 35-44	18% (5 cases)	23% (283 cases)
Female Drivers 25-34	32% (9 cases)	19% (229 cases)
Female Drivers 55-64	21% (6 cases)	8% (94 cases)
8-9 a.m., 6-7 p.m.	12% (14 cases), 12% (14 cases)	7% (345 cases), 8% (364 cases)
12-2 p.m., 4-6 p.m.	5% (5 cases), 8% (10 cases)	12% (550 cases), 15% (730 cases)

Findings:

Pedestrians between the ages of 25-44 were over-represented, and injuries were typically less severe than the other types of collisions. This collision type had a greater frequency of occurring during 8-9 a.m. and 6-7 p.m. compared to the other collision types.

Other studies suggest that drivers tend to check predominantly to the left for oncoming vehicles before deciding to make the right turn and only glancing to the right, and so may fail to detect pedestrians to their right.

Type 99: Other / Unknown

Description:

Collisions classified as “other/unknown” were those that did not fit into any of the previous categories, or the MVARs lacked sufficient information to fit into any of the categories created.

Findings:

About 5% of the total pedestrian/motor vehicle collisions fall into this category.

5.2. Summary – Collision Types

As seen in the combined 2002 and 2003 results, the numbers of pedestrian/motor vehicle collisions are distributed as follow:

- 47% of all pedestrian/motor vehicle collisions occurred at intersections;
- 37% occurred at non-intersection locations (driveway, mid-block, etc.);
- 11% occurred in parking lots; and
- 5% unknown.

The five most frequent pedestrian/motor vehicle collision types are the following:

Pedestrian hit at mid-block location (Type 8)

- 22% of all pedestrian/motor vehicle collisions
- 95% of drivers had the right-of-way
- Injuries were slightly more severe in this collision type than other collision types
- Weather and road conditions were not a major factor
- This collision type occurred more frequently during the month of June than other months

Vehicle is going straight through intersection while pedestrian crosses without right-of-way (Type 6)

- 14% of all pedestrian/motor vehicle collisions
- Injuries were slightly more severe in this collision type than in other collision types
- The female pedestrian age group of 25-54 were under-represented in this collision type
- The driver age group of 65+ were also under-represented
- Male pedestrians between the ages of 15 to 24 were over-represented
- The after-school hours tended to be over-represented

Vehicle turns left while pedestrian crosses with right-of-way at intersection (Type 1)

- 13% of all pedestrian/motor vehicle collisions
- Rain and wet road conditions were relatively frequent variables
- Winter months tended to be over-represented
- This collision type occurred more frequently in the morning (6-7 a.m., 9-10 a.m.) and evening hours (8-9 p.m., 10-11 p.m.) than in other types

Pedestrian hit in parking lot (Type 55)

- 11% of all pedestrian/motor vehicle collisions
- Injury severity tended to be minimal
- This collision type occurred more frequently on Saturdays
- 10 a.m. – 5 p.m. tended to be over-represented

Vehicle turns right while pedestrian crosses with right-of-way at intersection (Type 3)

- 9% of all pedestrian/motor vehicle collisions
- Male pedestrians age 75+ and female pedestrians age 15 to 19 were slightly over-represented
- This collision type occurred more frequently at 9-10 a.m.
- Mondays tended to be over-represented

5.3. Over-represented and Under-represented Characteristics

When analyzing the different collision types, each variable was reviewed to determine if there was an over-representation (above average) or under-representation (below average) of that particular type. **Tables 14** and **15** identify and review what variables were over- or under-represented.

Table 14 – Over-Represented Characteristics by Collision Types

		COLLISION TYPES										
		1	**2**	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**	**55**
		Intersection (47%)						Non-Intersection (37%)				
VARIABLES	**Percentage of Ped./Motor Veh. Collisions**	13%	4%	9%	2%	5%	14%	22%	7%	5%	3%	11%
	Injury Severity	Minor	Minor	Minimal	Minimal	Minimal	Minor		Minimal	Major	Major	Minimal
	Pedestrian Age Group (Male)	55-64	55+	75+	25-44 55-64 75+	15-19	15-24	5-14	55-64 75+	5-14	25-44	
	Pedestrian Age Group (Female)	25-44		15-19	25-44		5-14	5-14	75+	5-14	25-44	25-44 75+
	Driver Age Group (Male)	65+	45-54		35-44 55+64				45-54	25-34	16-24 35-44	25-34
	Driver Age Group (Female)		35-44	16-24	25-34 55-64	65+	16-24 45-54			25-34 55-64	16-24	65+
	Weather Conditions	Rain	Rain	Clear		Clear		Clear		Rain	Clear	Clear
	Road Surface Conditions	Wet	Wet	Dry		Dry		Dry		Wet		Dry
	Hourly Distribution	6-7am 9-10am 8-9pm 10-11pm	8-9am 7-8pm	9-10am	8-9am 6-7pm	5-6pm	3-4pm	12-1pm	12-1pm 3-4pm	8-9am 5-6pm	1-3pm	10am- 5pm
	Daily Distribution	Tue	Thu-Fri	Mon	Mon	Fri	Thu-Fri	Sat	Sun	Mon	Fri	Sat
	Monthly Distribution	Nov-Feb	Nov-Jan	Feb	Jul-Aug Nov- Dec	Feb Oct	Aug	Apr-Jul	Jun	May Dec	Jun	Apr Jun

1: Yellow (lighter) highlights – identify the patterns for intersection.
2: Blue (darker) highlights – identify the patterns for non-intersection.

Table 14 identifies the specific categories that are over-represented within each variable for the different pedestrian/motor vehicle collision types.

From **Table 14**, the following patterns are identifiable:

Injury Severity

Minimal and minor injuries were over-represented in most of the collision types (1-6 [at intersections], 9 [at private driveway], and 55 [in parking lot]). However, major injuries were over-represented in types 10 (at pedestrian crossover) and 11 (on sidewalk or shoulder).

Pedestrian Age

When looking at children (5-14), teenagers (15-19), adults (20-64), and seniors (65+), there was no significant pattern or trend that was identifiable.

Driver Age

No pattern or trend was easily identifiable.

Weather Conditions

There was no one specific weather condition that was over-represented.

Road Surface Conditions

No trend or pattern could be identified.

Hourly Distribution

There is no recognizable pattern for hourly distribution.

Daily Distribution

Intersection pedestrian/motor vehicle collisions were frequent during the weekdays and non-intersection collisions occurred more on weekends.

Monthly Distribution

Intersection pedestrian/motor vehicle collisions seem to be occurring during the autumn/winter seasons; while non-intersection collisions show a pattern of occurring more frequently in the spring/summer seasons.

Table 15 – Under-Represented Characteristics by Collision Types

		COLLISION TYPES										
		1	**2**	**3**	**4**	**5**	**6**	**8**	**9**	**10**	**11**	**55**
		Intersection (47%)						Non-Intersection (37%)				
VARIABLES	**Percentage of Ped./Motor Veh. Collisions**	13%	4%	9%	2%	5%	14%	22%	7%	5%	3%	11%
	Injury Severity		Major	Major	Major		Minimal			Minimal	Minimal	
	Pedestrian Age Group (Male)	5-14	5-19 25-44		5-14 65-74					25-54	55-64 75+	5-19
	Pedestrian Age Group (Female)	5-19	5-14 25-44		15-19 75+		25-54	25-44	5-14	25-44 55-64 75+	5-14	5-14 20-24
	Driver Age Group (Male)		16-24	35-54	25-34	25-34				35-44	25-34	55-64
	Driver Age Group (Female)		45-54		35-44 45-54 65+	25-34 45-54	65+			65+	25-44	25-34
	Weather Condition	Clear	Clear			Rain		Rain		Clear	Rain	Rain
	Road Surface Condition	Dry	Dry			Wet		Wet		Dry	Wet	Wet
	Hourly Distribution	3-4pm	10-11am	8-11pm	12-2pm 4-6pm	2-3pm 4-5pm	8-9am 11-12pm	7-8am	6-7pm	8-9pm	5-6pm	8-9am
	Daily Distribution		Wed Sat-Sun	Sat-Sun	Fri-Sun	Mon	Mon- Tue	Thu	Mon	Sat-Sun	Wed- Thu	Wed-Fri
	Monthly Distribution	Jun, Jul	Apr-Jun	Apr-Jun	May-Jun	Dec	Jun	Dec-Feb	Nov- Dec	Sep	Dec-Jan	Oct-Dec

1: Yellow (lighter) highlights – identify the patterns for intersection.
2: Blue (darker) highlights – identify the patterns for non-intersection.

Table 15 provides the following trends:

Injury Severity

More severe injuries such as major and fatalities are less frequent at intersections. At non-intersection locations, less severe injuries such as minor or minimal show a pattern of being under-represented.

Pedestrian Age

When looking at children (5-14), teenagers (15-19), adults (20-64), and seniors (65+), there was no significant pattern or trend that was identifiable.

Driver Age

No pattern or trend was easily identifiable.

Weather Conditions

No specific trend or pattern was recognizable.

Road Surface Conditions

No specific trend or pattern was recognizable.

Hourly Distribution

There is no recognizable pattern for hourly distribution.

Daily Distribution

Non-intersection pedestrian/motor vehicle collisions are under-represented during the weekdays. Intersection related pedestrian/motor vehicle collisions show no trend or pattern in the daily distribution.

Monthly Distribution

Intersection related pedestrian/motor vehicle collisions occurred less frequently during the spring/summer seasons, while non-intersection collisions show a pattern of occurring less frequently in the autumn/winter seasons.

6. CONCLUSION

In the previous chapters, the pedestrian/motor vehicle collision data has been analyzed from a macro and a micro perspective. More detailed analysis of each collision type can be found in the attached appendices.

The findings have been summarized in this chapter. Included are the key findings and current safety programs.

6.1. Discussions of Key Findings:

The key findings were derived from analyzing the data set and identifying variables that were considered above average (over-represented) or below average (under-represented). It should be noted that while there are some key findings, they do not provide the answers as to how and/or why a collision occurred. Rather, they can suggest the possible contributing factors for the collision occurring.

6.1.1. Severity of Injury

Minimal and minor injuries were the most frequent categories in this variable. Also, these injuries were over-represented in most of the collision types (1-6, 9, and 55). However, major injuries were over-represented in types 10 (at pedestrian crossover) and 11 (on sidewalk or shoulder).

6.1.2. Age and Gender

These findings are important for a variety of reasons in that they provide information on who is mostly involved in collisions as well as the possible behavioural causes for the collisions occurring. When looking at the various age groups, they can provide details on certain habits that generally pertain to a specific age group.

When attempting to explain the degree of collision-involvement of any particular group, their exposure to the risk of collision must be considered. For example, while the gender distribution of licensed drivers is relatively equal, male drivers tend to be involved in more collisions than female drivers. If, as is likely, male license holders drive more than female license holders, they would suffer greater exposure to collisions. It is also possible (and other research suggests) that male drivers are more aggressive and take more risks than female drivers. Without knowing the actual vehicle-kilometers driven by males and females, it is not possible to determine how much of their over-representation in collisions is attributable to risk-taking and aggressive driving, and how much is exposure-related.

Another finding that was very interesting was the pedestrian age group of 65+. While this age group was under-represented in collisions, they were over-represented in the injury category. While they were not involved in as many collisions, this age group tended to have a greater fatality rate than other age groups. This may be attributed to the frailty of seniors.

Pedestrians under the age of 14 were over-represented when analyzing collisions that occurred at mid-block locations (Type 8). These collisions could be occurring in areas where school age children want to cross the street to get to a school, park, home, etc. This collision type also included pedestrians who were crossing between parked cars. This, of course, would cause a visibility problem for drivers since they are not expecting a pedestrian to be crossing at these locations.

6.1.3. Weather and Road Surface Conditions

While the majority of the pedestrian/motor vehicle collisions analyzed occurred during clear and dry conditions, rainy/wet conditions were over-represented. In some collision types (Types 1, 2, and 10) this can lead to the suggestion that poor visibility may have been a contributing factor in some of these collisions. Wet conditions can also impair to the driver's ability to stop in sudden/unexpected situations.

6.1.4. Time of Collision

As expected, most collisions took place on weekdays between the morning and evening rush periods. Once again, this can be linked to exposure. During those times, there are more vehicles and pedestrians on the roadway and therefore a greater chance of collisions occurring. The analysis identified that the autumn/winter months (October to February) had the greatest frequency of collisions occurring at intersections (Types 1-6). This once again leads to the suggestion that visibility is probably a significant factor in the occurrence of the collisions. During the autumn/winter months daylight hours are shorter, and there is a greater probability of inclement weather. These variables combined could potentially contribute to motorists' inability to see pedestrians clearly.

6.1.5. Location of Collision

When reviewing the geographical distribution of all the pedestrian/motor vehicle collisions, three areas of concern were identified: downtown, arterial roads, and intersections/non-intersections. A significant number of the pedestrian/motor vehicle collisions occurred in the downtown area, this can be as a result of exposure – during the week, there are more vehicles and pedestrians in that vicinity and therefore the potential for a collision is greater. The geographical distribution also showed pedestrian/motor vehicle collisions occurring more frequently along arterial roads. Once again this can be as a result of greater volumes of pedestrians and vehicles along the arterial roads rather than on the collector and local roads.

6.2. Safety Programs

Three ways to increase the safety of pedestrians are: infrastructure improvements, education and enforcement. Each one of these measures has the ability to target different problems. All three approaches should be used in conjunction with each other to gain the best results.

6.2.1. Infrastructure Improvements

In 2002, the City of Toronto adopted the Toronto Pedestrian Charter, which presents six principles and eleven areas of action to guide policies and practices which affect walking in the city. The Charter, incorporated within the City's Official Plan, documents the importance of providing infrastructure and programs which encourage walking, and improves safety and accessibility. The Pedestrian Charter is the first step in developing a Pedestrian Plan for the City.

Since 2000, Transportation Services has researched, developed and adopted several pedestrian initiatives to improve accessibility and safety for pedestrians. These include: a 10 year, $20 million program to construct new sidewalks; installation of Audible Pedestrian Signals at 17 new intersections per year; and a five-year program to replace 61 pedestrian crossovers with traffic signals and enhance operations of 269 existing pedestrian crossovers with several features to make the crossover location and the pedestrians using them more visible to drivers. In 2006, the City adopted two features to enhance pedestrian safety at signalized intersections. Pedestrian countdown signals are being installed at all signalized intersections over the next seven years, commencing in 2006. Beginning in 2007, zebra crosswalk markings will be installed as part of the standard design for signalized intersections for all road resurfacing and reconstruction projects. Transportation Services will continue to research new approaches for making the city's transportation road system accessible and safer for all users.

6.2.2. Education and Public Awareness

Transportation Services' annual traffic safety campaign has focused on red light running and other behaviours, including actions which present a risk to pedestrians. In past campaigns the "We're All Pedestrians" slogan was used to reinforce the message that everyone benefits from safe driving.

General pedestrian safety education is also taught in elementary school. With the "School Crossing Guard" program that is implemented in most elementary schools, children are taught the rules of the road and when and where they may safely cross the street. While everyone knows

the rules of the road from both the pedestrian and the driver's perspective, pedestrian-vehicle collisions still occur. This can be as a result of both driver and pedestrian risk taking.

Education can play a key role in providing messages to the general public. Advertising campaigns can be used to educate both drivers and pedestrians on the general rules of the road, such as the safe usage of pedestrian crossovers. The results of this collision review will also assist the City in identifying key messages for specific audiences (age, gender, etc.) about the behaviours most prevalent to their group. For example, educational programs can be created in schools to help school-age children better understand how to avoid the types of collisions most common amongst their age group.

6.2.3. Enforcement

Enforcement of traffic laws has limited effectiveness in collision prevention. Generally, when there is an enforcement safety campaign, the initial compliance rate can be very positive. Unfortunately, once the enforcement campaign has ended, the compliance rate begins to revert back to the pre-enforcement conditions.

In most cases, enforcement alone will not have lasting impacts. Combining enforcement with education and/or infrastructure improvements may provide more lasting positive changes.

In conclusion, this pedestrian collision study has provided greater insight into the pedestrian/motor vehicle collisions. The results of this study can aid in the design, development and implementation of current and future safety programs.

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William W. Hunter, Jane C. Stutts, Wayne E. Pein, and Chante L. Cox. Pedestrian and Bicycle Crash Types of the Early 1990's. Office of Safety and Traffic Operations R&D, Federal Highway Administration. FHWA-RD-95-163, 1996.

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APPENDIX A
DETAILED ANALYSIS RESULTS

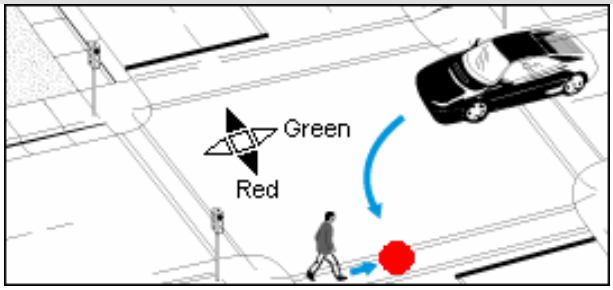
APPENDIX A: DETAILED ANALYSIS RESULTS

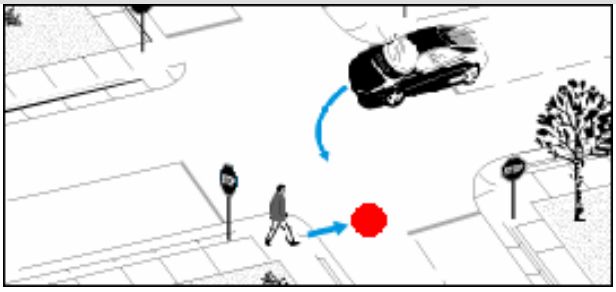
This section presents the detailed analysis results for each collision type. These summaries provide detailed information about each collision type, and can be used to compare the characteristics of different collision types. They illustrate the features that are reference in the report, and future investigation and possible countermeasures provide a basis.

Data is presented graphically, using histograms that compare the distribution in each collision type with the distribution of all pedestrian/motor vehicle collisions in the study; thus enabling an over- or under- representation comparison.

In addition, maps are provided to depict the geographical distribution of the collision incidents within the city of Toronto.

1. Vehicle turns left while pedestrian crosses with right-of-way at intersection



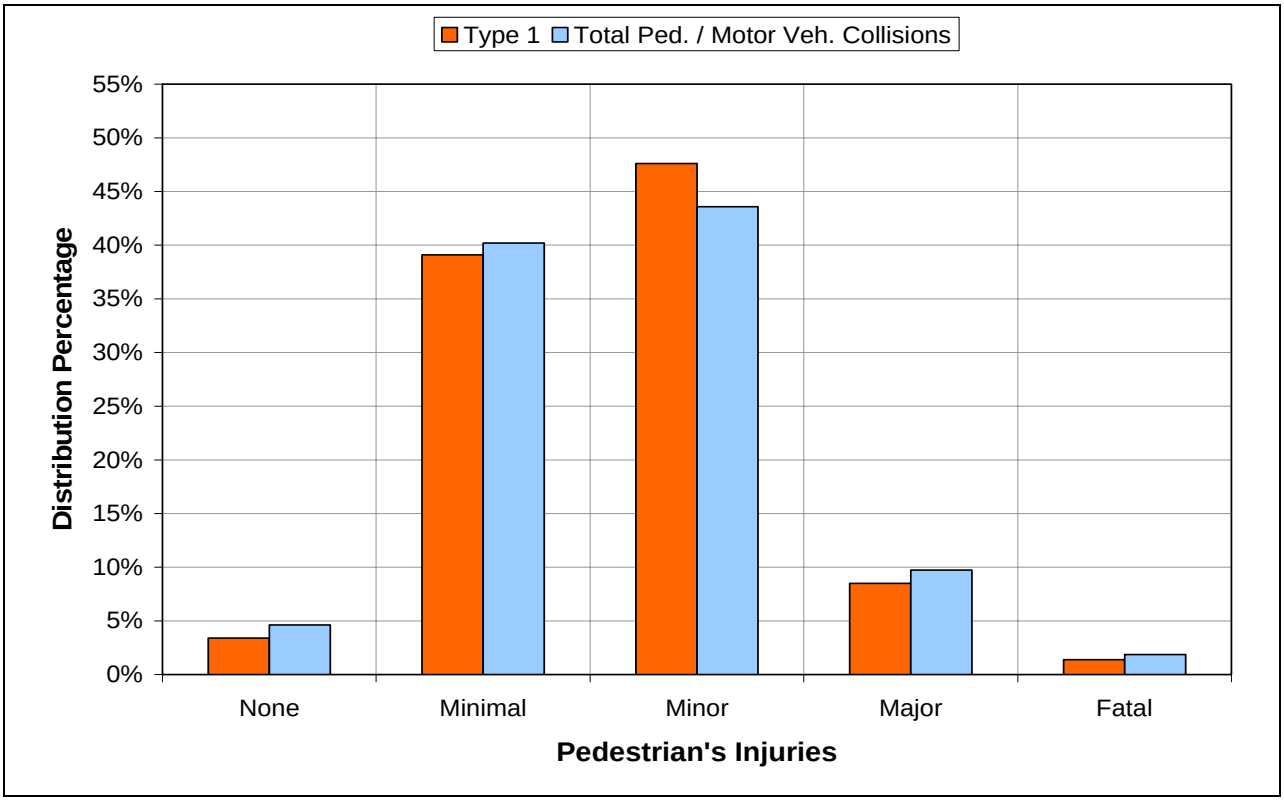


Description: A pedestrian and a vehicle collided at the intersection while the vehicle was preparing to turn left, in the process of turning left, or had just completed a left turn. The pedestrian was crossing with the right-of-way.

Frequency:

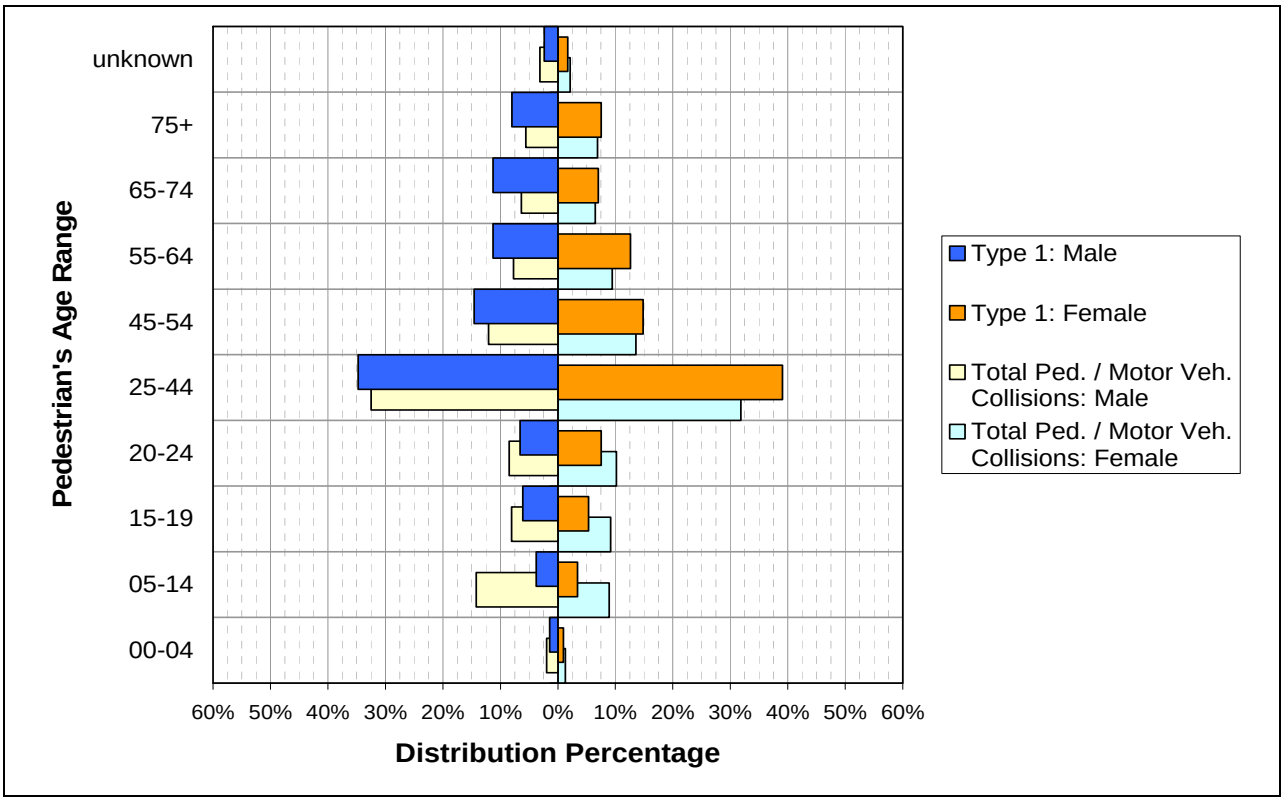
632 of 4,557 collisions 13% of all collisions Rank #3

Pedestrian's Injury:

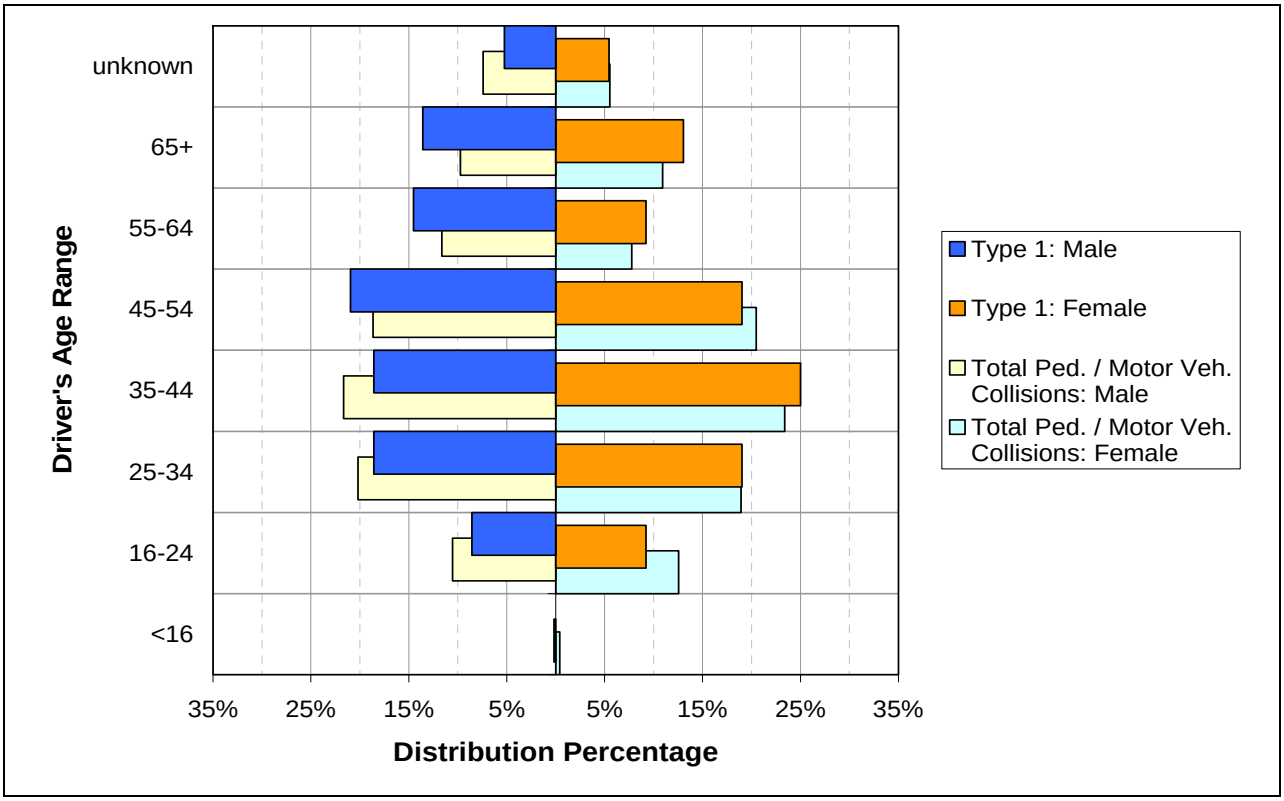


Type 1	3%	39%	48%	9%	1%
Total	5%	40%	44%	10%	2%

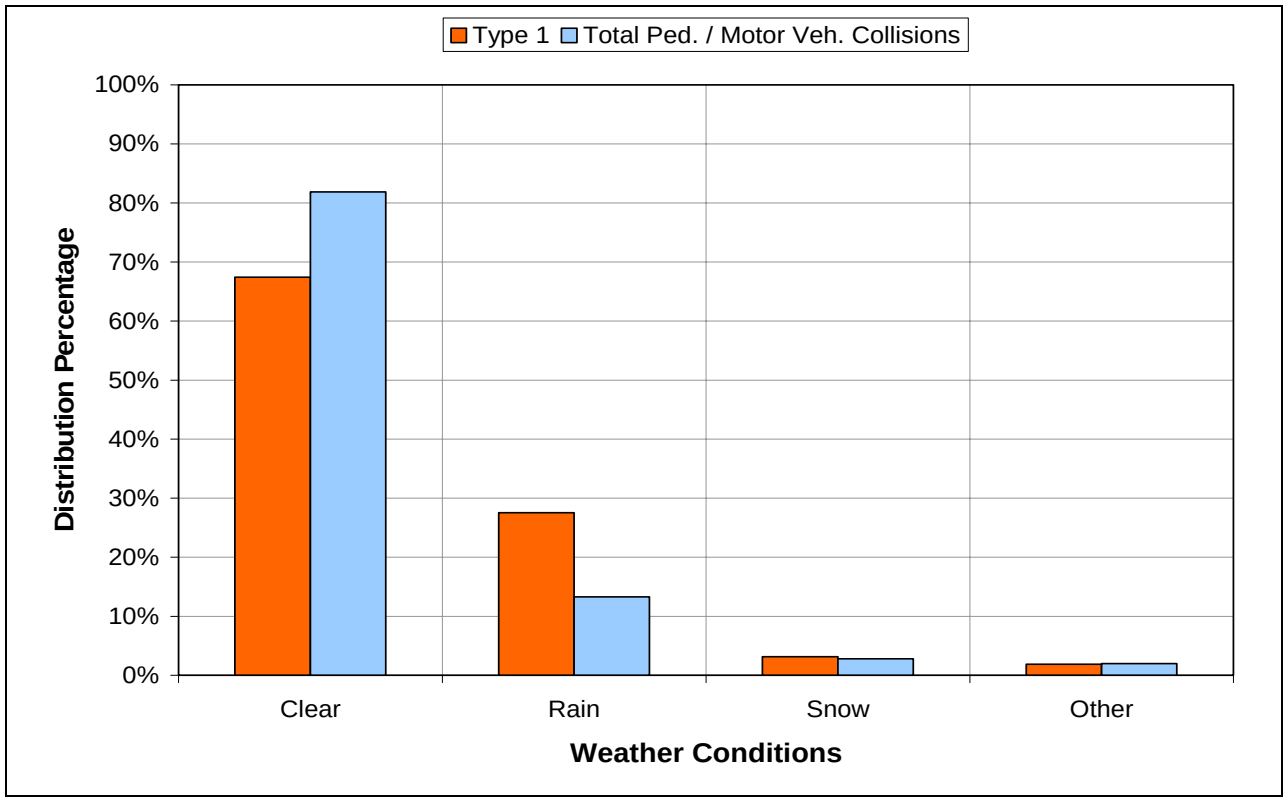
Pedestrian's Age Range:



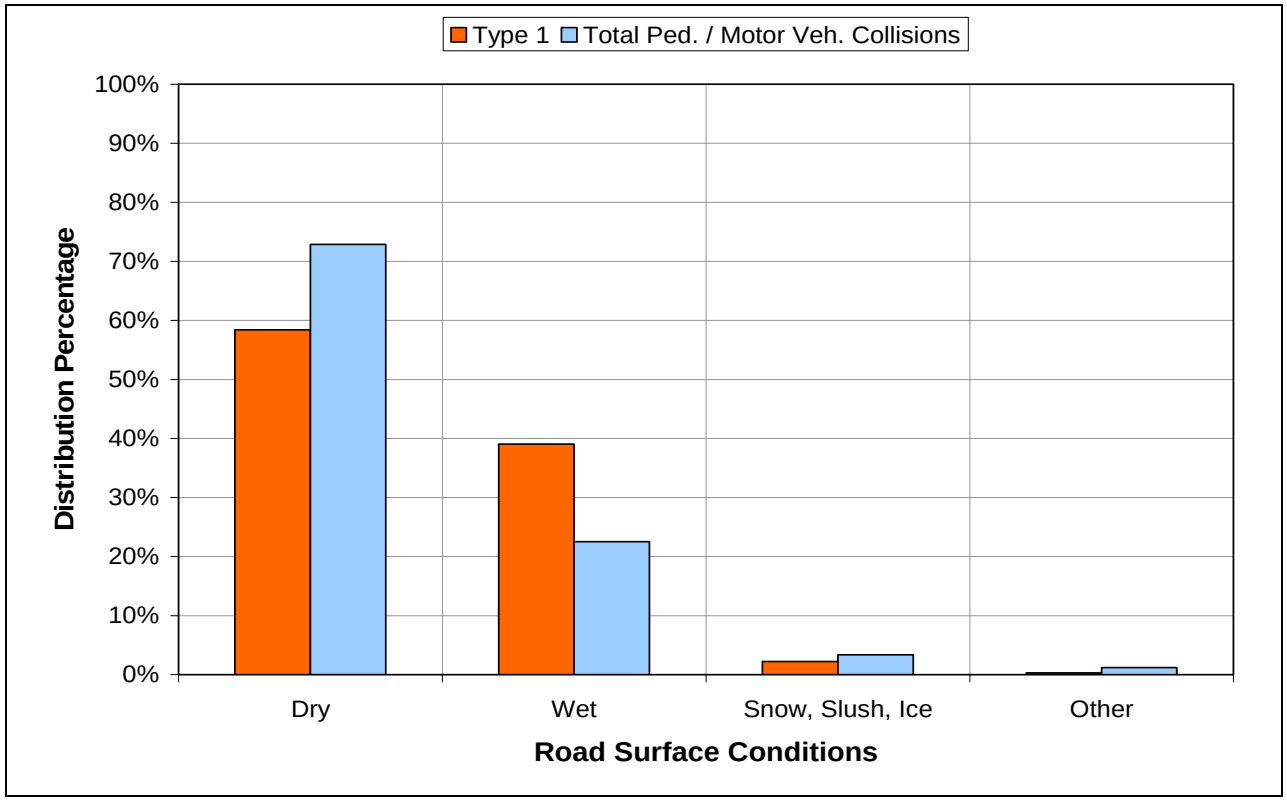
Driver's Age Range:



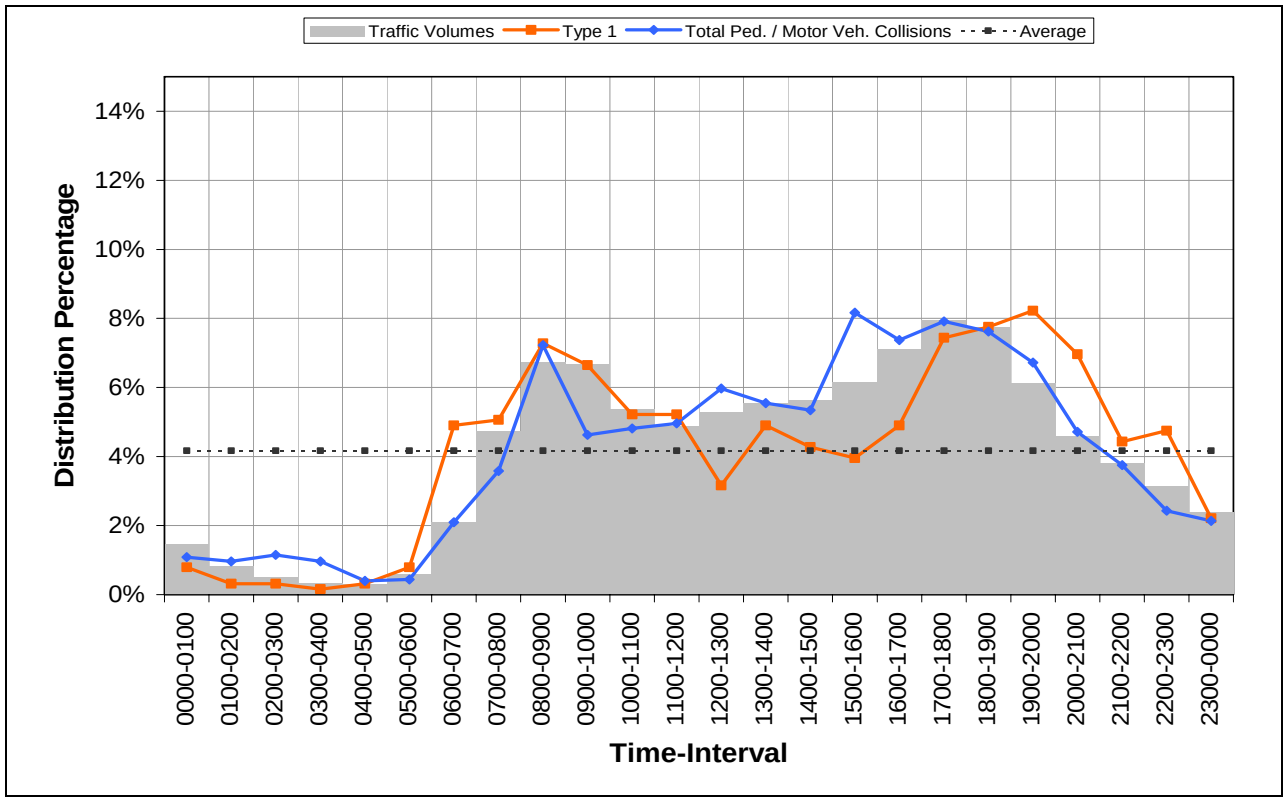
Weather Condition:



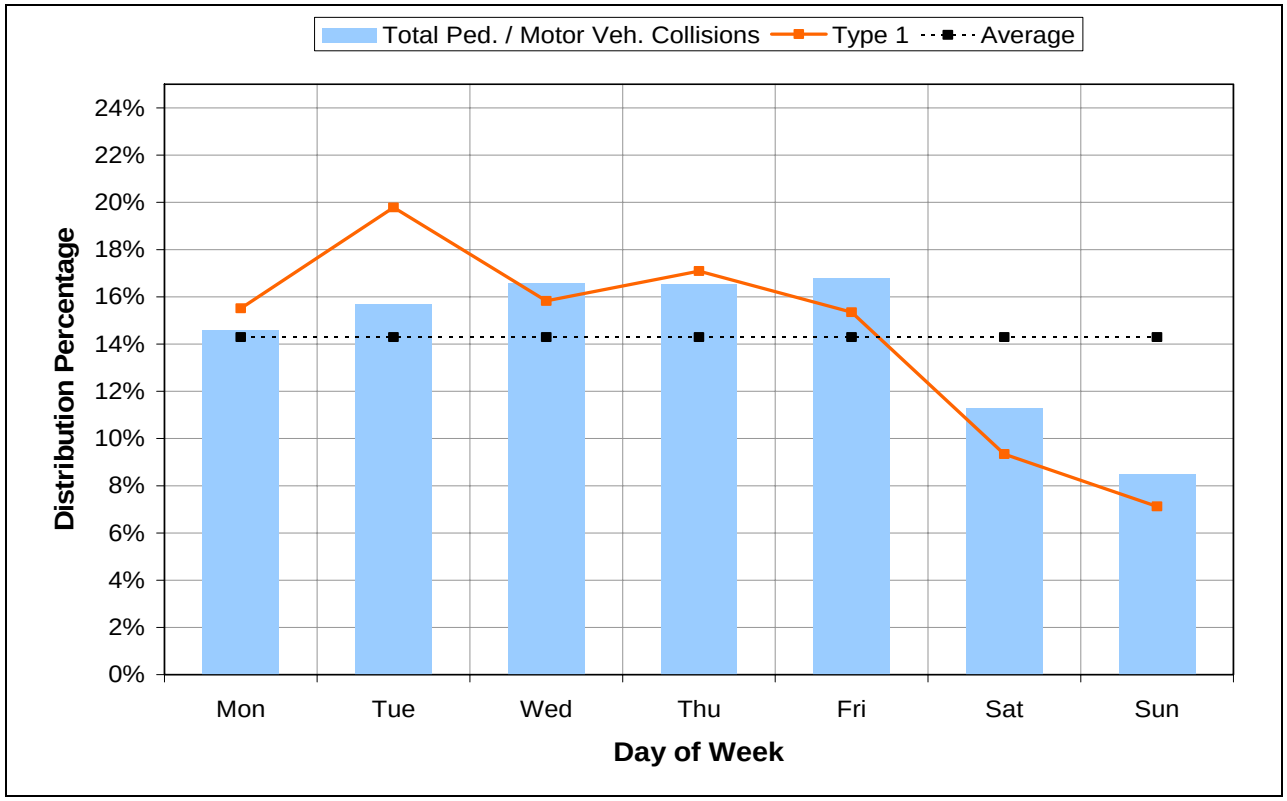
Road Surface Condition:



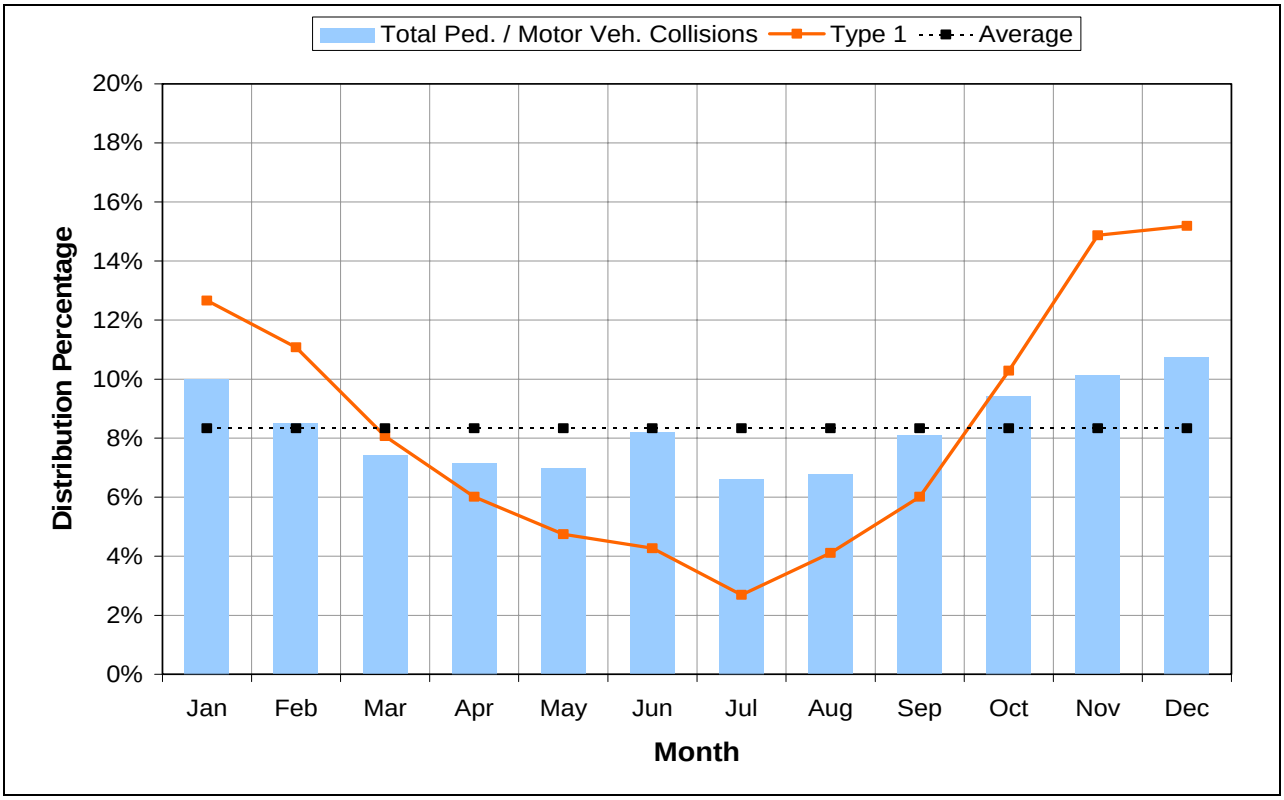
Temporal Pattern – Time of Day:



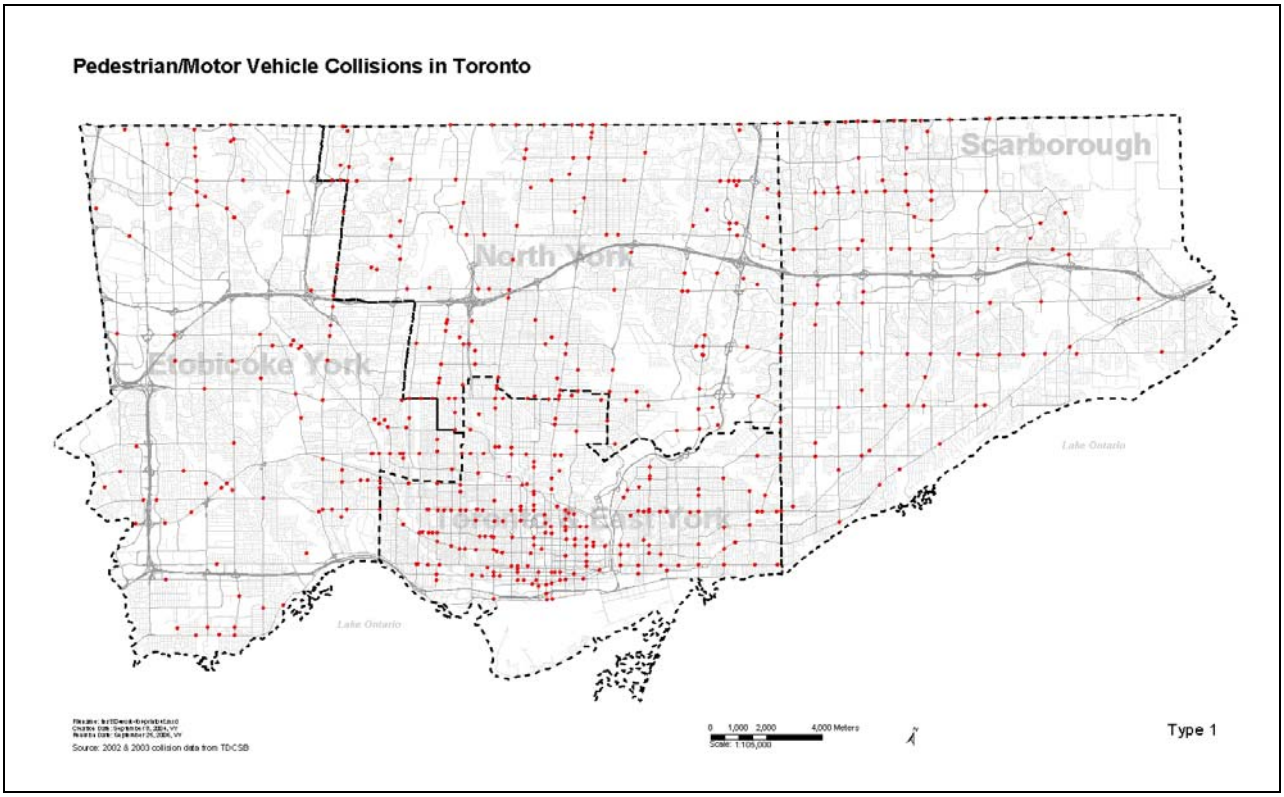
Temporal Pattern – Day of Week:



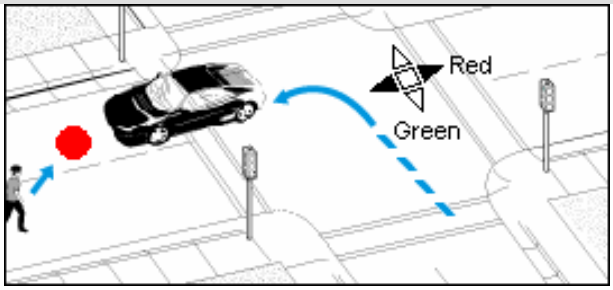
Temporal Pattern – Month of Year:

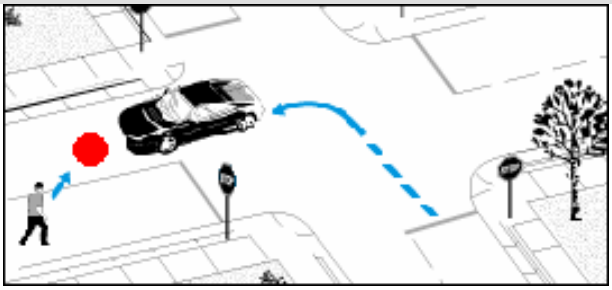


Geographic Distribution:



2. Vehicle turns left while pedestrian crosses without right-of-way at intersection



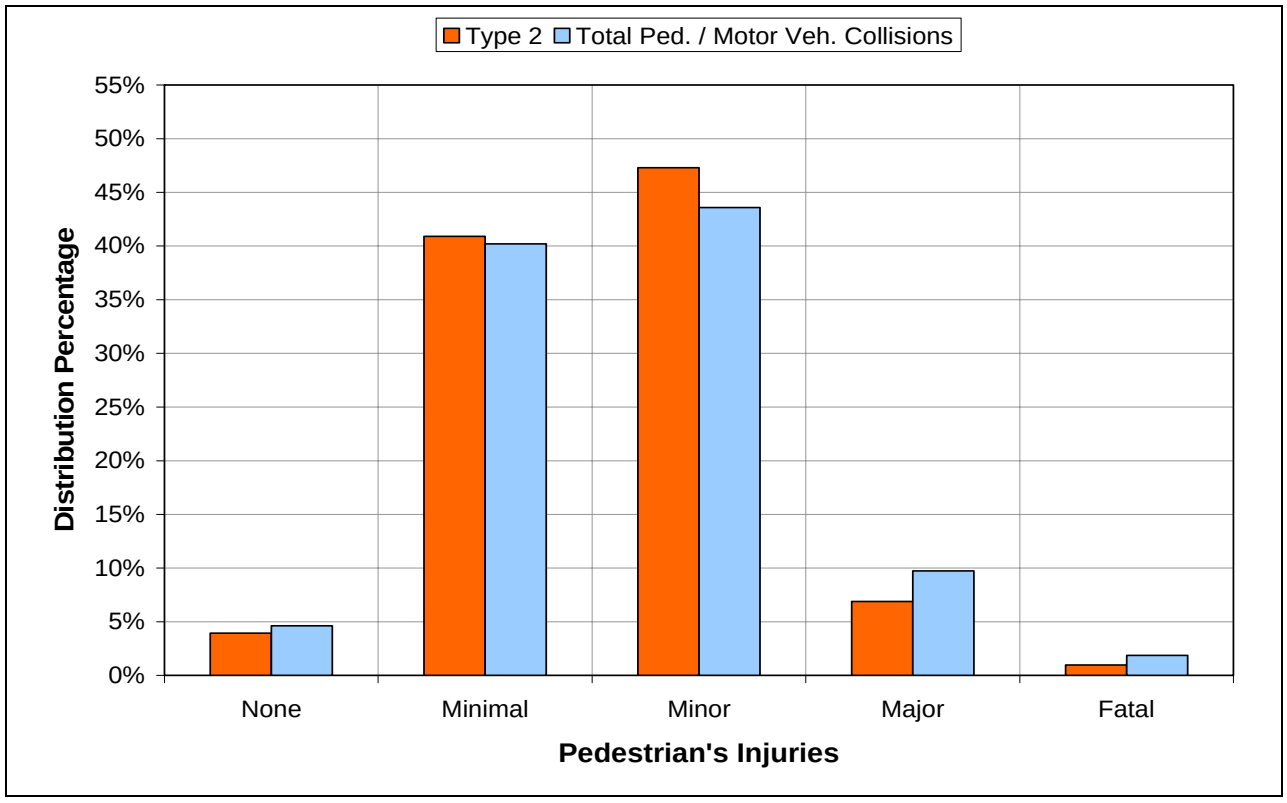


Description: A pedestrian and a vehicle collided at the intersection while the vehicle was preparing to turn left, in the process of turning left, or had just completed a left turn (this includes the 20m buffer zone outside the intersection). The pedestrian did not have the right-of-way to cross at the intersection.

Frequency:

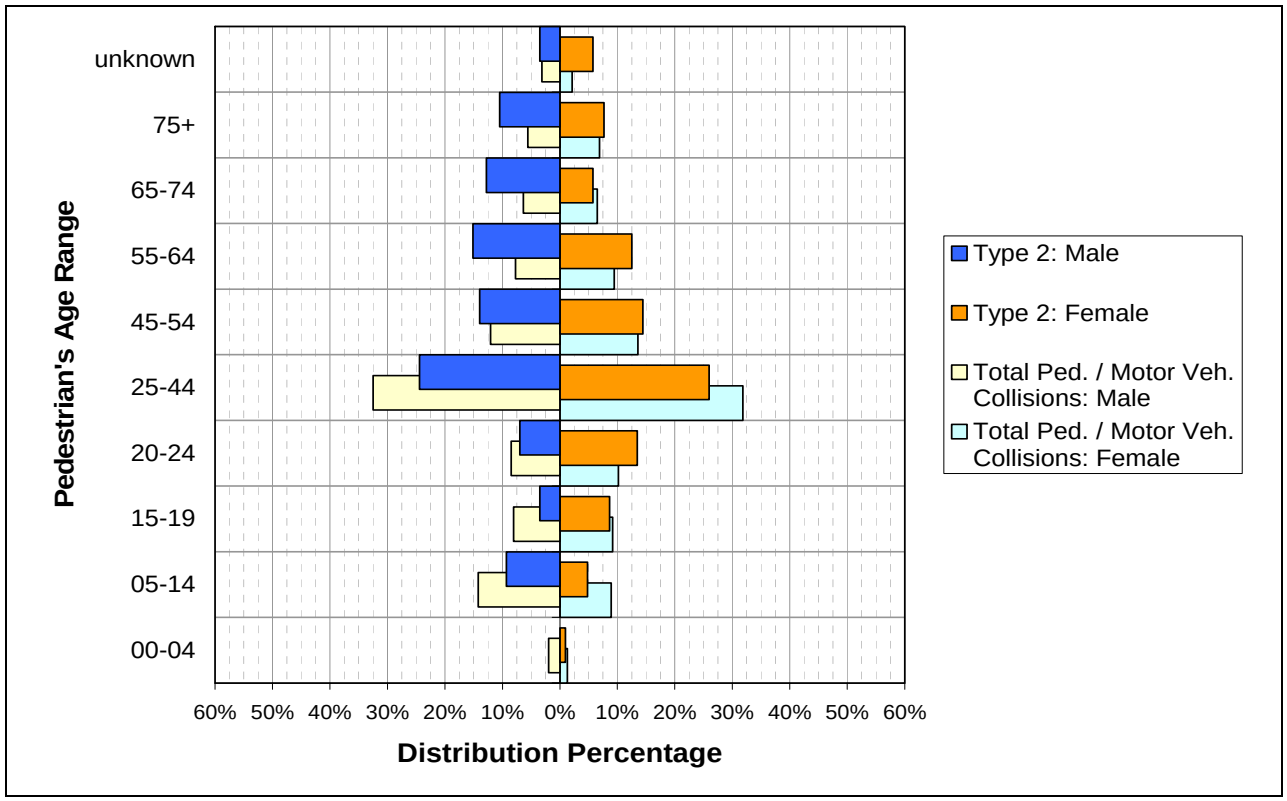
196 of 4,557 collisions 4% of all collisions Rank #9

Pedestrian's Injury:

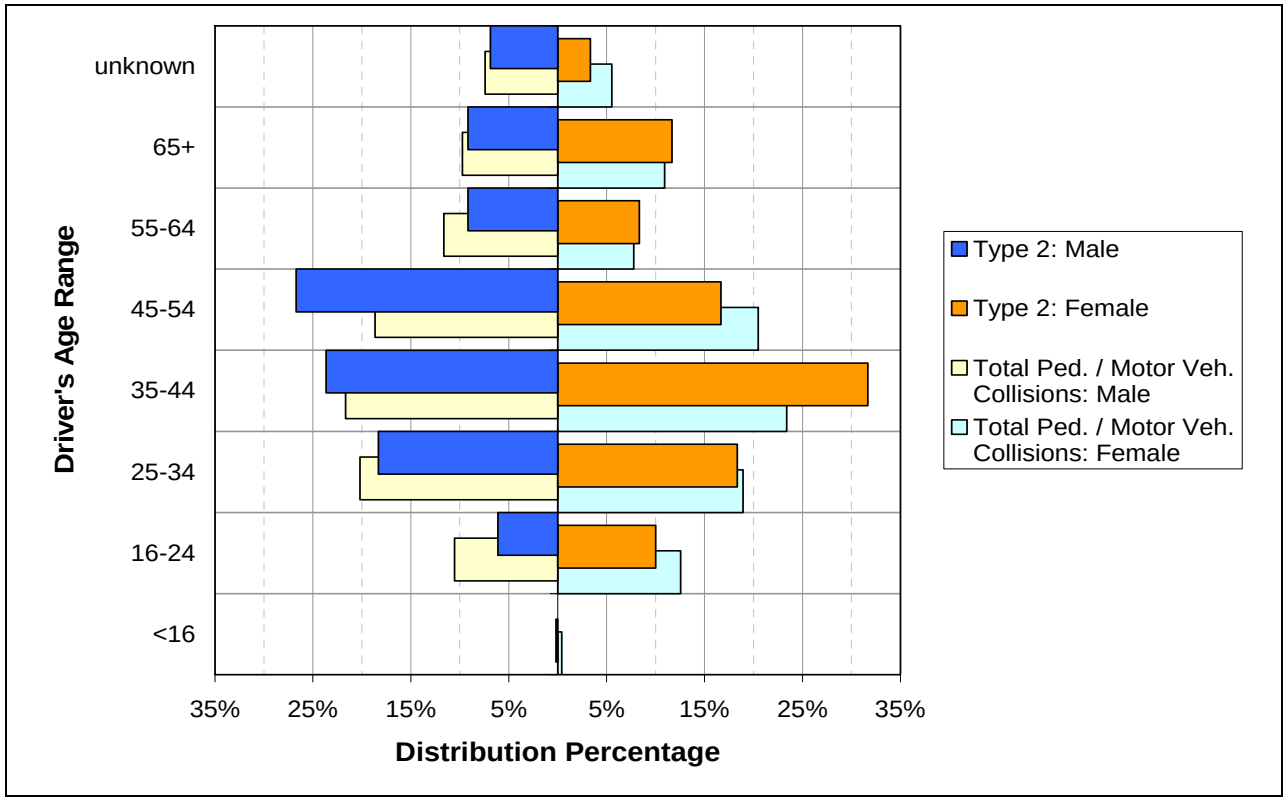


Type 2	4%	41%	47%	7%	1%
Total	5%	40%	44%	10%	2%

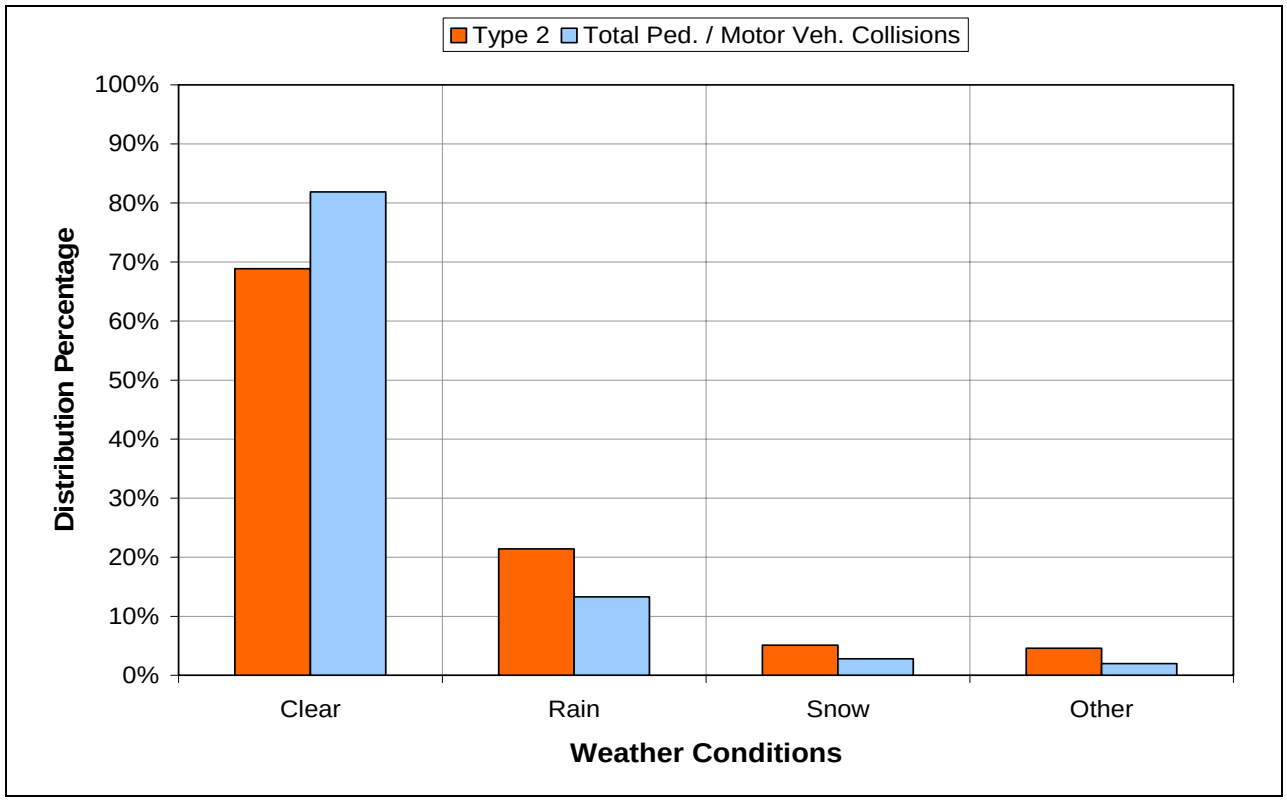
Pedestrian's Age Range:



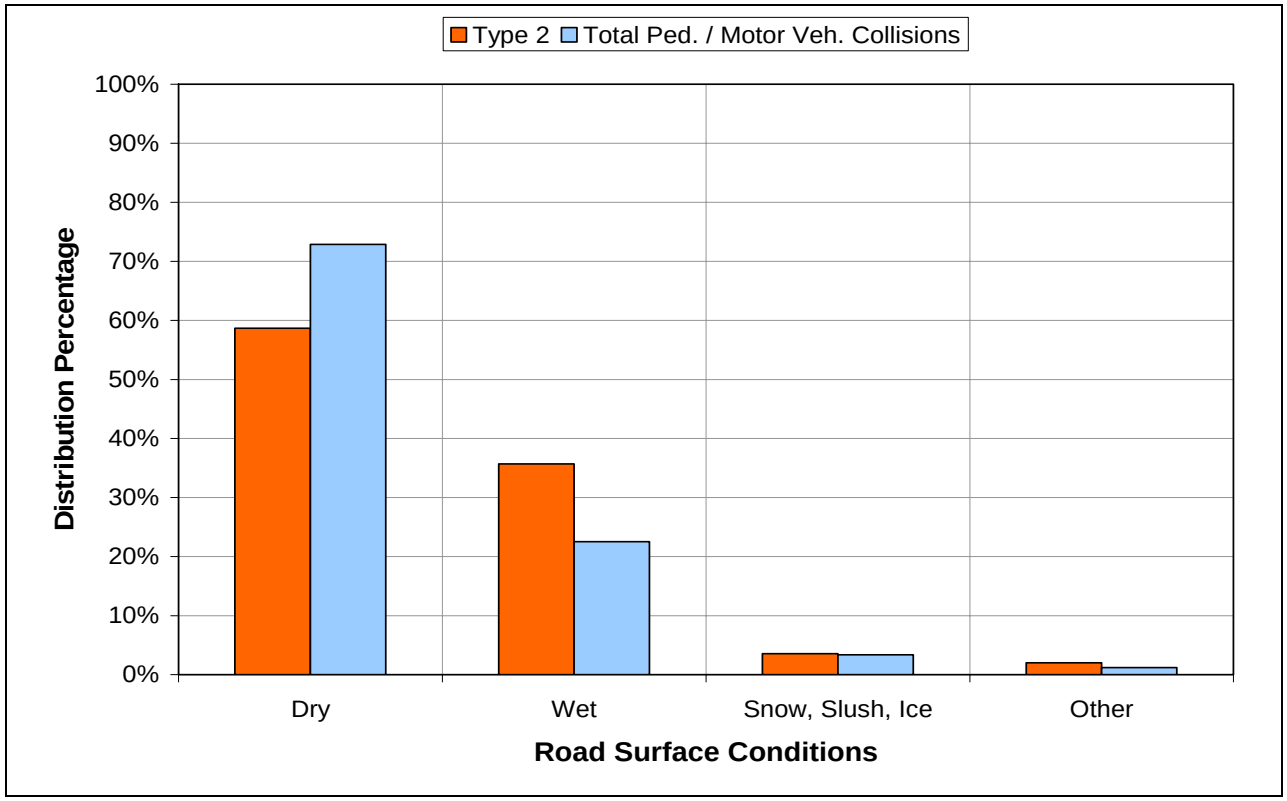
Driver's Age Range:



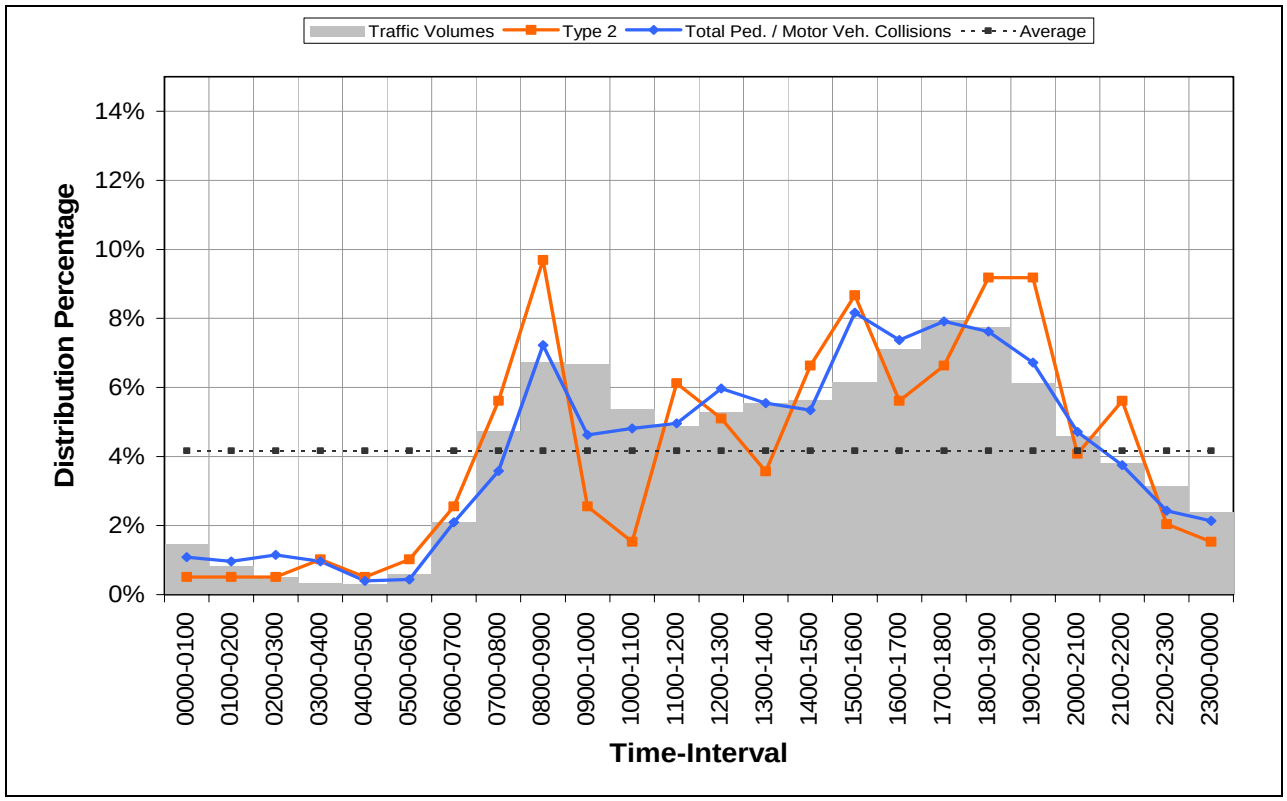
Weather Condition:



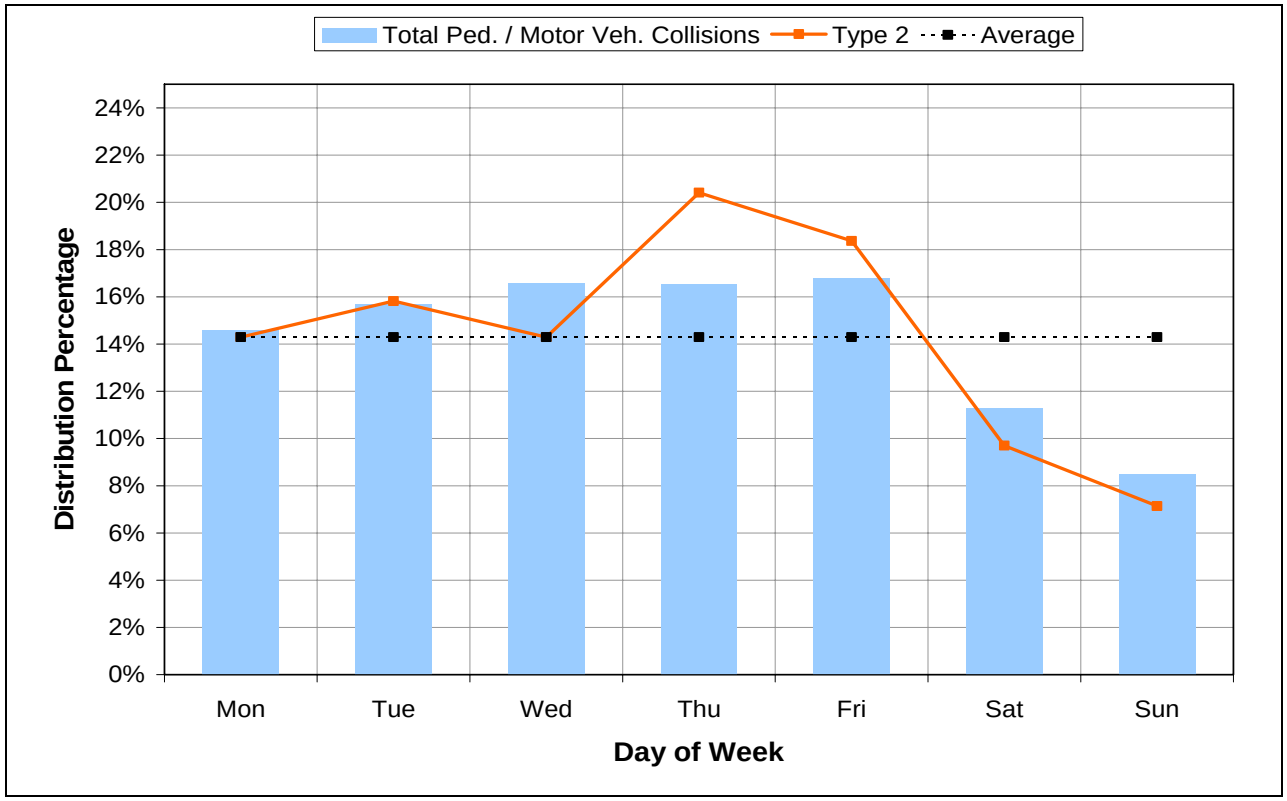
Road Surface Condition:



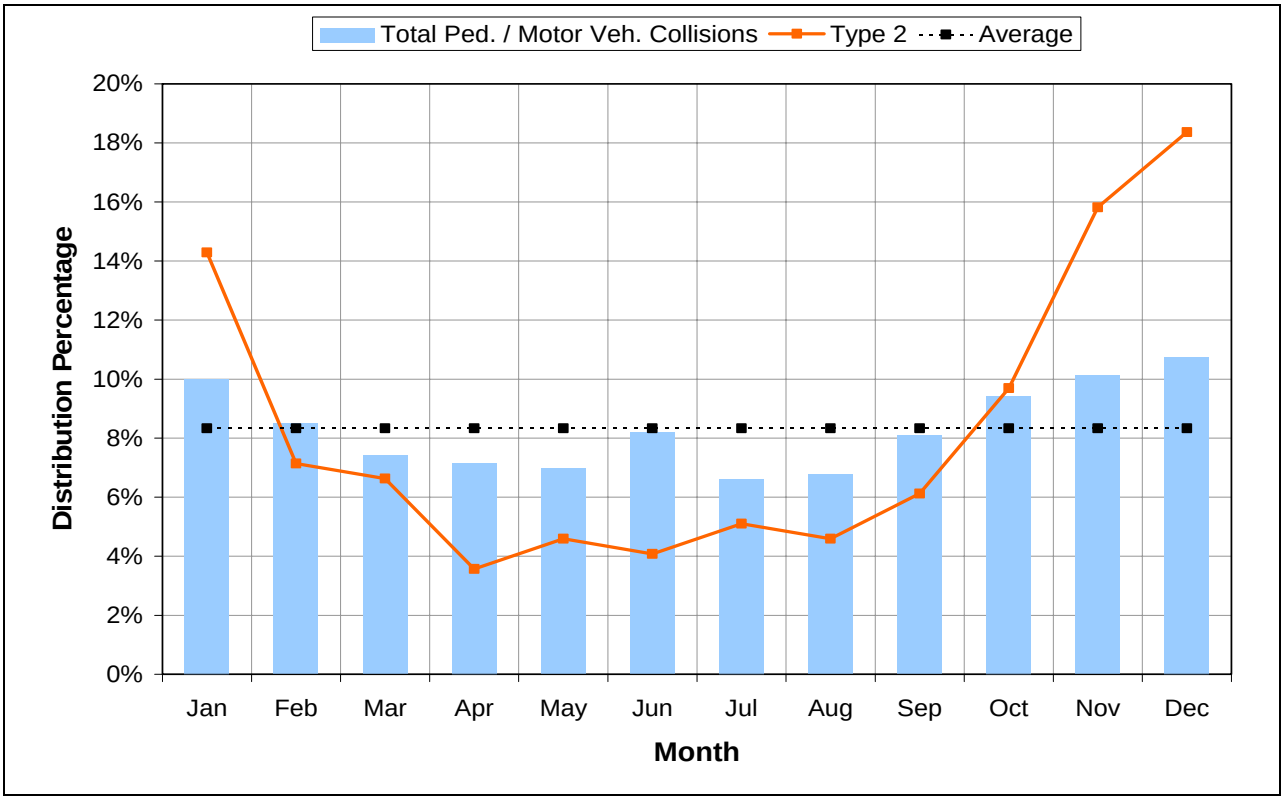
Temporal Pattern – Time of Day:



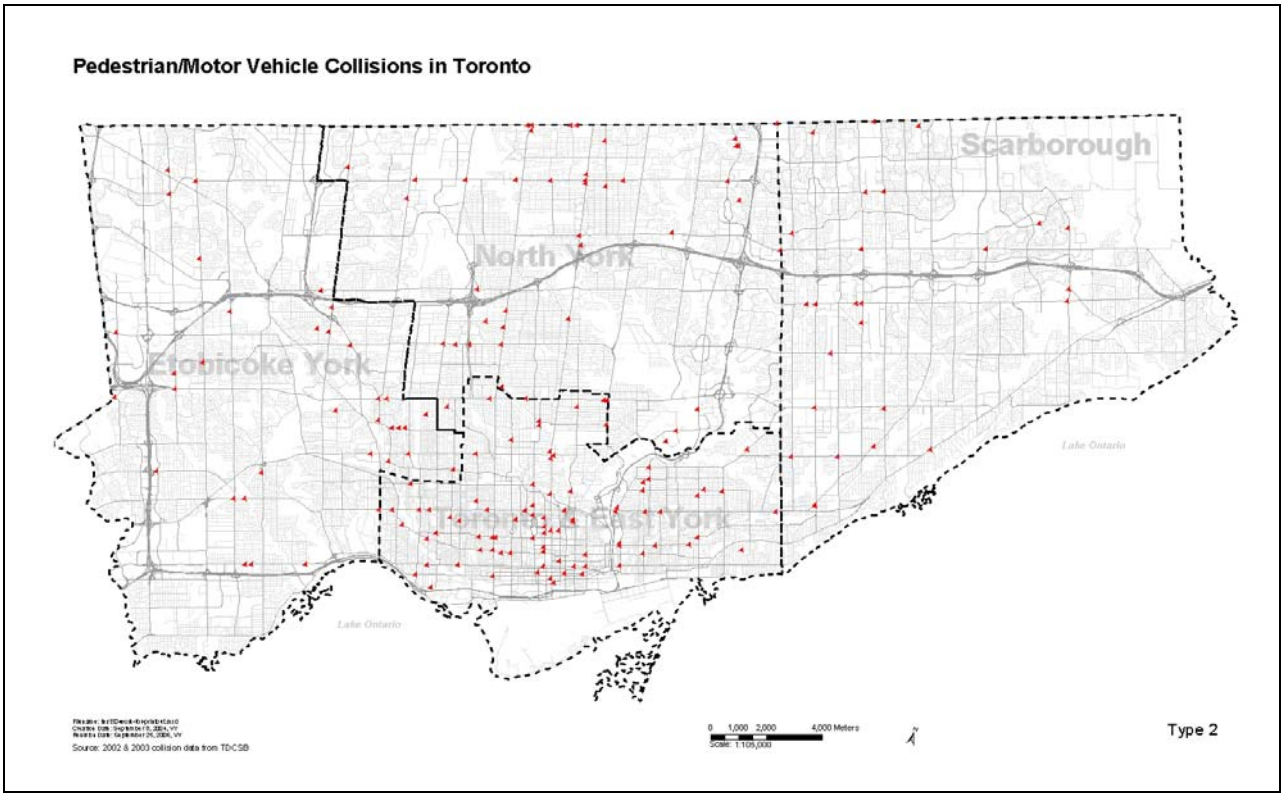
Temporal Pattern – Day of Week:



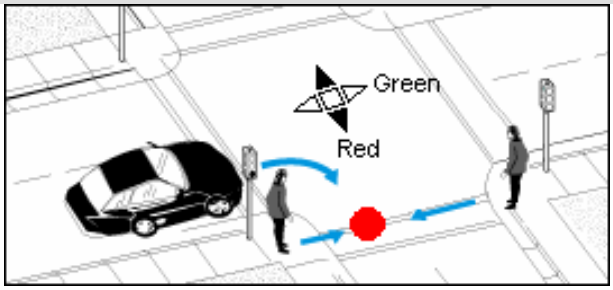
Temporal Pattern – Month of Year:

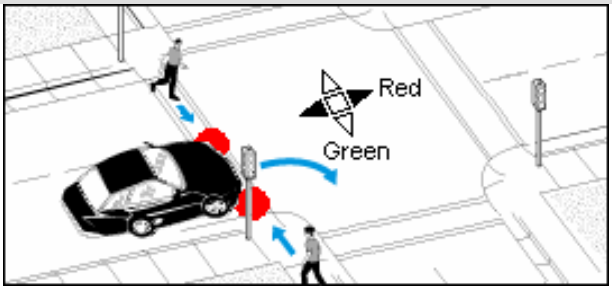


Geographic Distribution:



3. Vehicle turns right while pedestrian crosses with right-of-way at intersection



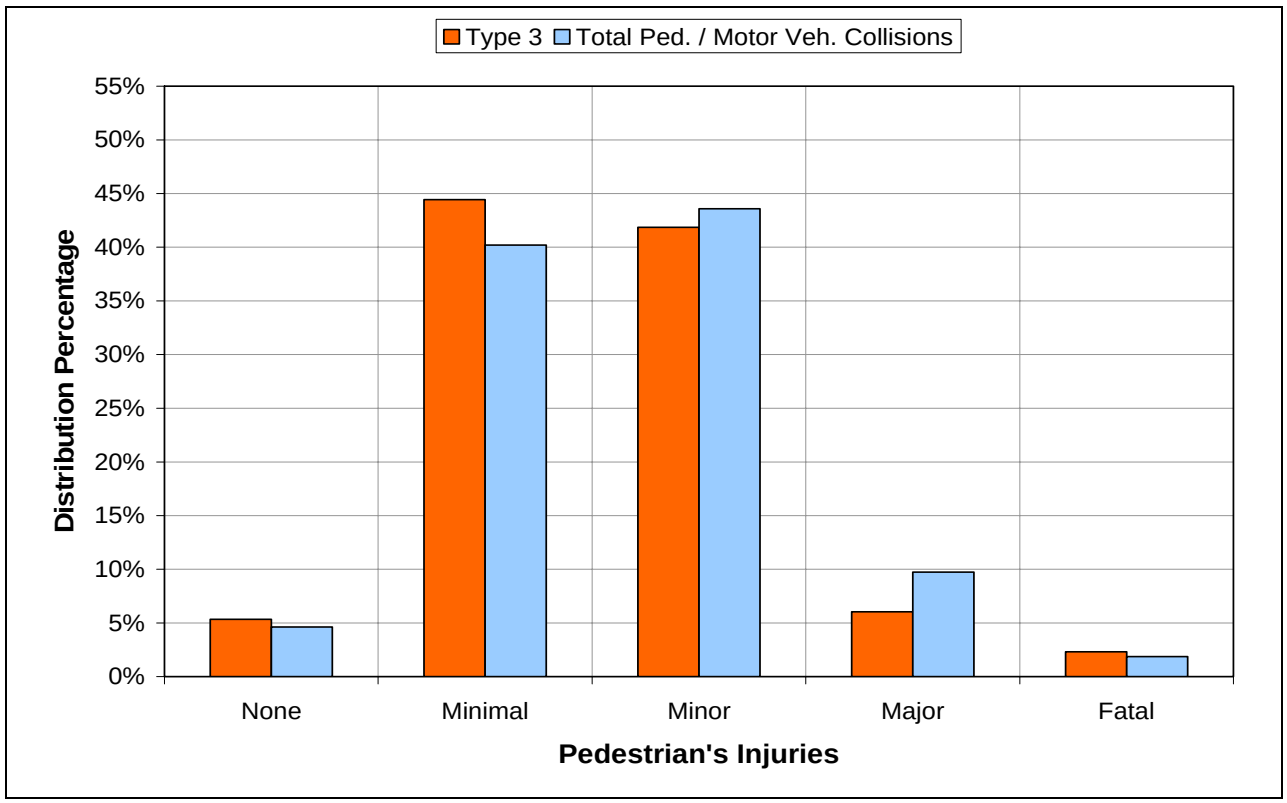


Description: A pedestrian and a vehicle collided at an intersection while the vehicle was preparing to turn right, in the process of turning right, or had just completed a right turn. The pedestrian was crossing with the right-of-way.

Frequency:

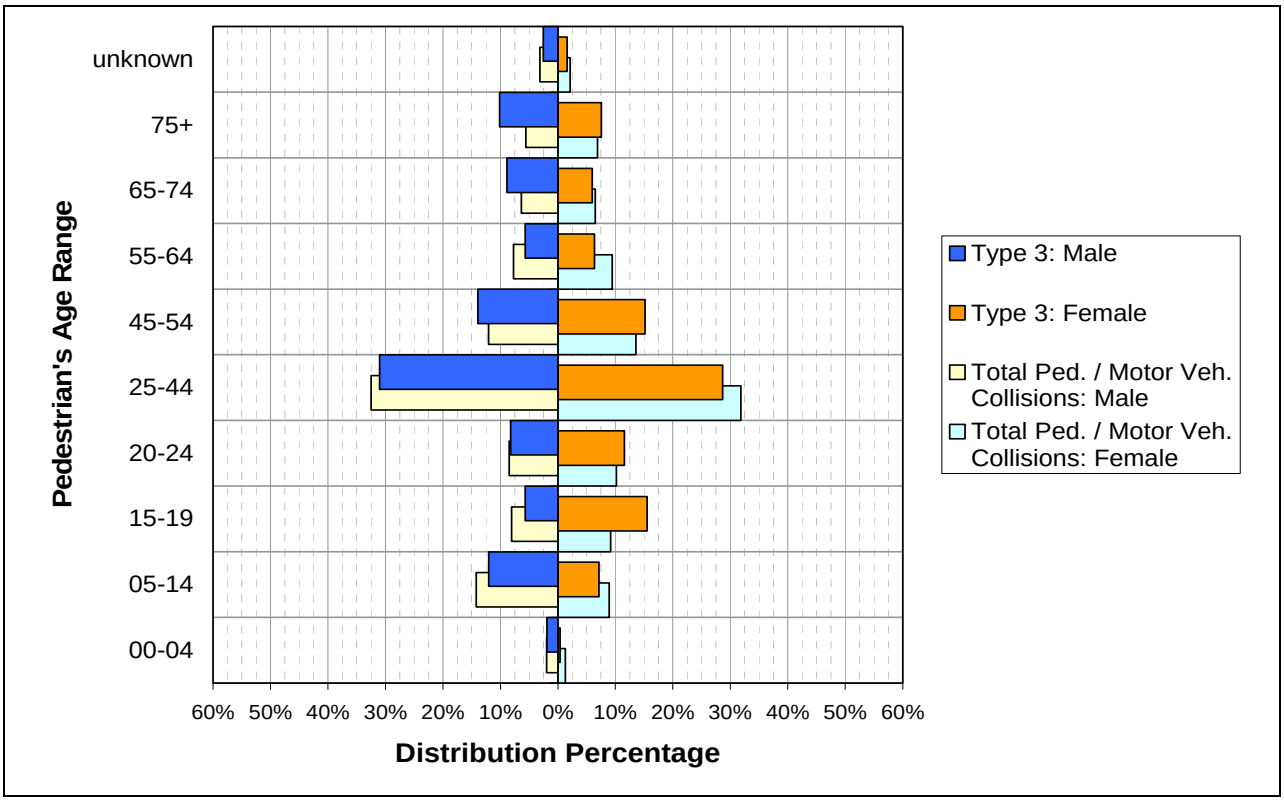
422 of 4,557 collisions 9% of all collisions Rank #5

Pedestrian's Injury:

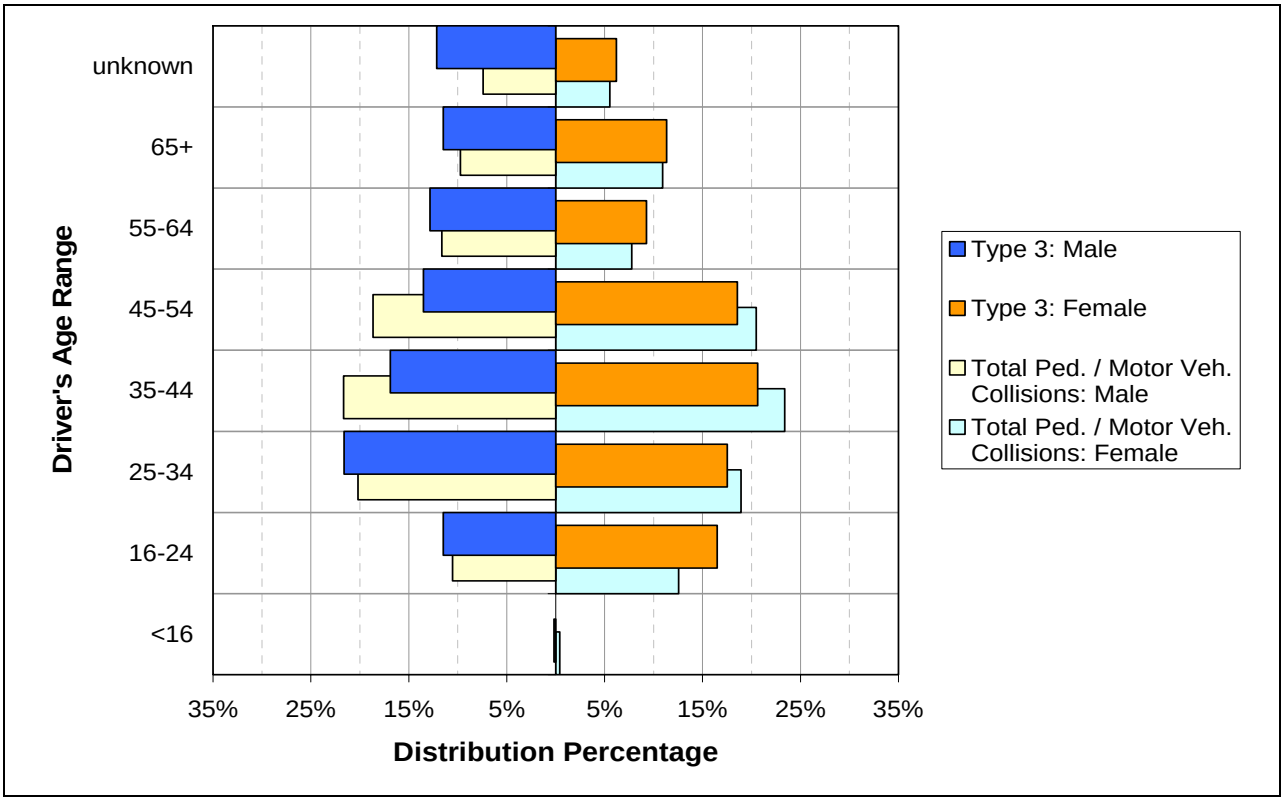


Type 3	5%	45%	42%	6%	2%
Total	5%	40%	44%	10%	2%

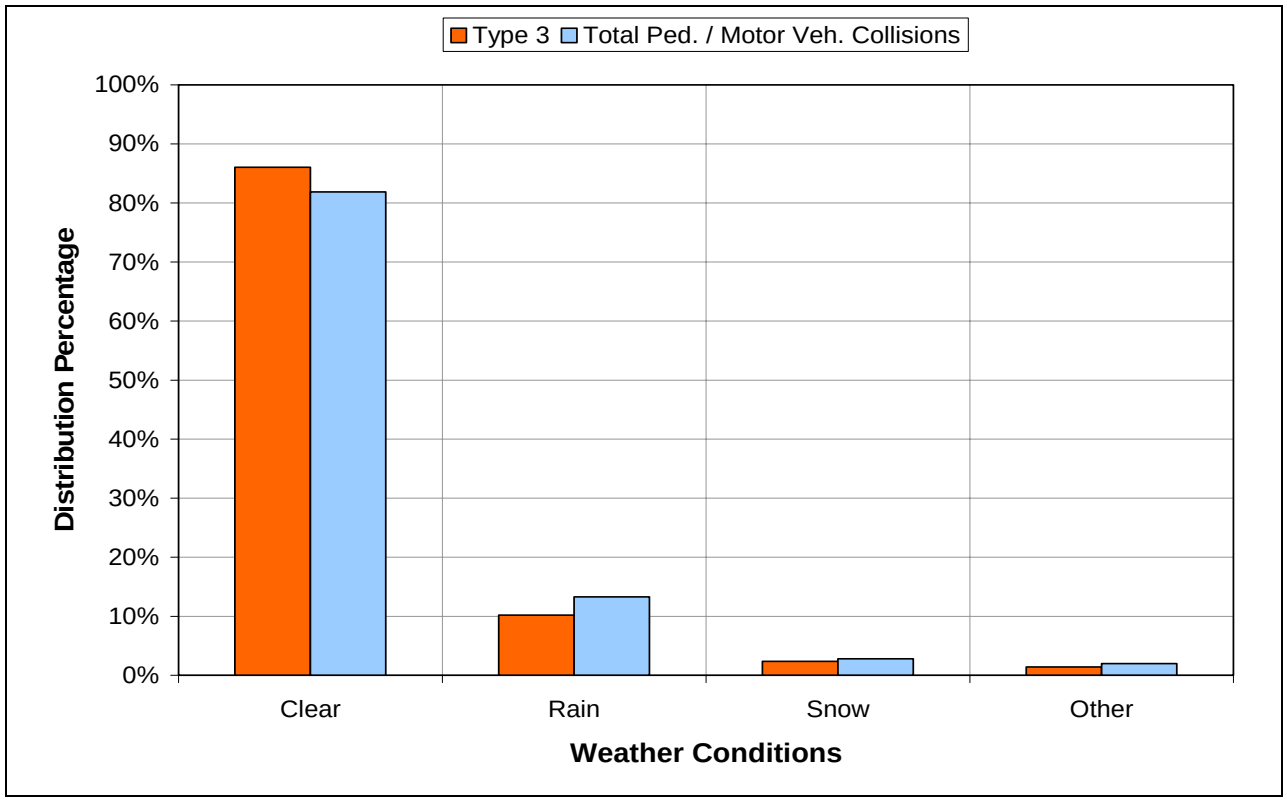
Pedestrian's Age Range:



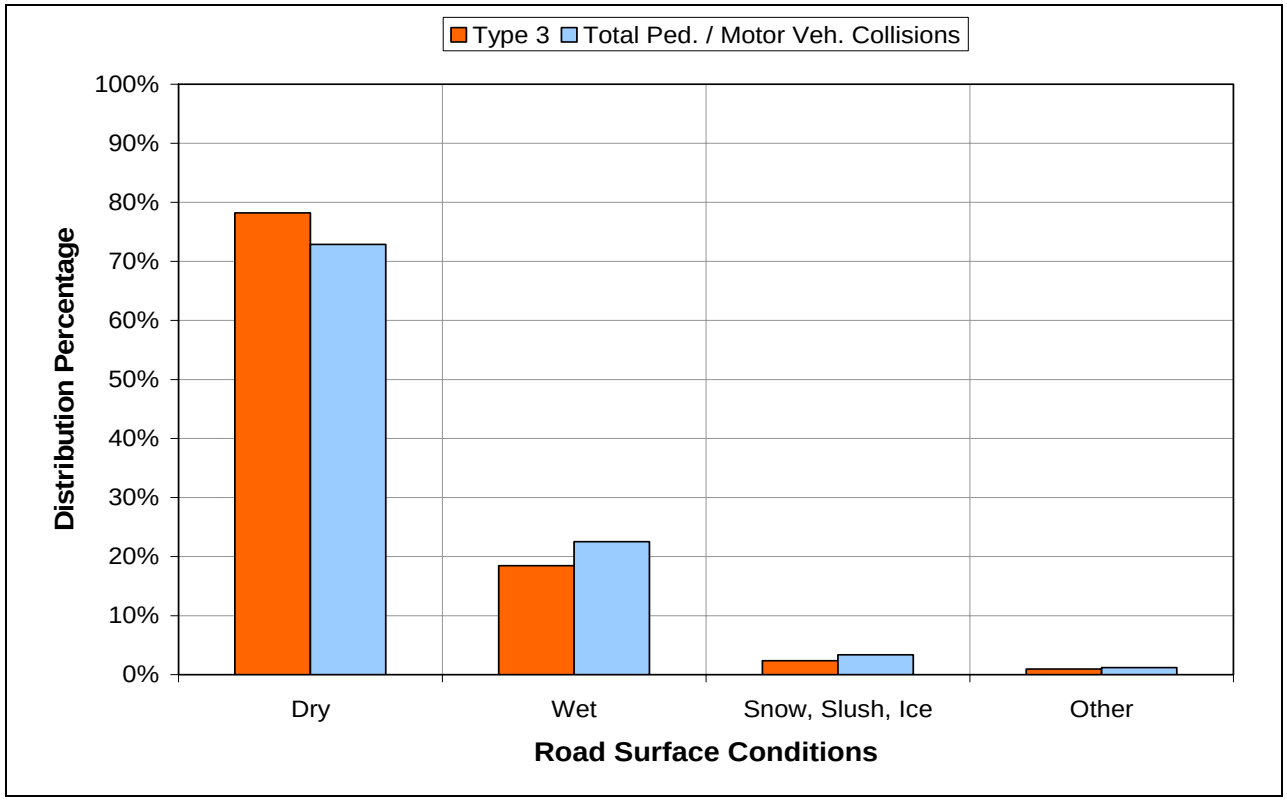
Driver's Age Range:



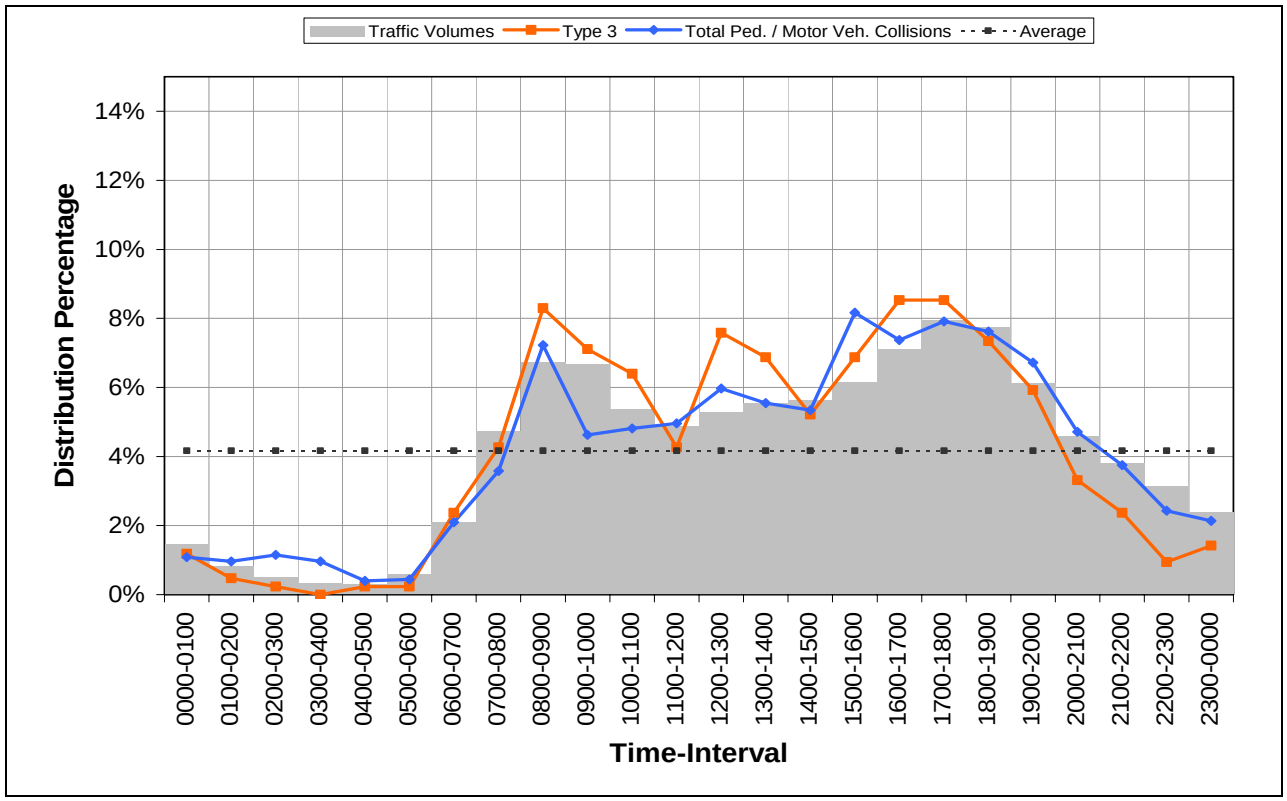
Weather Condition:



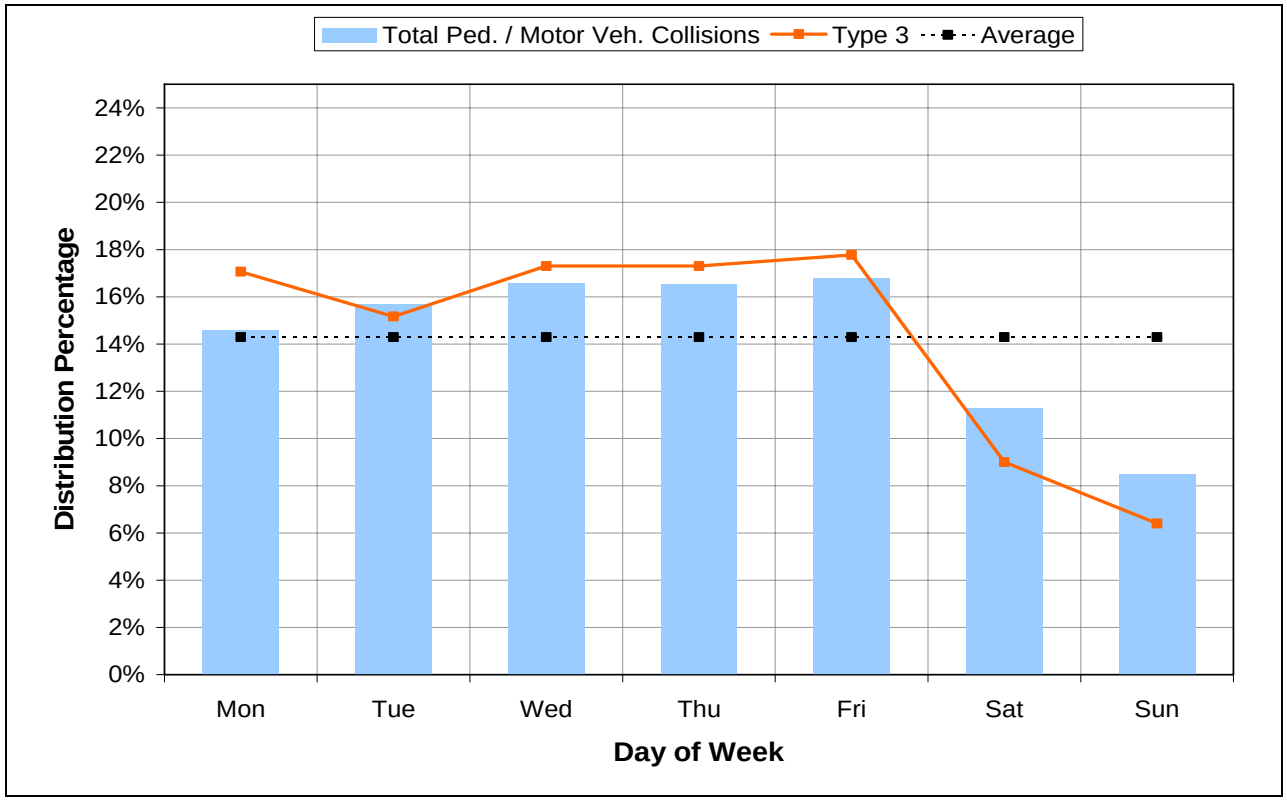
Road Surface Condition:



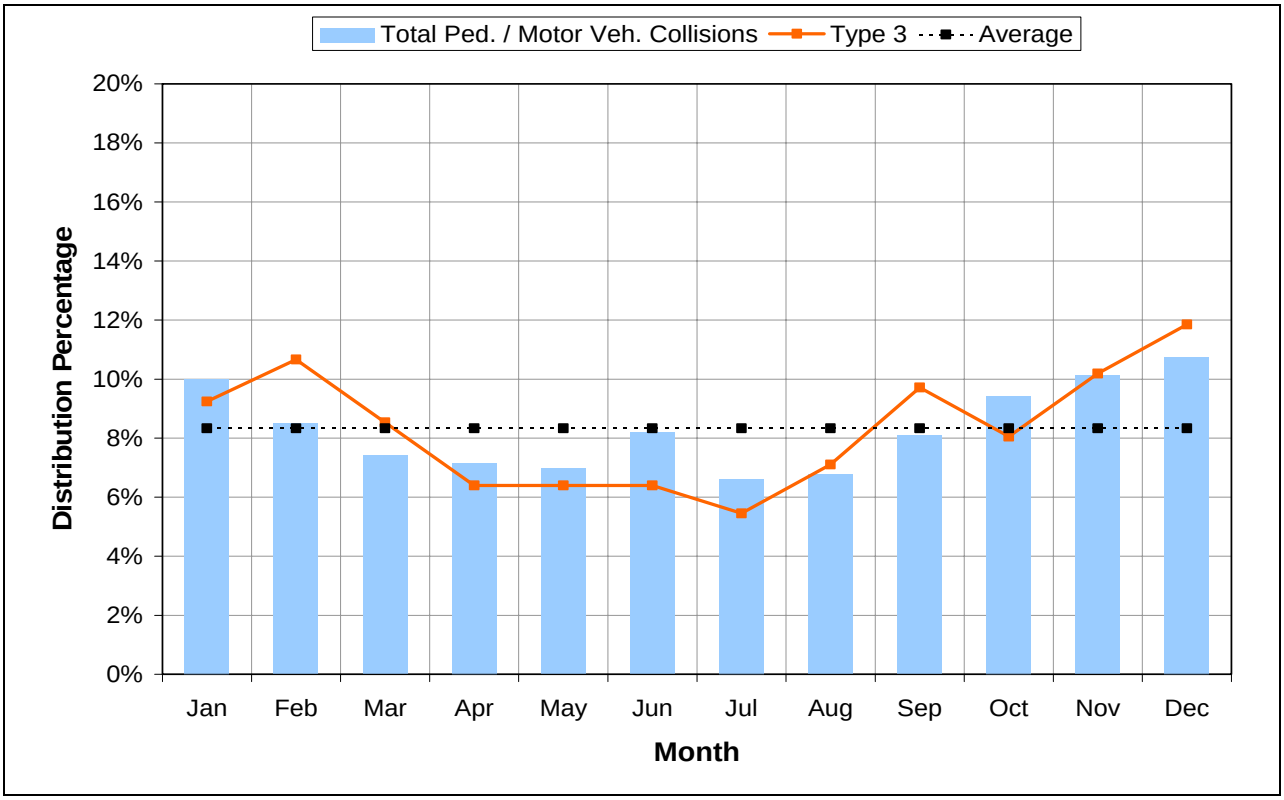
Temporal Pattern – Time of Day:



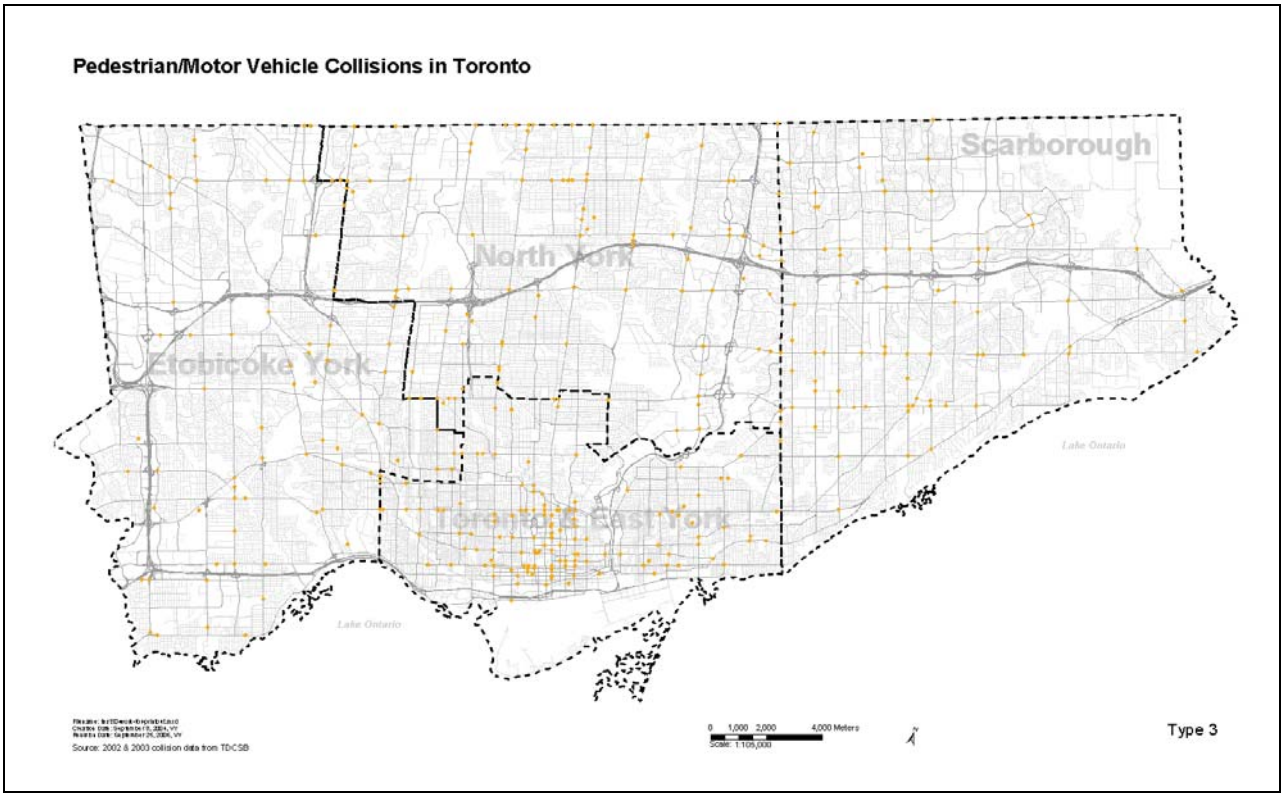
Temporal Pattern – Day of Week:



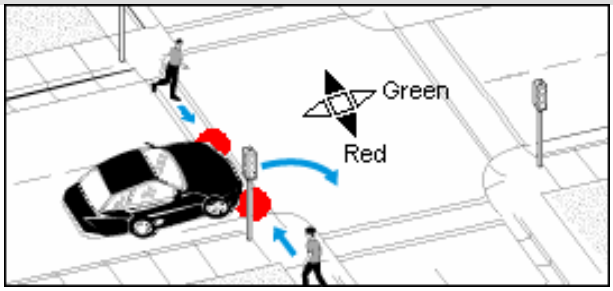
Temporal Pattern – Month of Year:

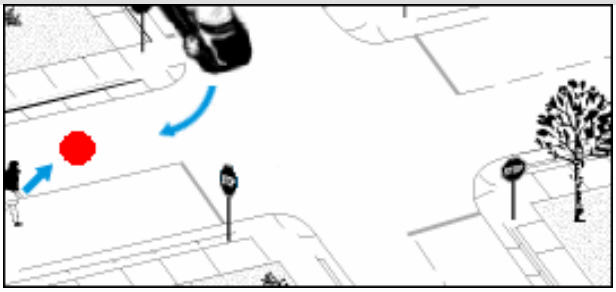


Geographic Distribution:



4. Vehicle turns right while pedestrian crosses without right-of-way at intersection



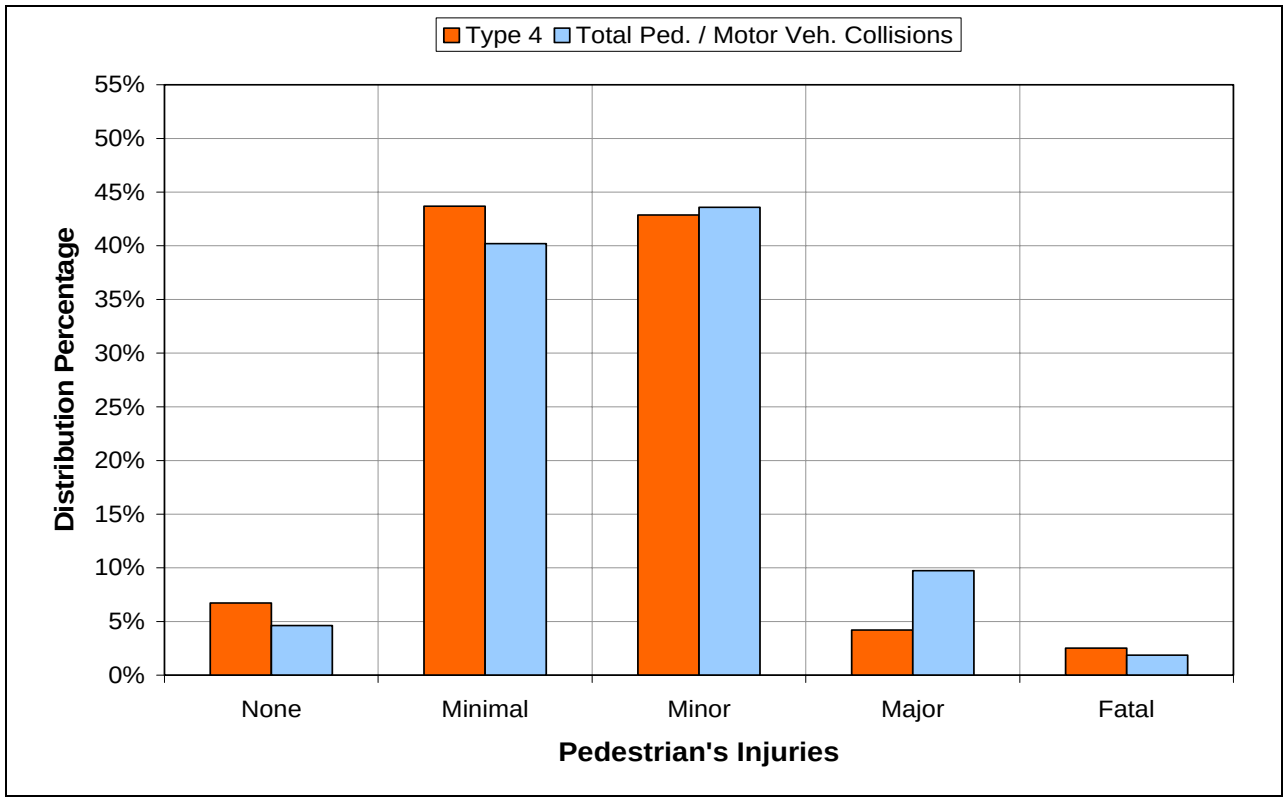


Description: A pedestrian and a vehicle collision at an intersection while the vehicle was preparing to turn right, or in the process of turning right, or had just completed a right turn (this includes the 20m buffer zone outside the intersection). The pedestrian did not have the right-of-way to cross at the intersection.

Frequency:

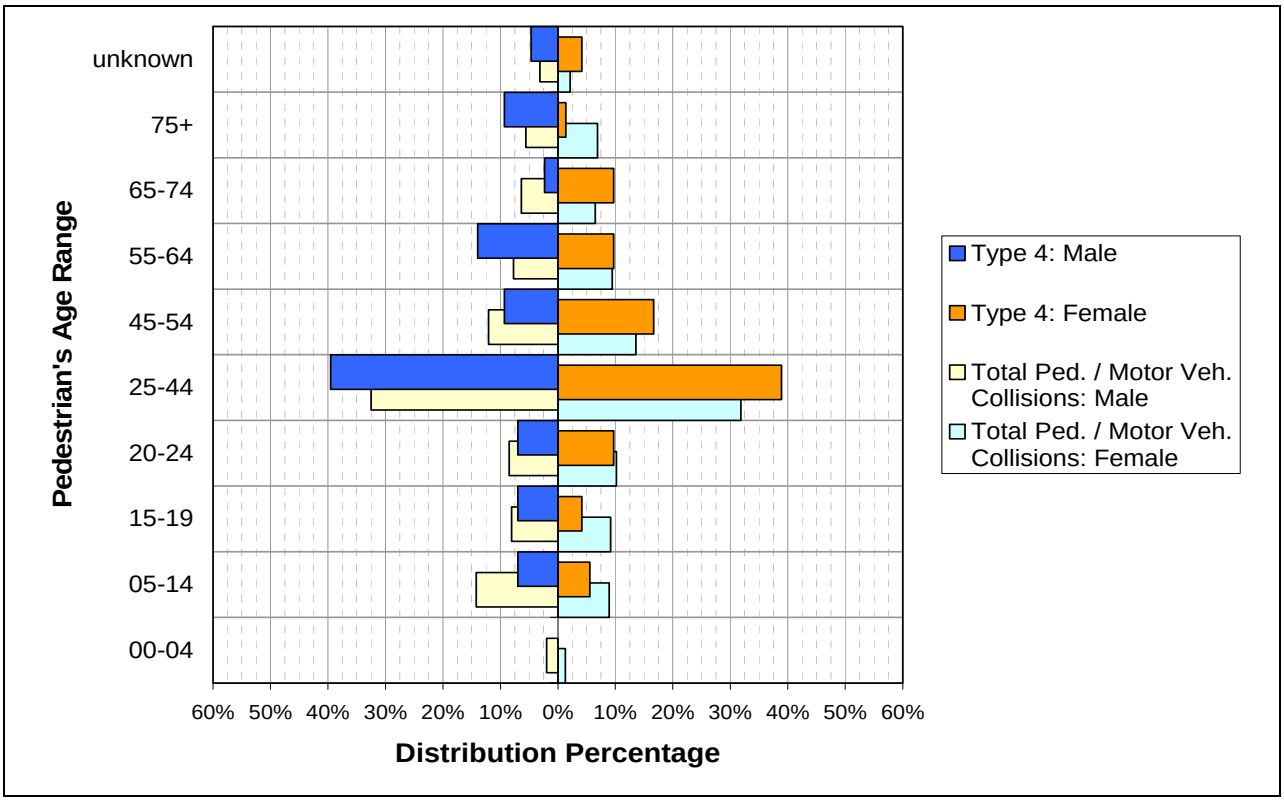
117 of 4,557 collisions 2% of all collisions Rank #12

Pedestrian's Injury:

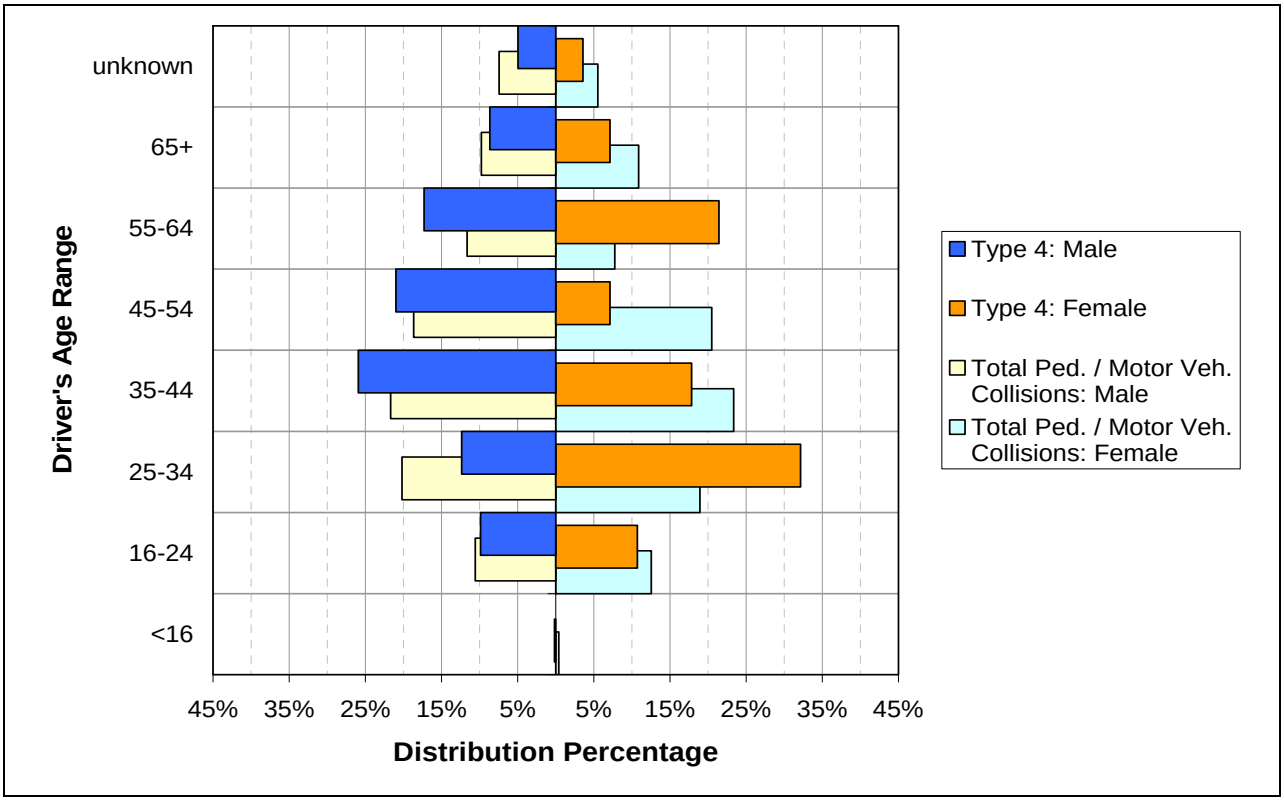


Type 4	7%	44%	43%	4%	2%
Total	5%	40%	44%	10%	2%

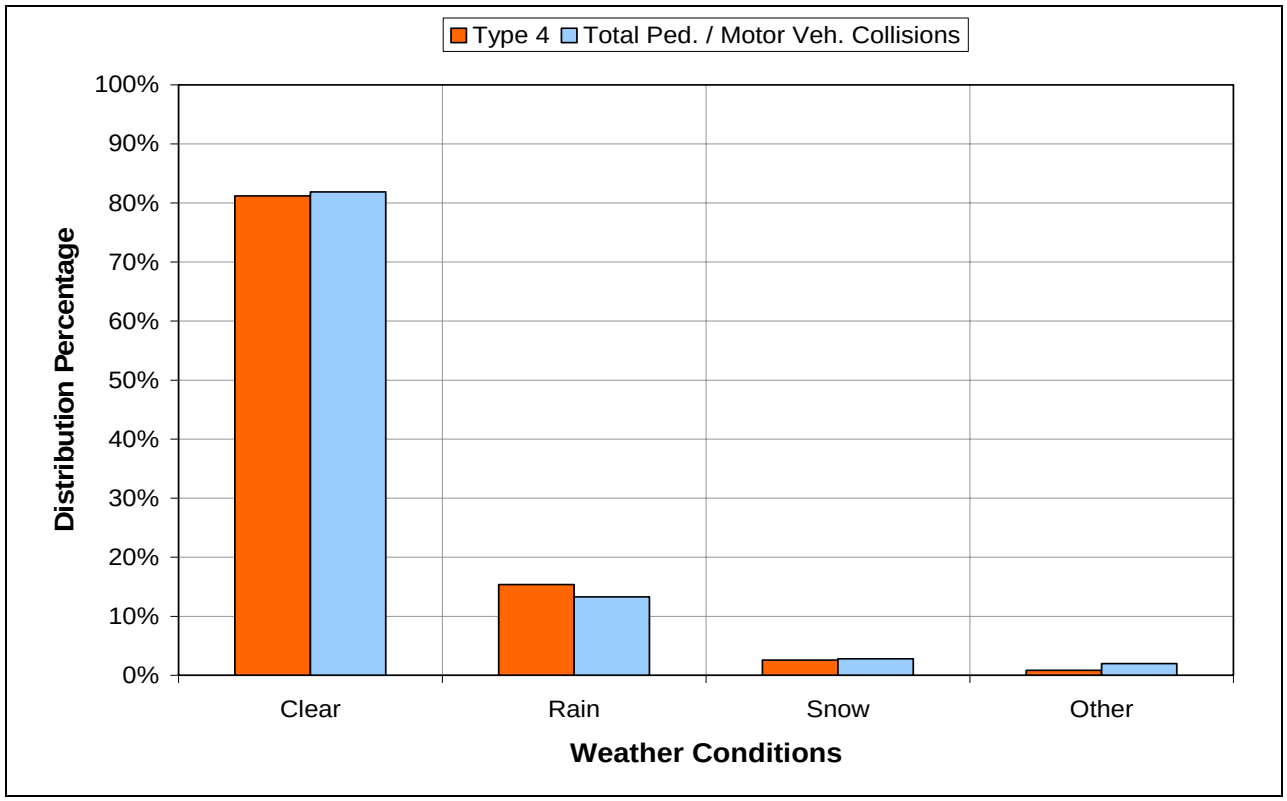
Pedestrian's Age Range:



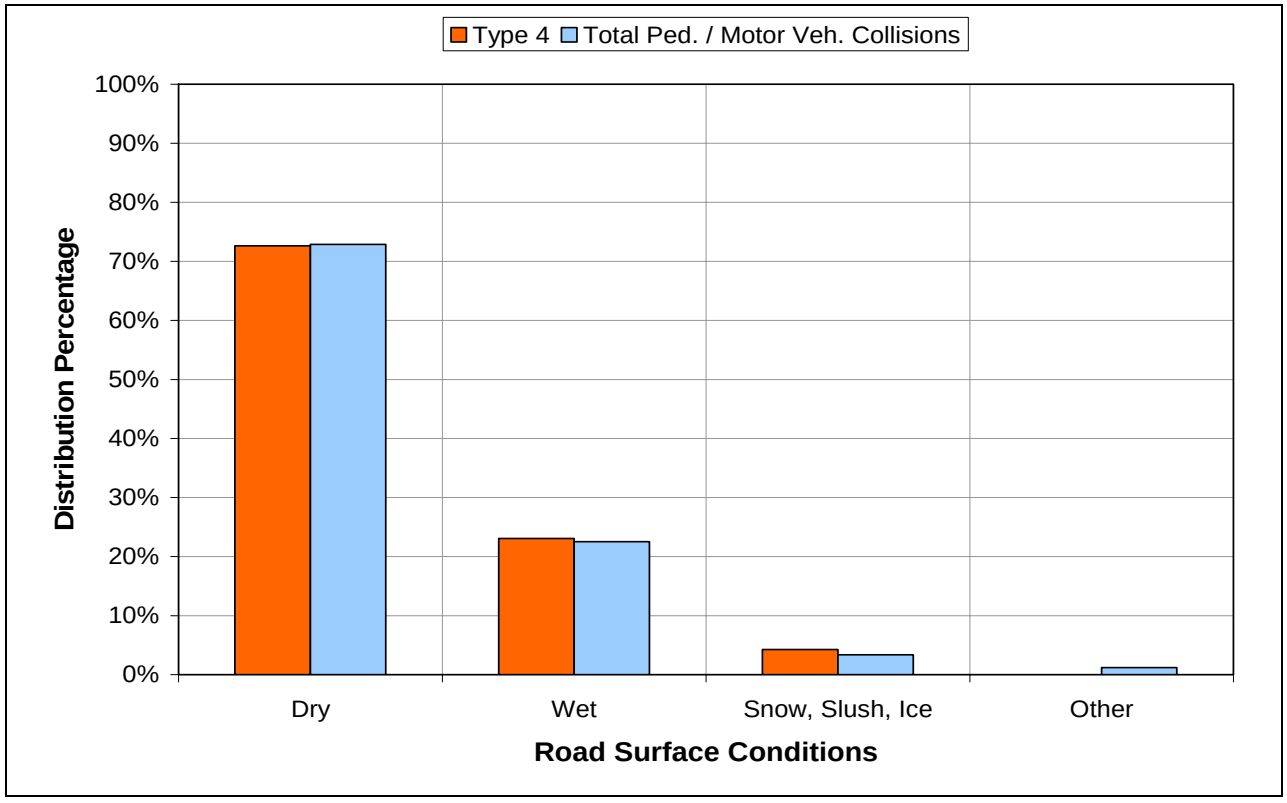
Driver's Age Range:



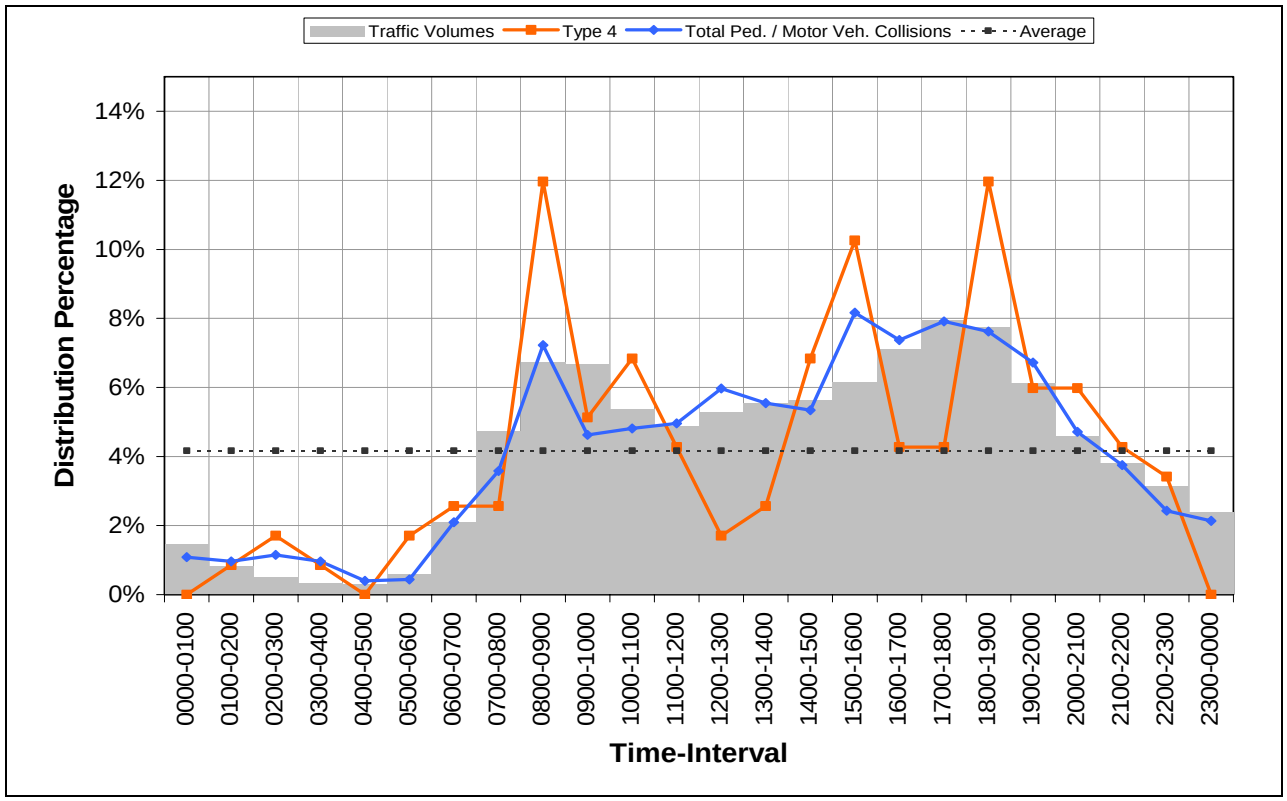
Weather Condition:



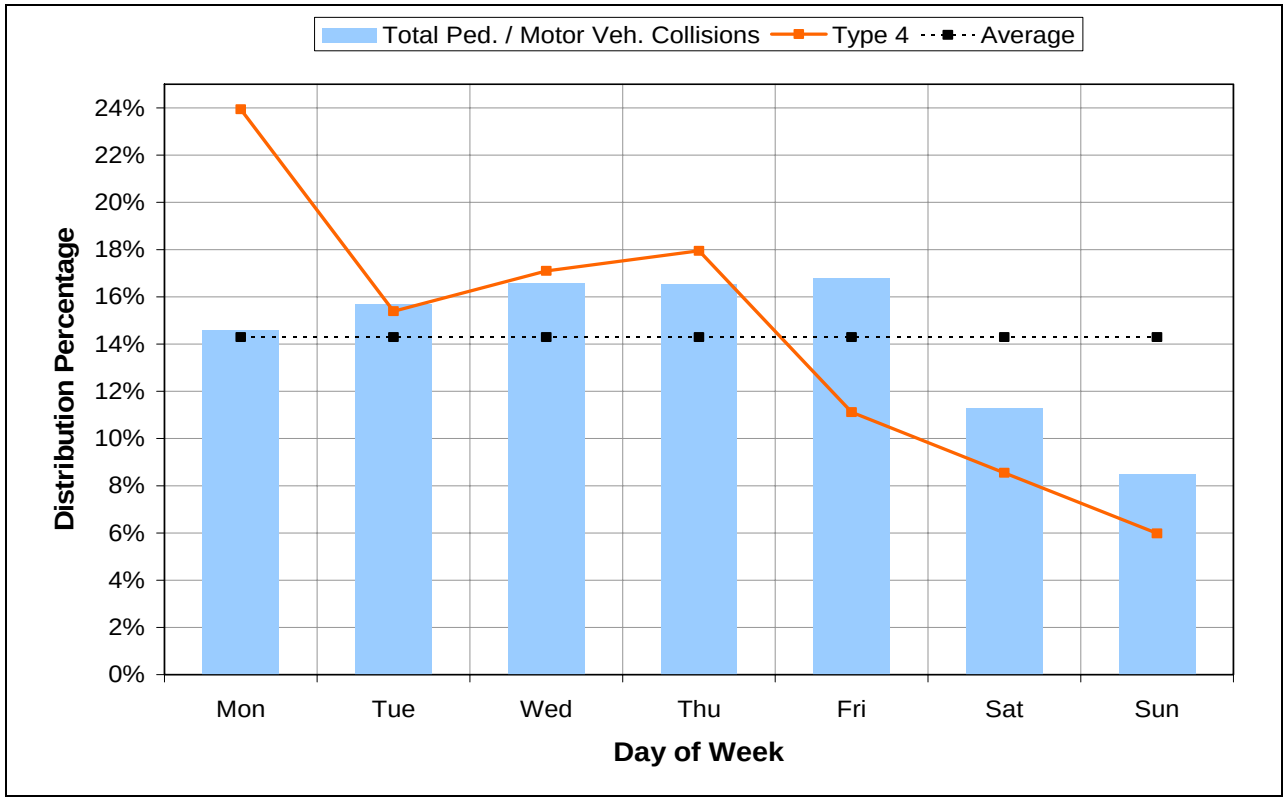
Road Surface Condition:



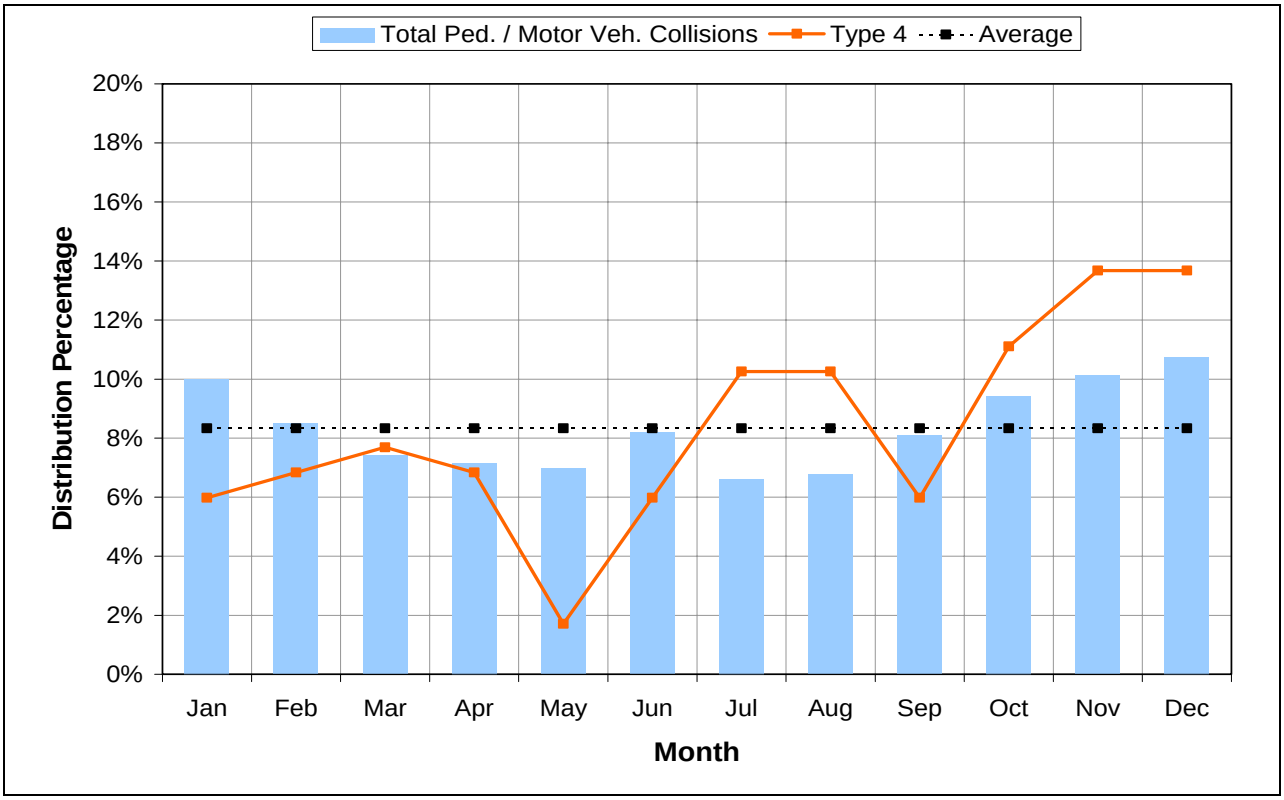
Temporal Pattern – Time of Day:



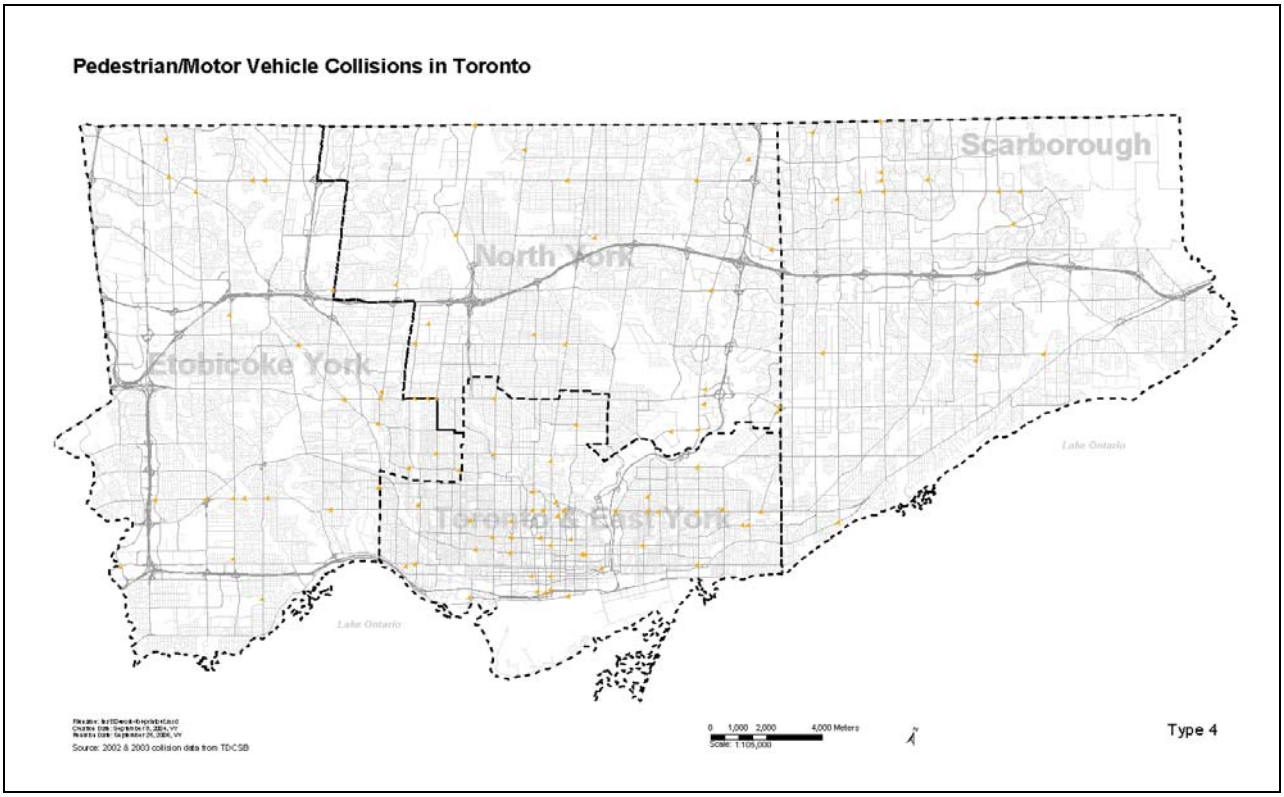
Temporal Pattern – Day of Week:



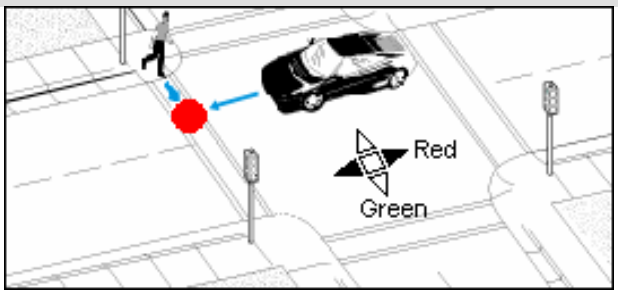
Temporal Pattern – Month of Year:

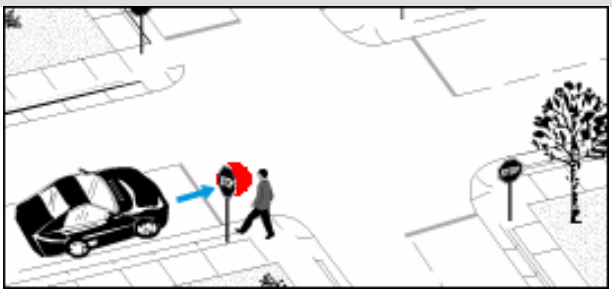


Geographic Distribution:



5. Vehicle is going straight through intersection while pedestrian crosses with right-of-way



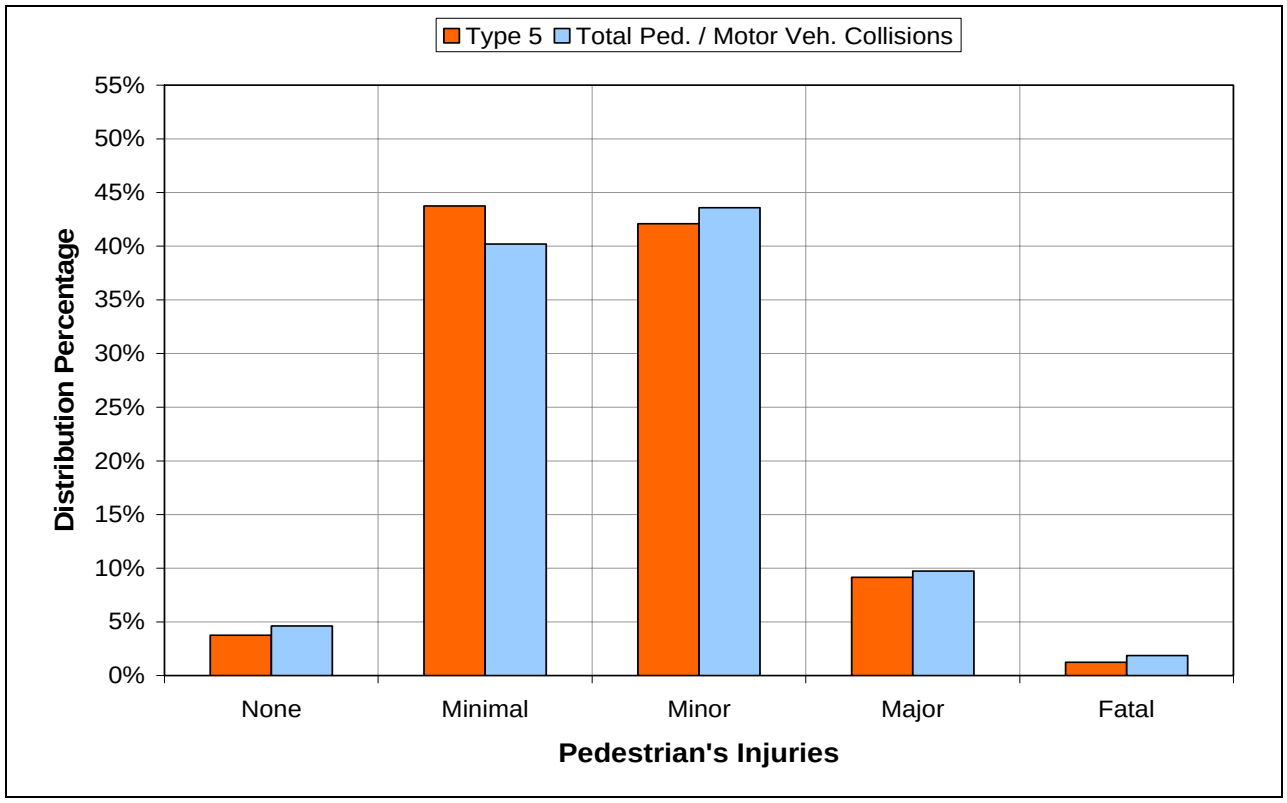


Description: A pedestrian and a vehicle collided at the intersection while the vehicle was proceeding straight ahead. The pedestrian had the right-of-way to cross at the intersection.

Frequency:

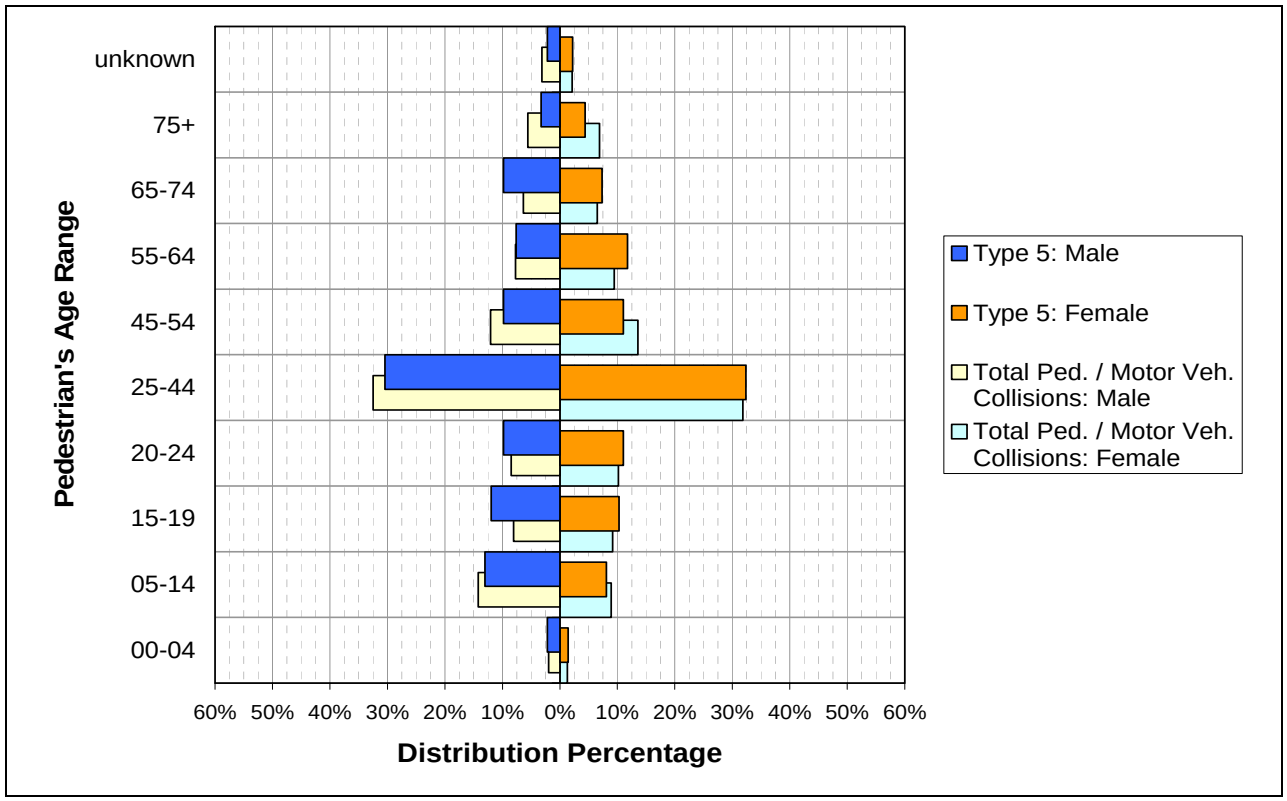
232 of 4,557 collisions 5% of all collisions Rank #7

Pedestrian's Injury:

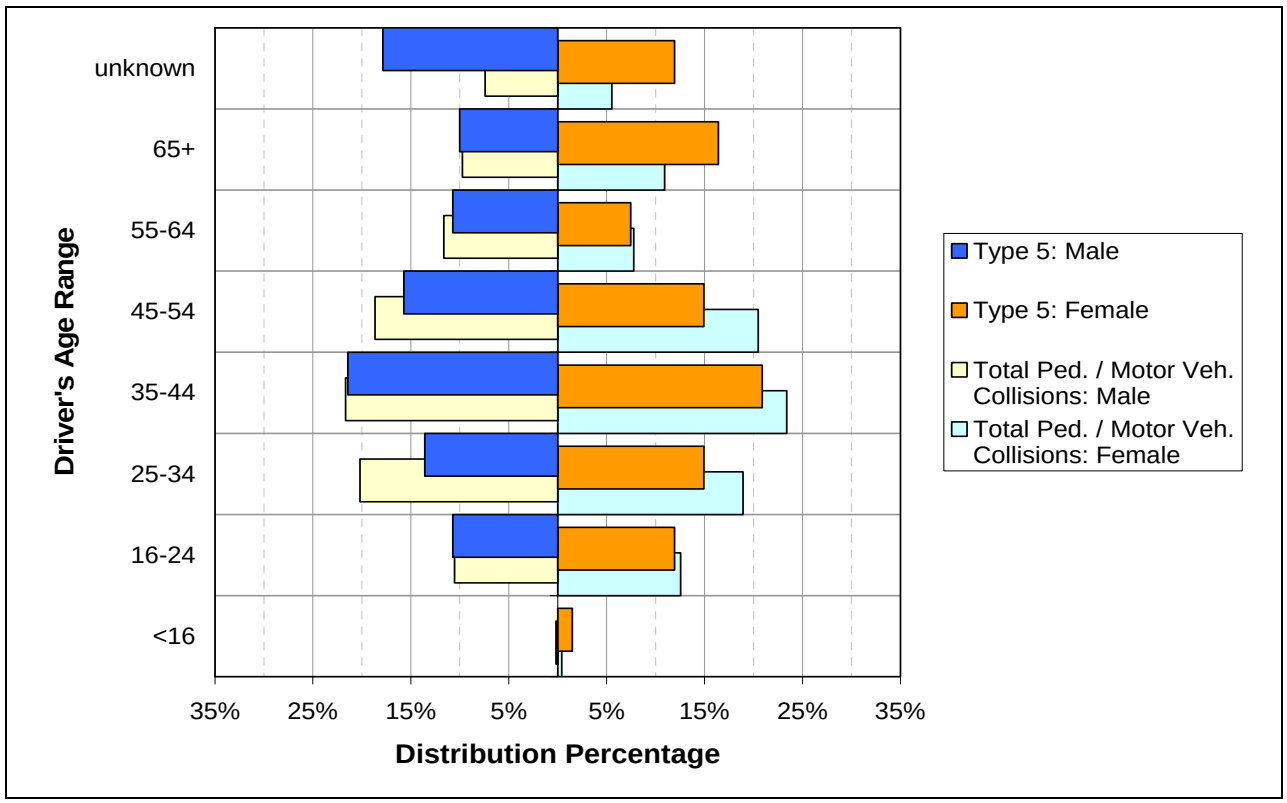


Type 5	4%	44%	42%	9%	1%
Total	5%	40%	44%	10%	2%

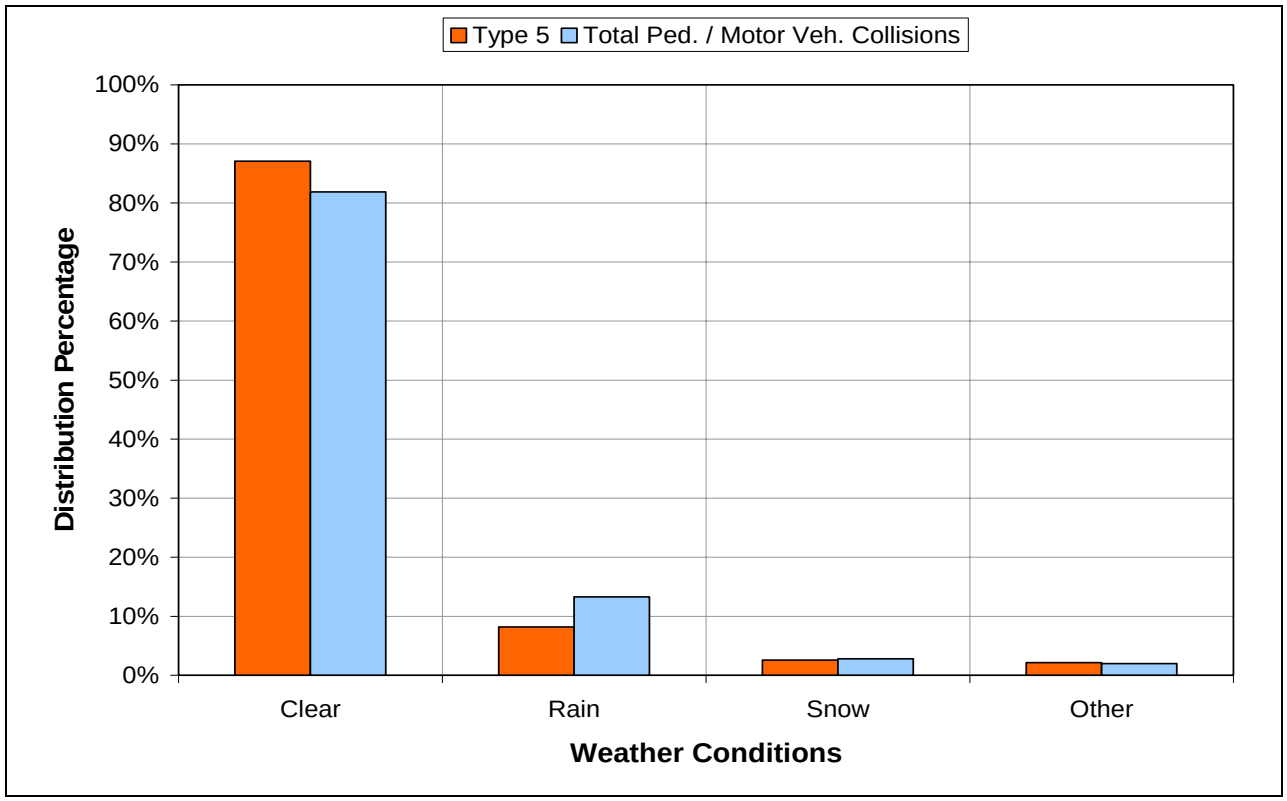
Pedestrian's Age Range:



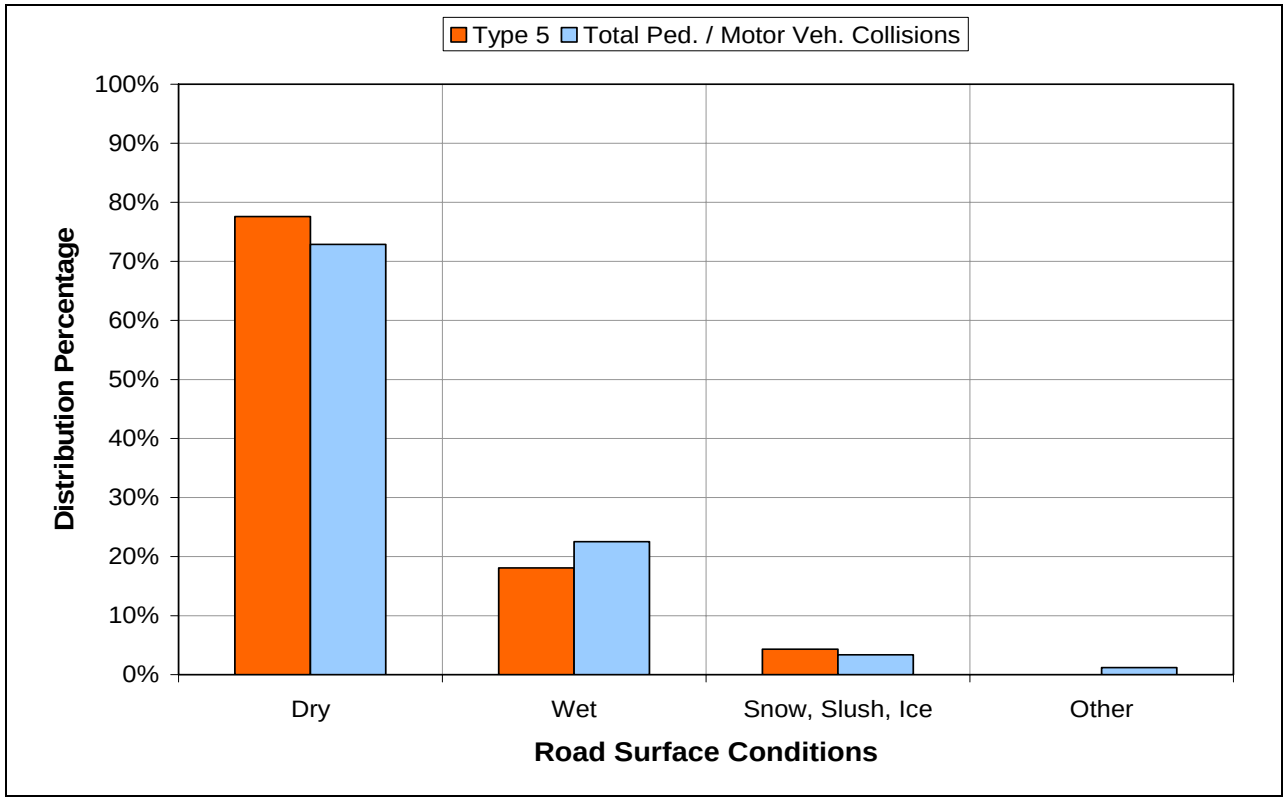
Driver's Age Range:



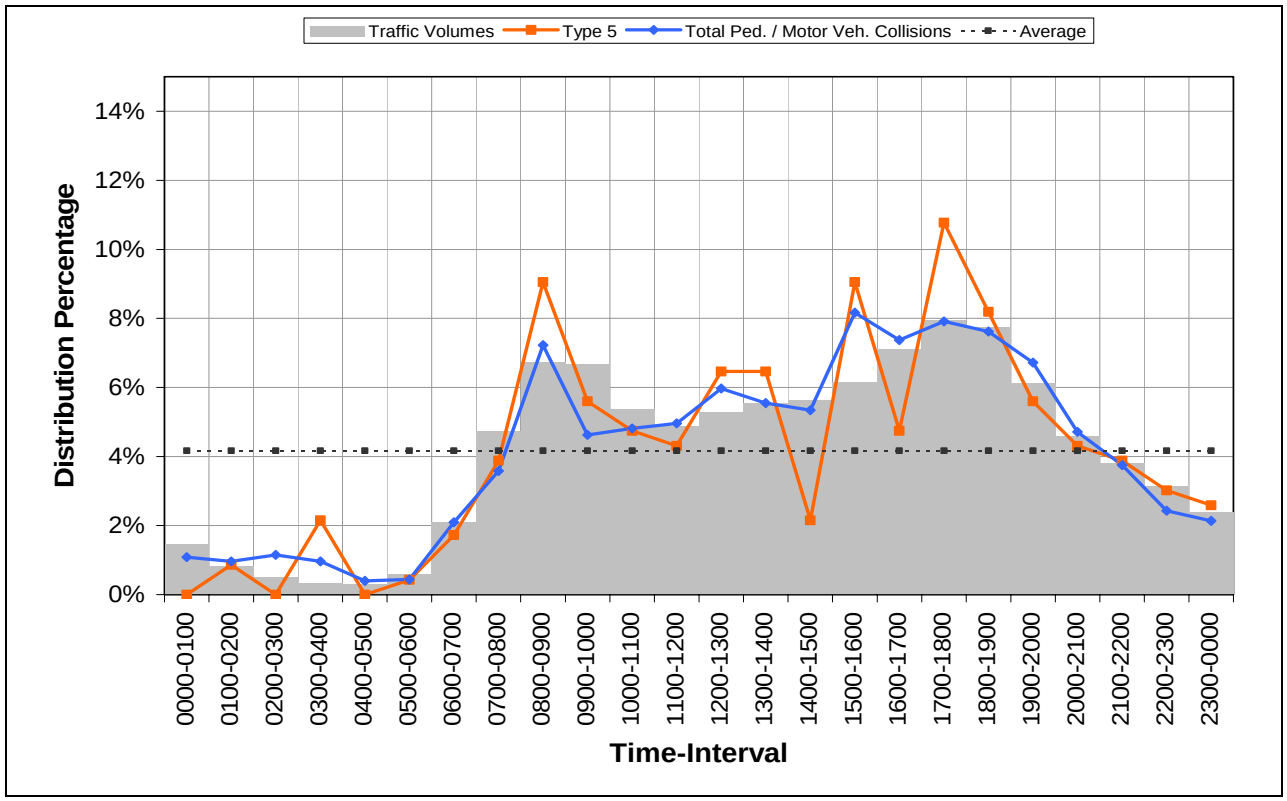
Weather Condition:



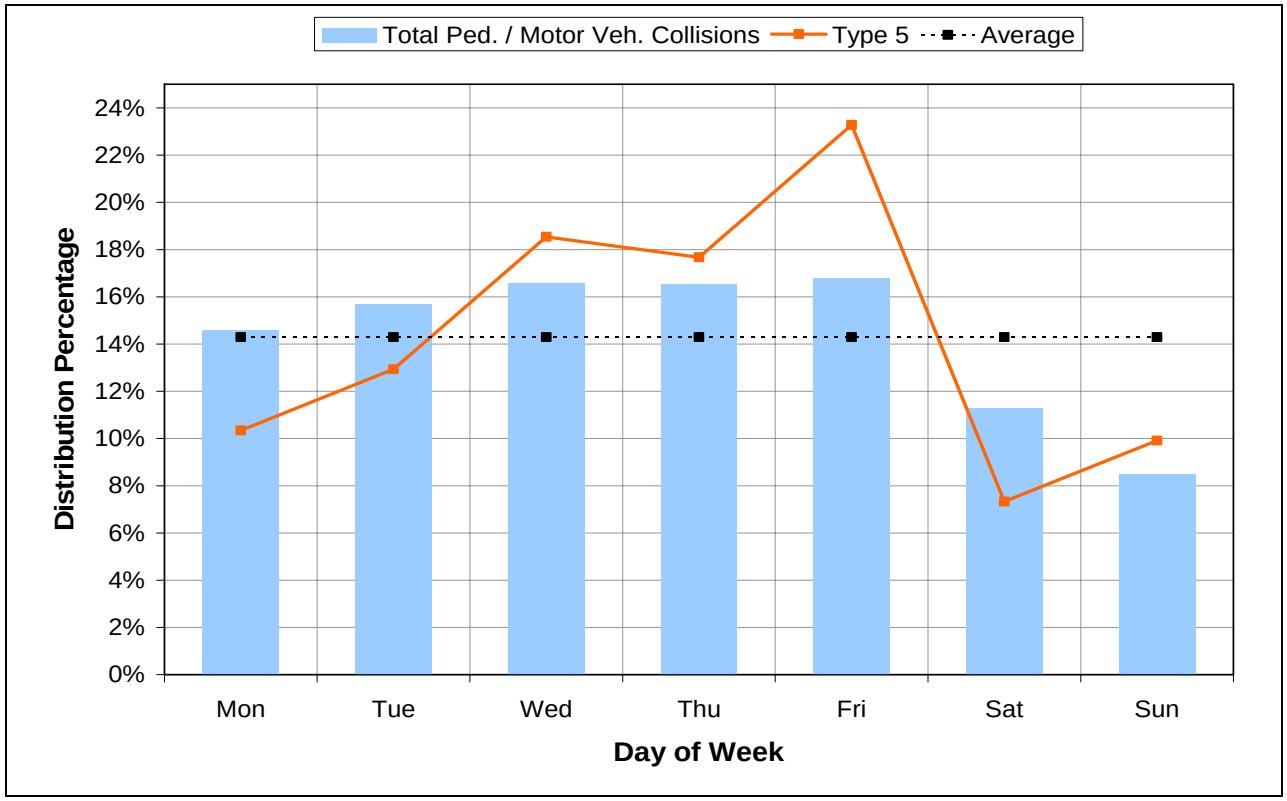
Road Surface Condition:



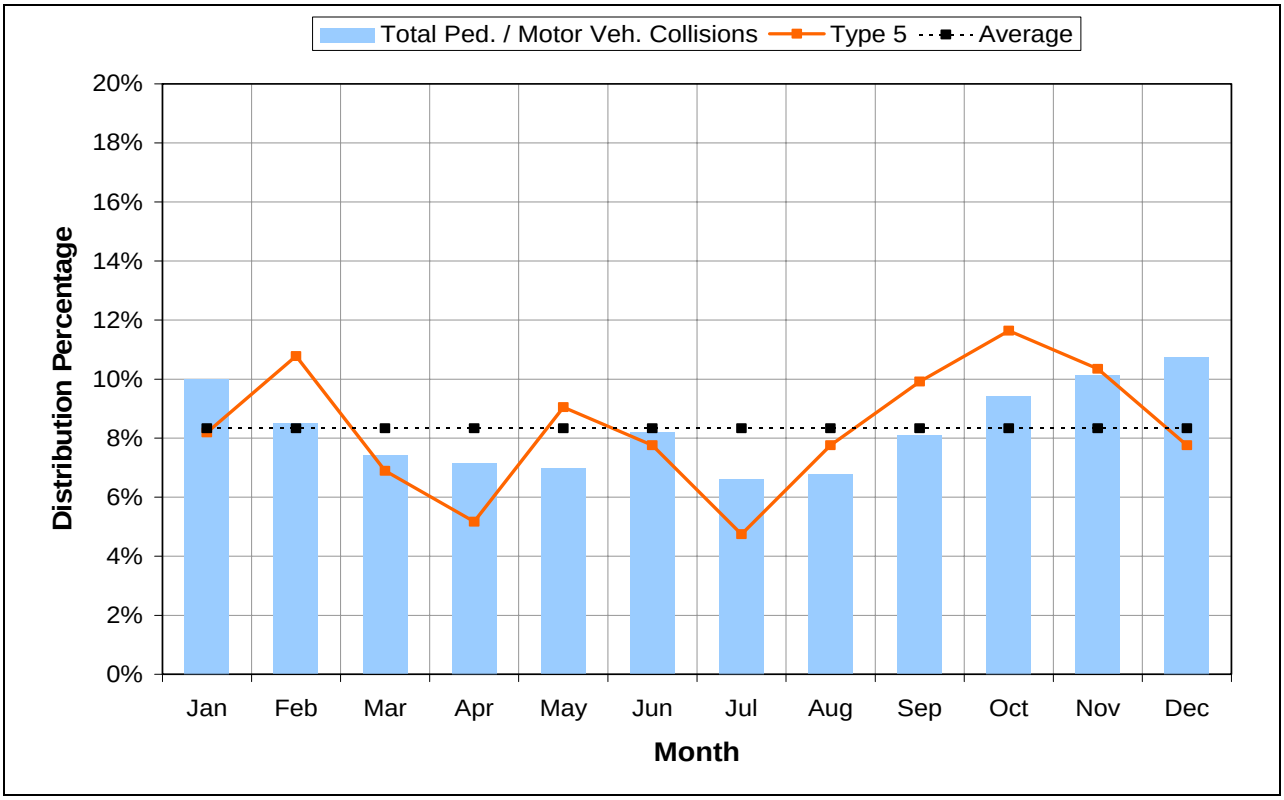
Temporal Pattern – Time of Day:



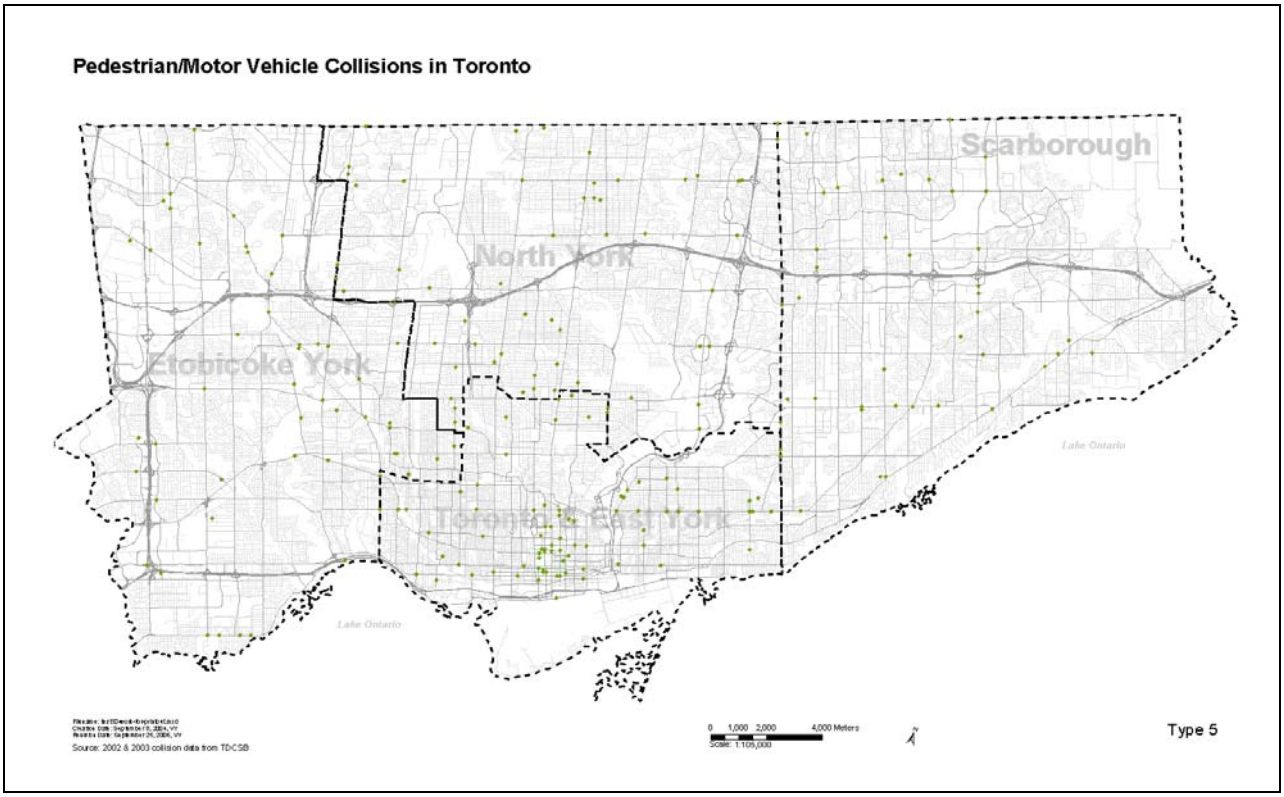
Temporal Pattern – Day of Week:



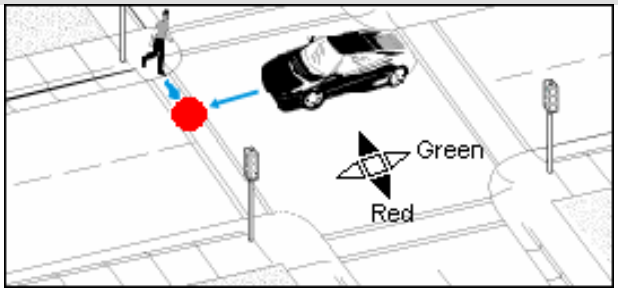
Temporal Pattern – Month of Year:

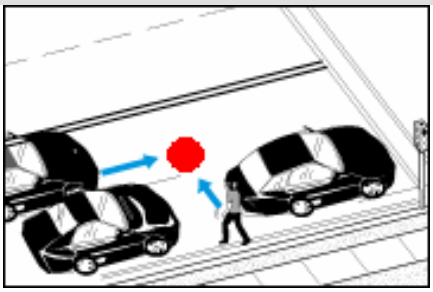


Geographic Distribution:



6. Vehicle is going straight through intersection while pedestrian crosses without right-of-way



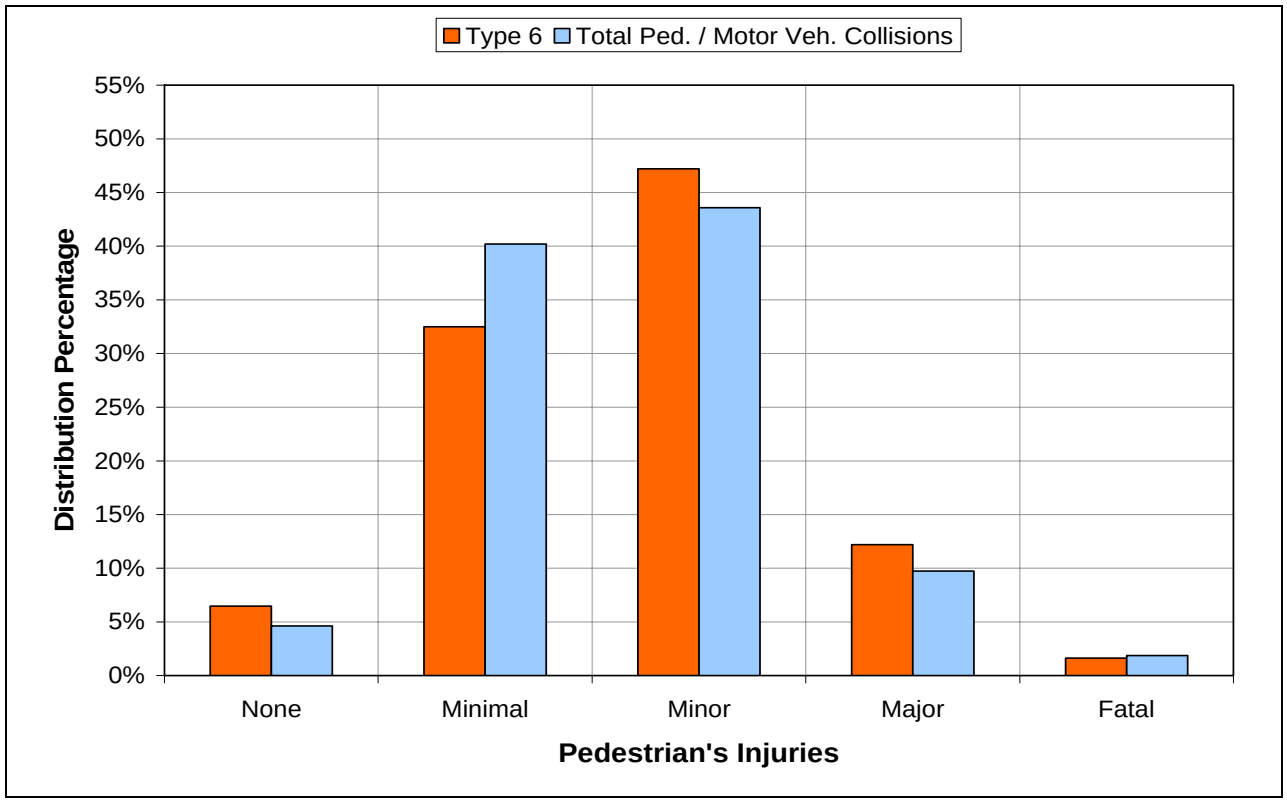


Description: A pedestrian and a vehicle collided at an intersection while the vehicle was proceeding straight ahead and the pedestrian was crossing without the right-of-way .

Frequency:

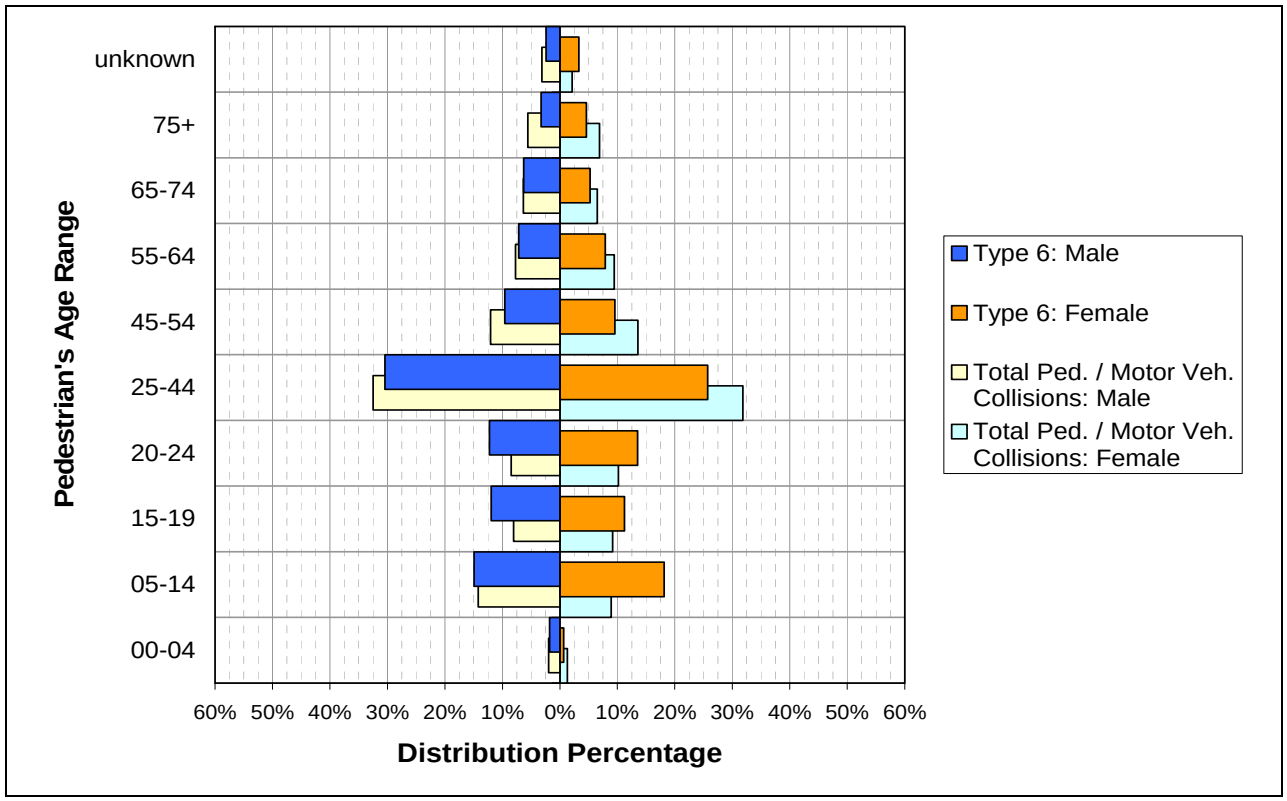
654 of 4,557 collisions 14% of all collisions Rank #2

Pedestrian's Injury:

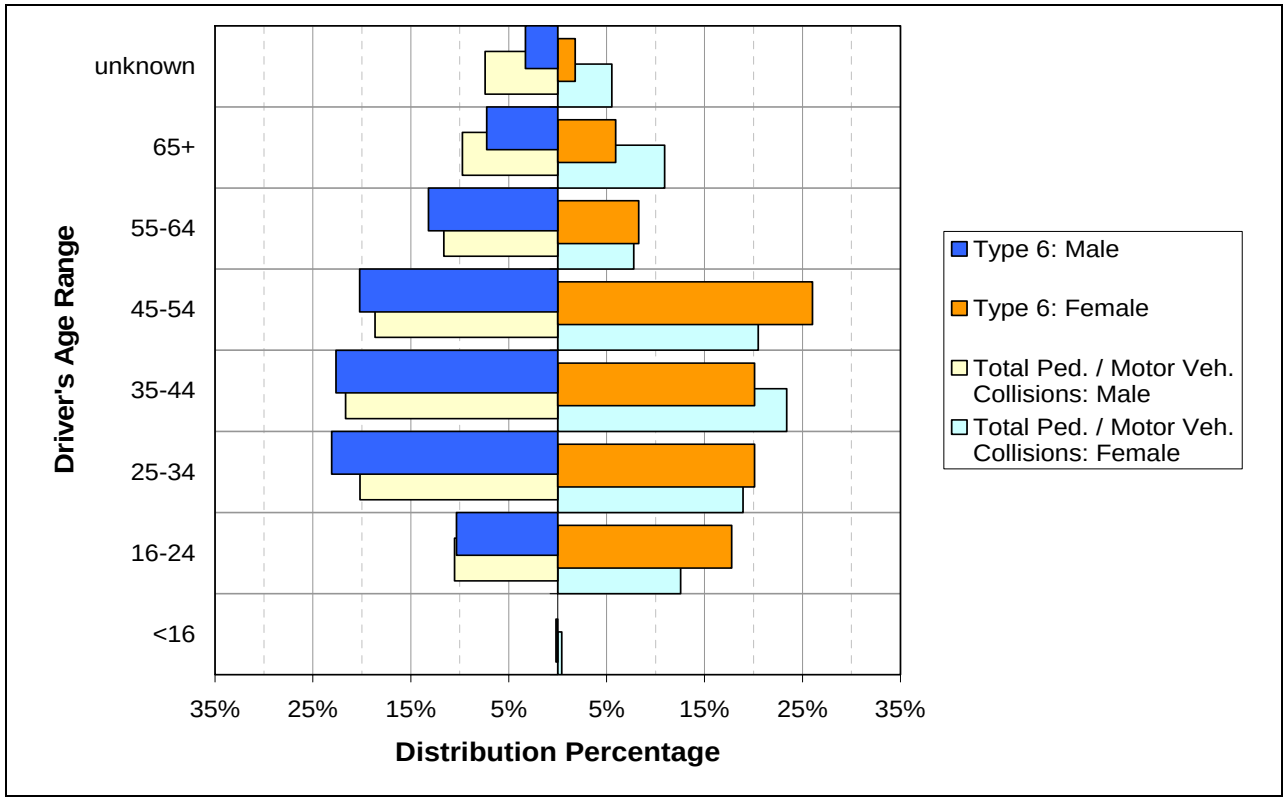


Type 6	6%	33%	47%	12%	2%
Total	5%	40%	44%	10%	2%

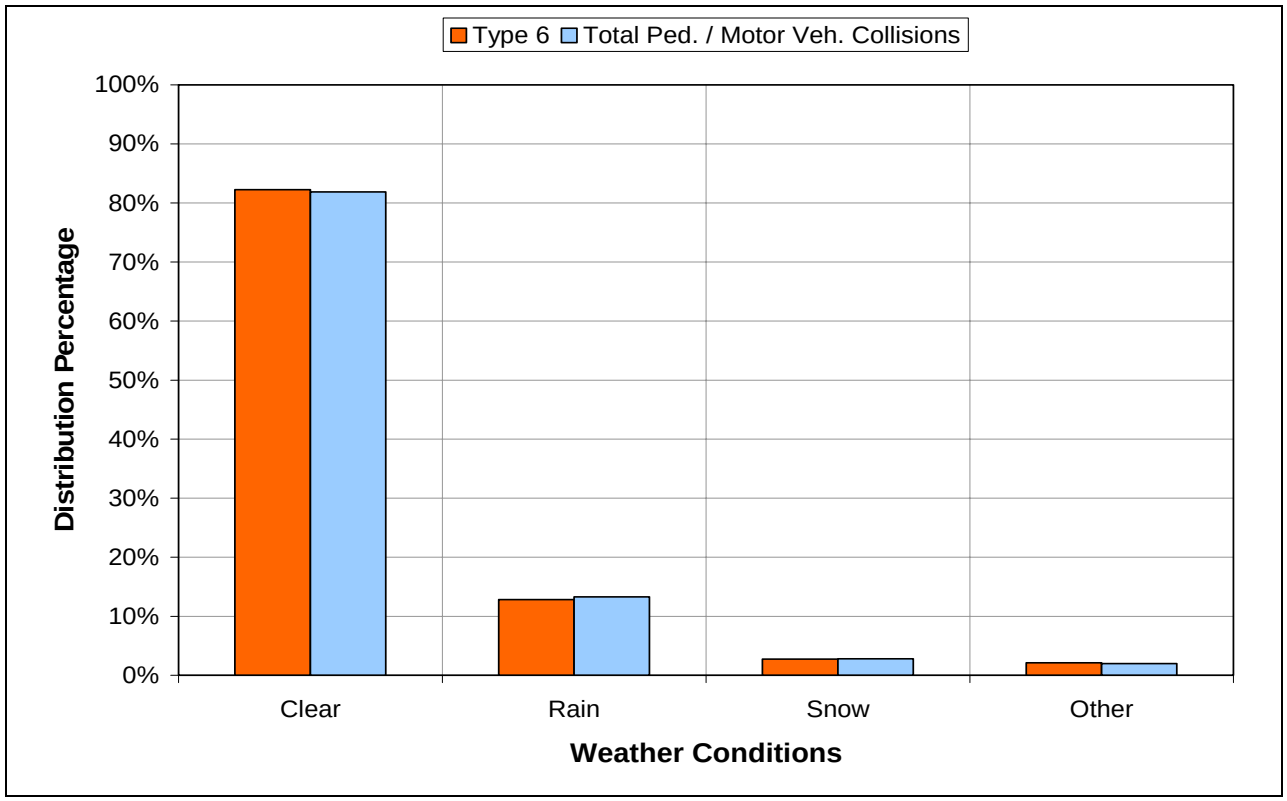
Pedestrian's Age Range:



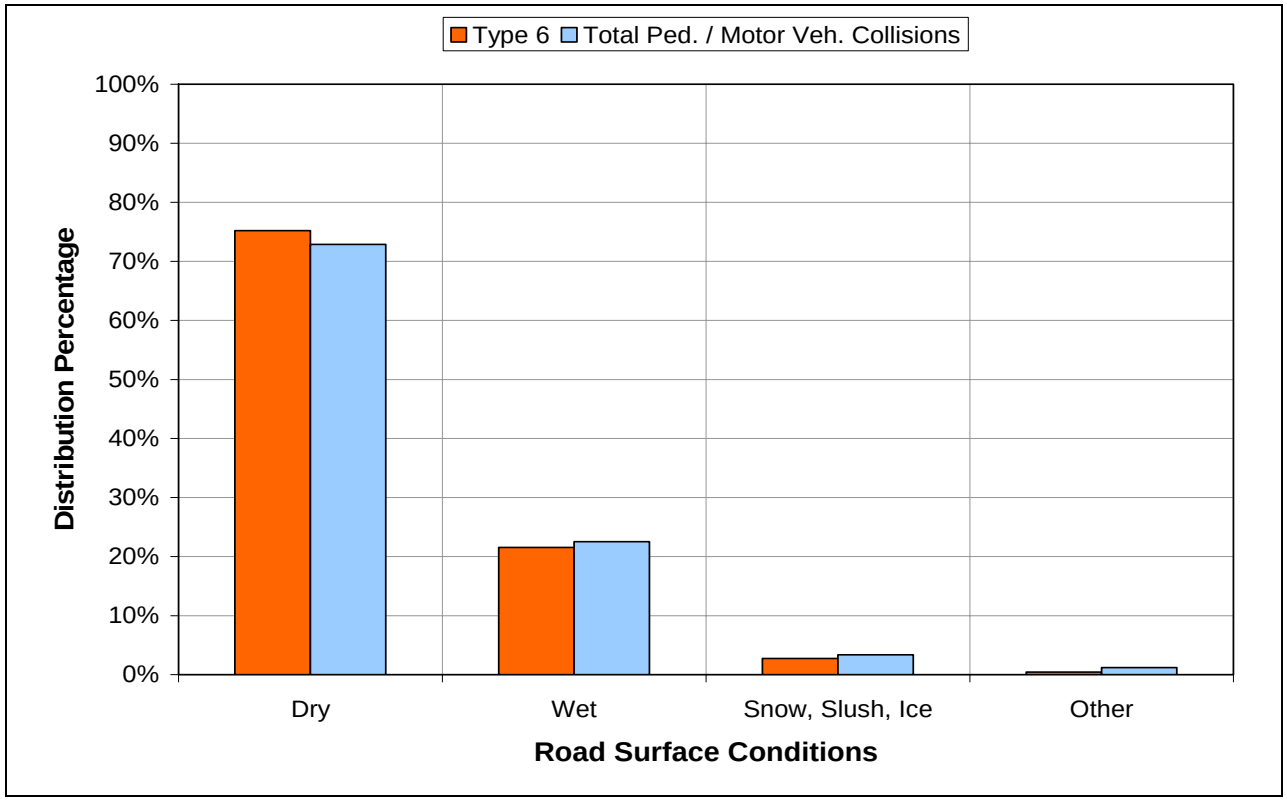
Driver's Age Range:



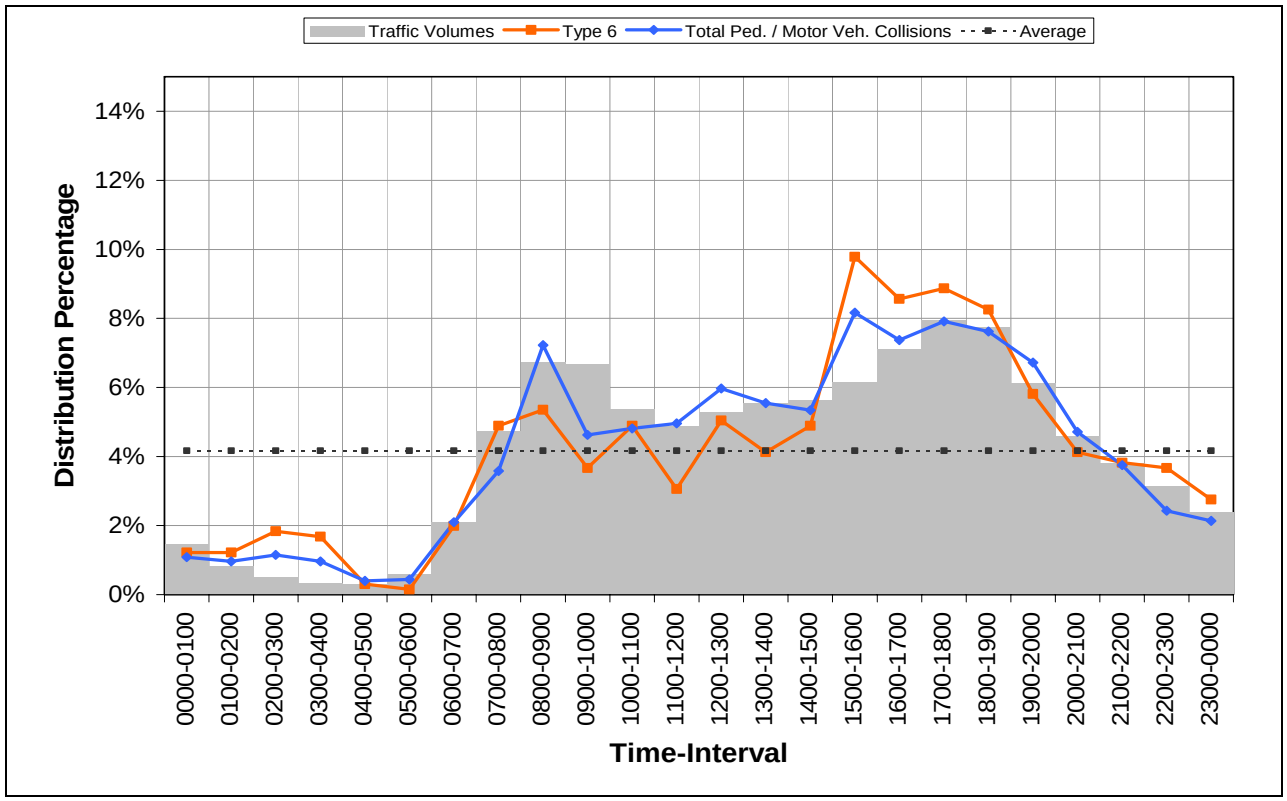
Weather Condition:



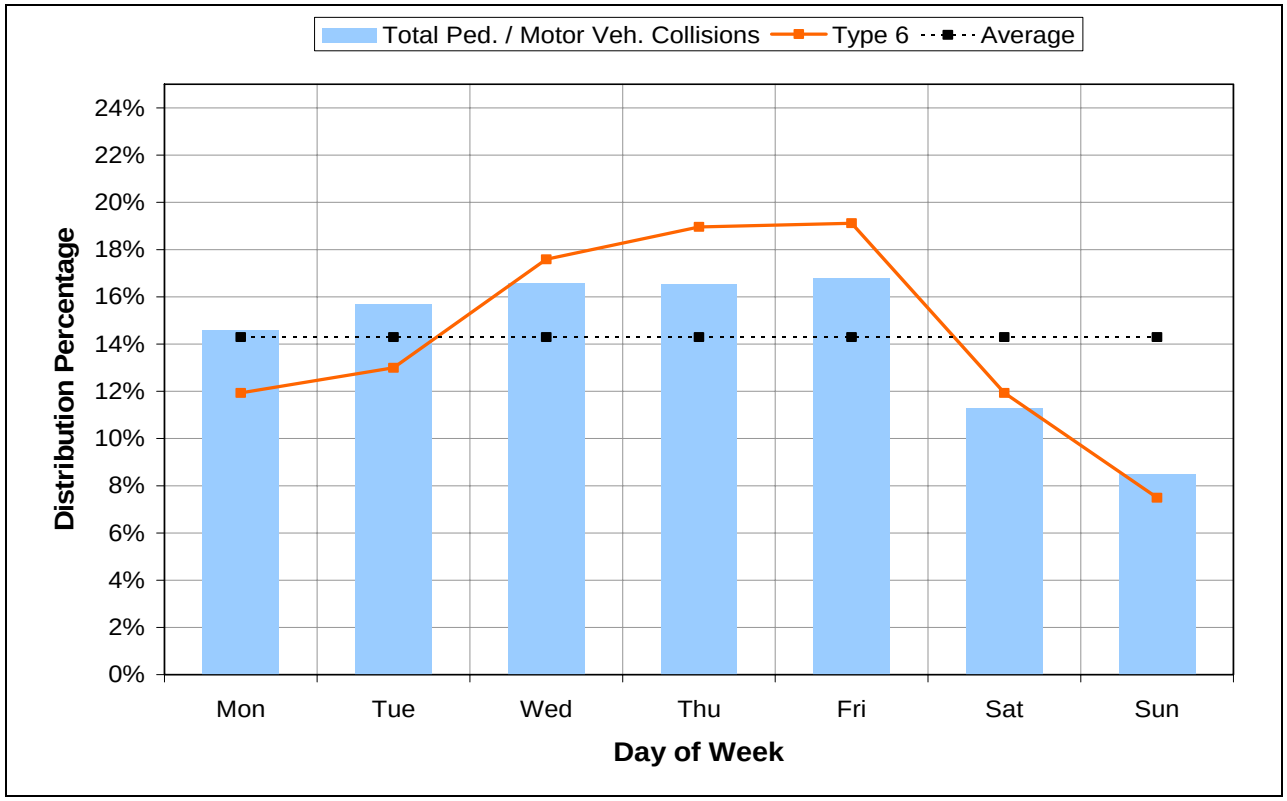
Road Surface Condition:



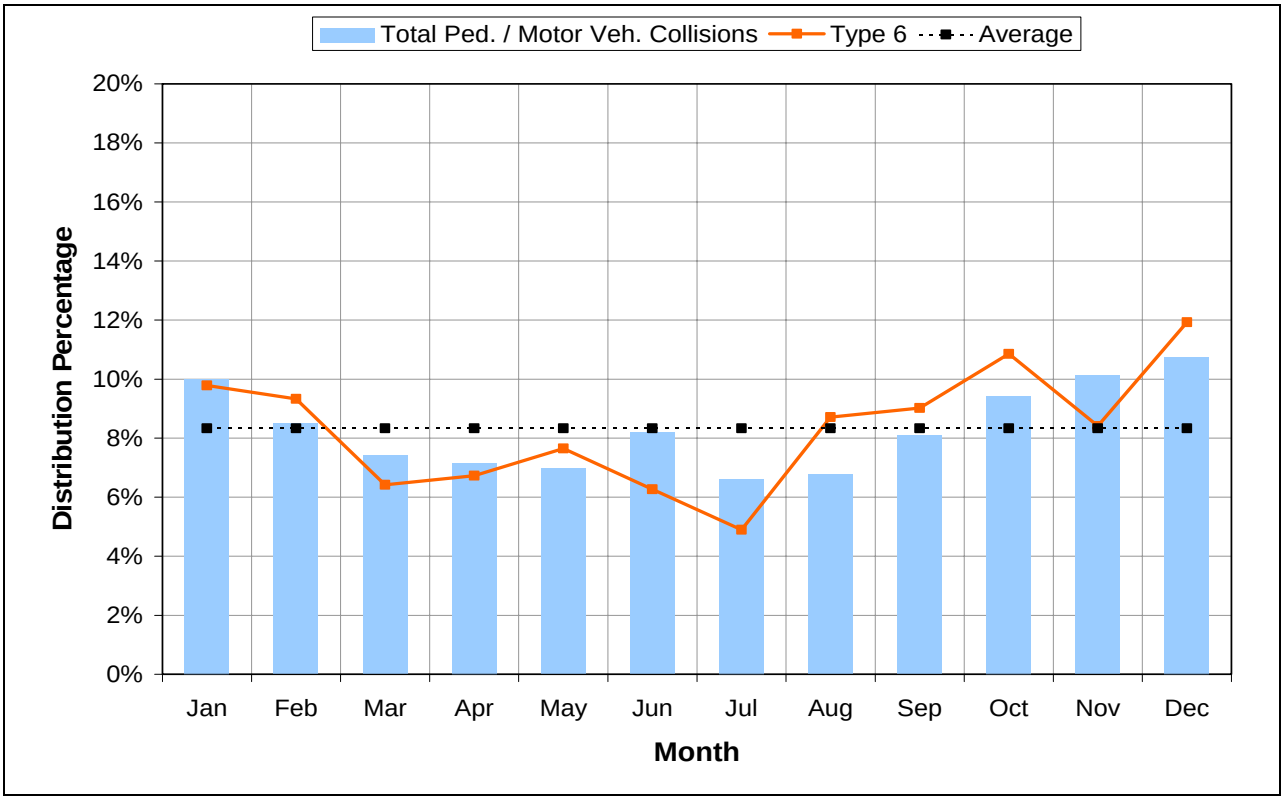
Temporal Pattern – Time of Day:



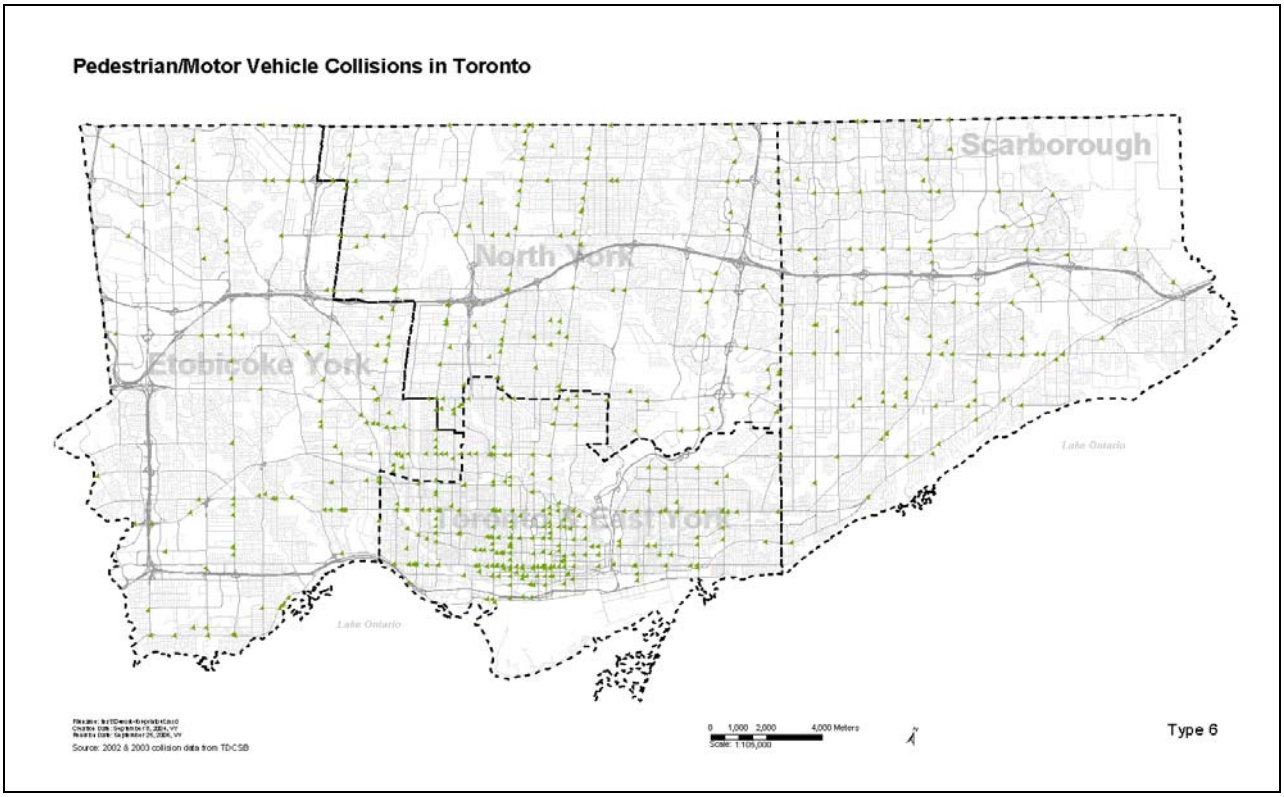
Temporal Pattern – Day of Week:



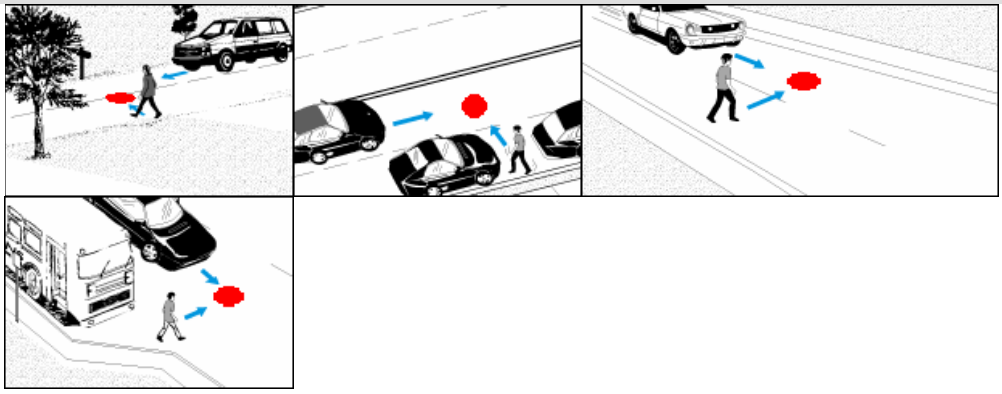
Temporal Pattern – Month of Year:



Geographic Distribution:



8. Pedestrian hit at mid-block location

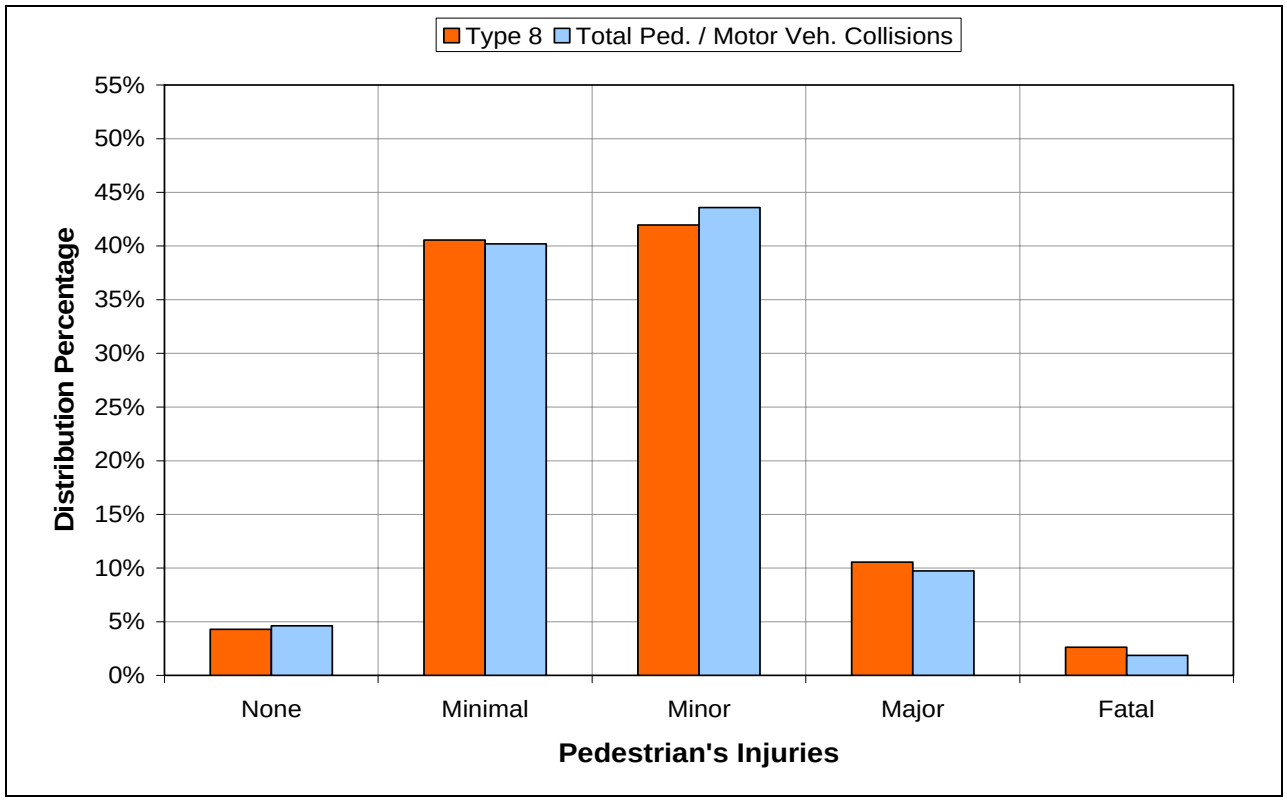


Description: A pedestrian and a vehicle collided at a mid-block location.

Frequency:

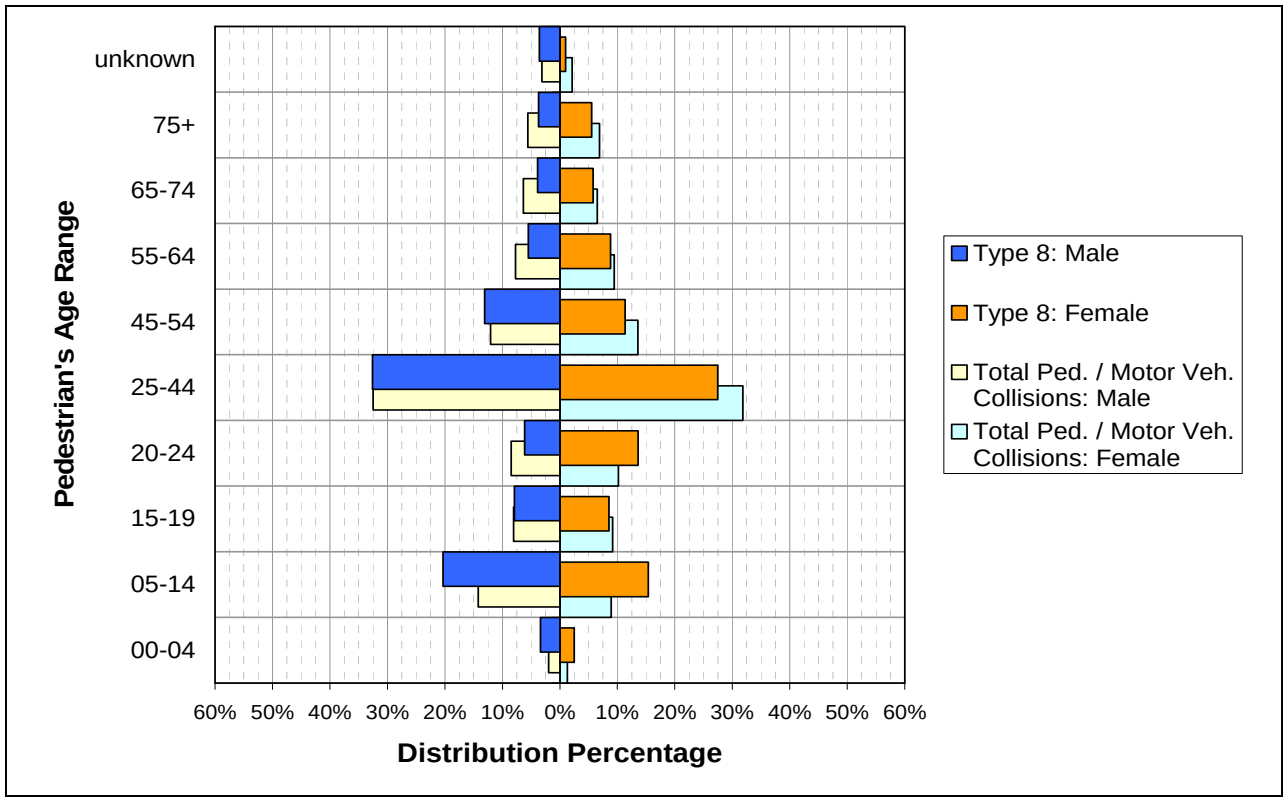
1,042 of 4,557 collisions 22% of all collisions Rank #1

Pedestrian's Injury:

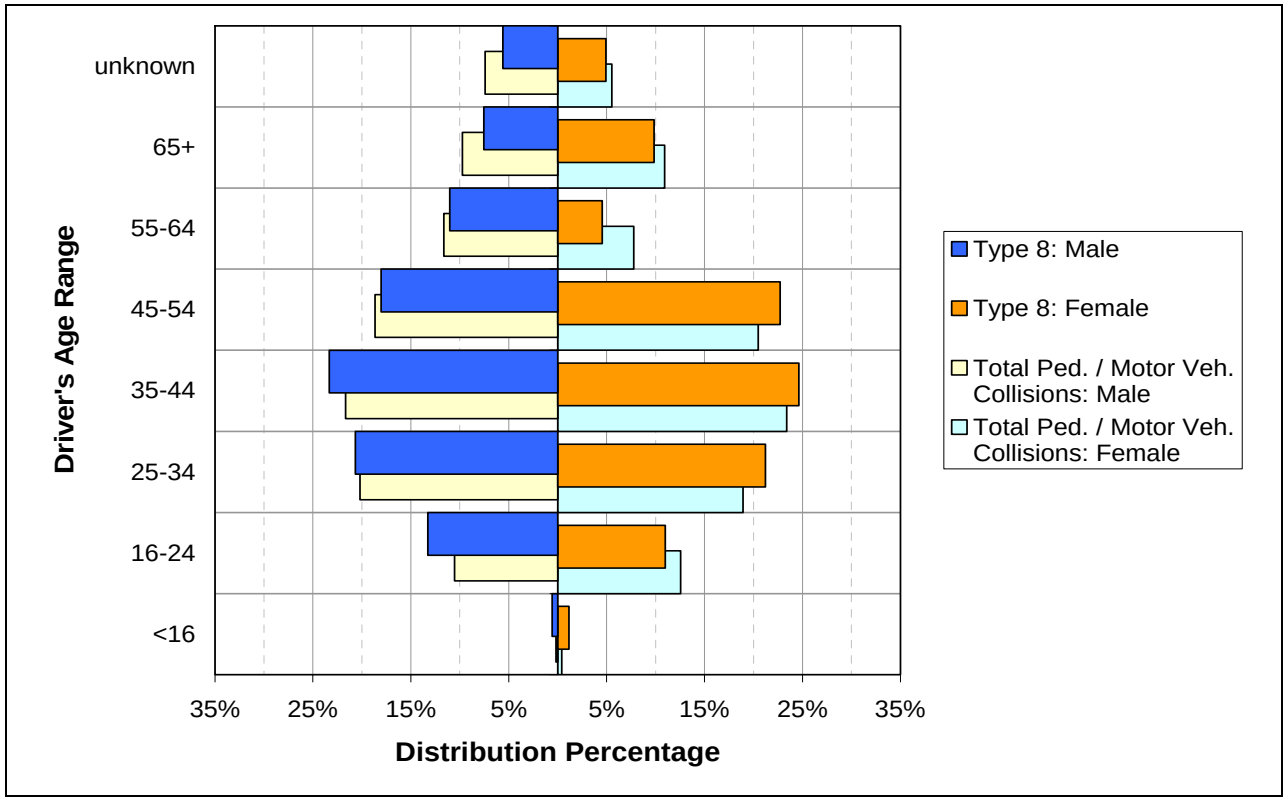


Type 8	4%	41%	42%	10%	3%
Total	5%	40%	44%	10%	2%

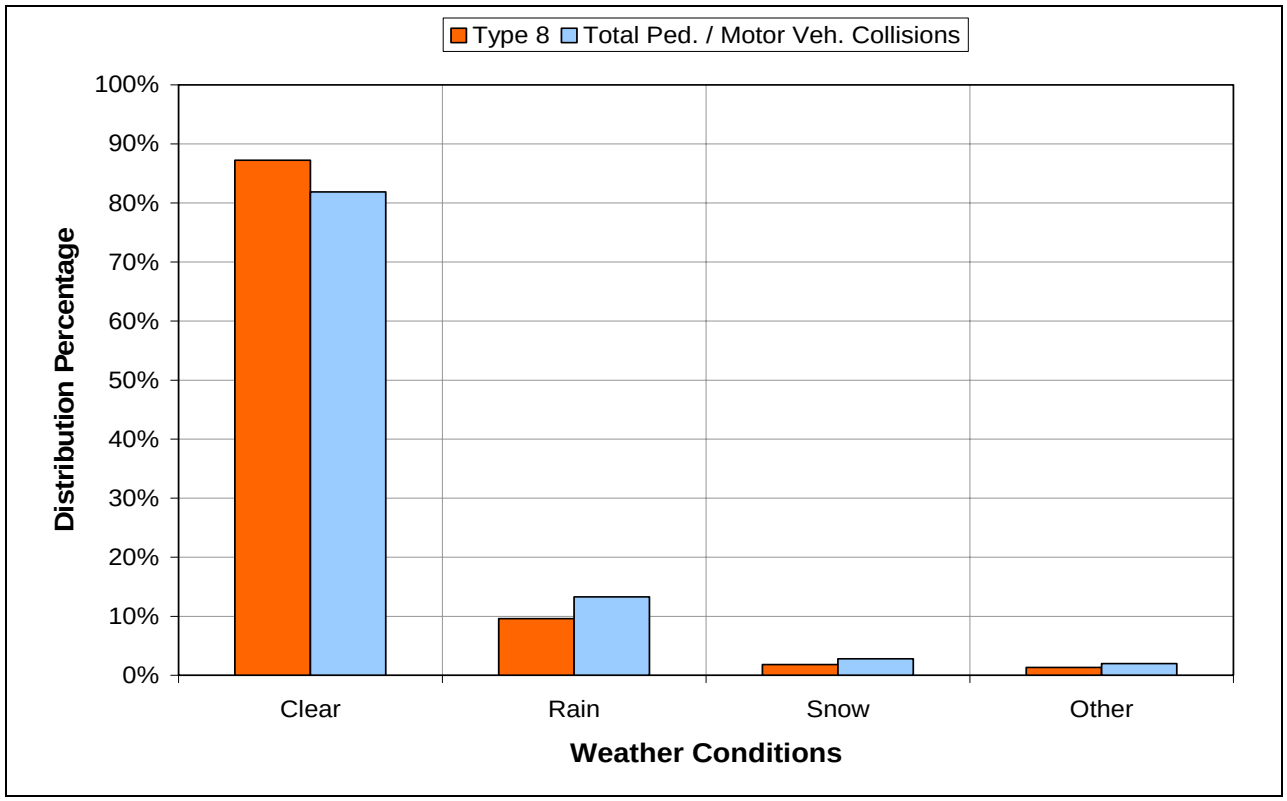
Pedestrian's Age Range:



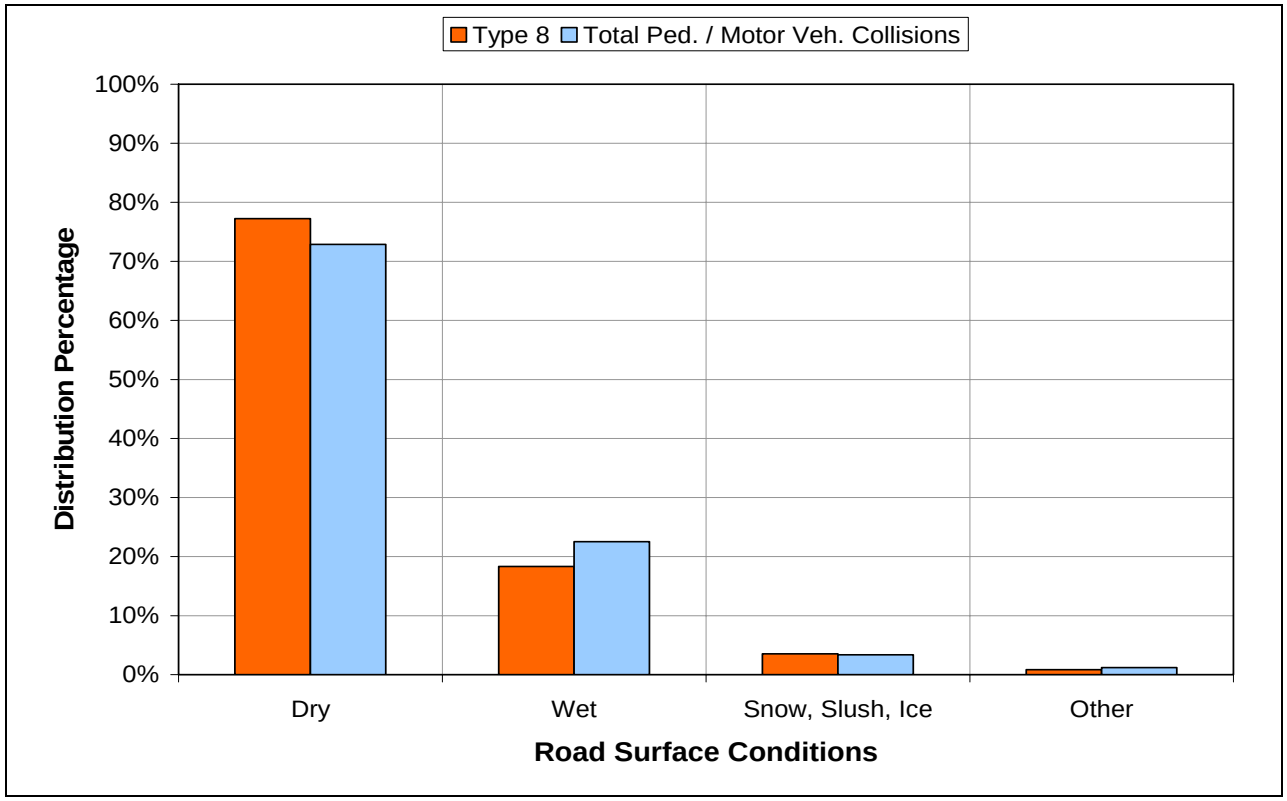
Driver's Age Range:



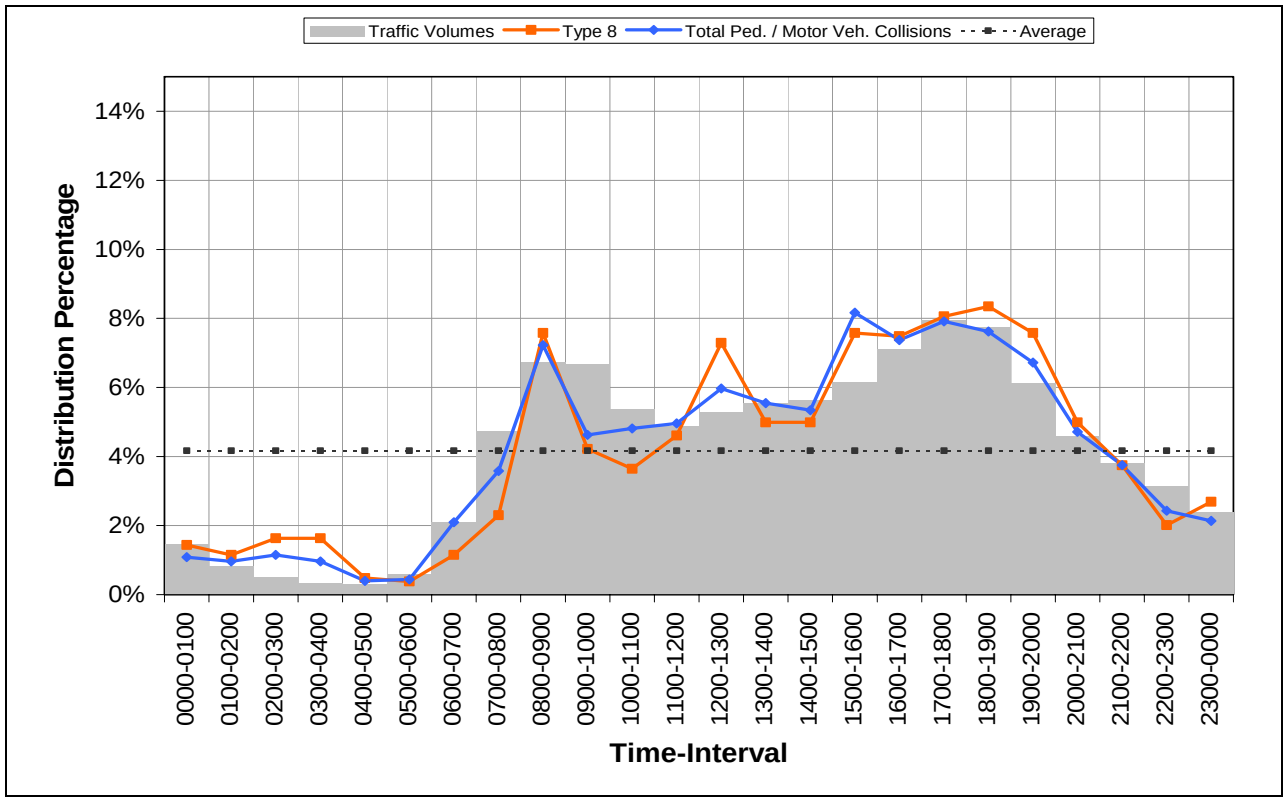
Weather Condition:



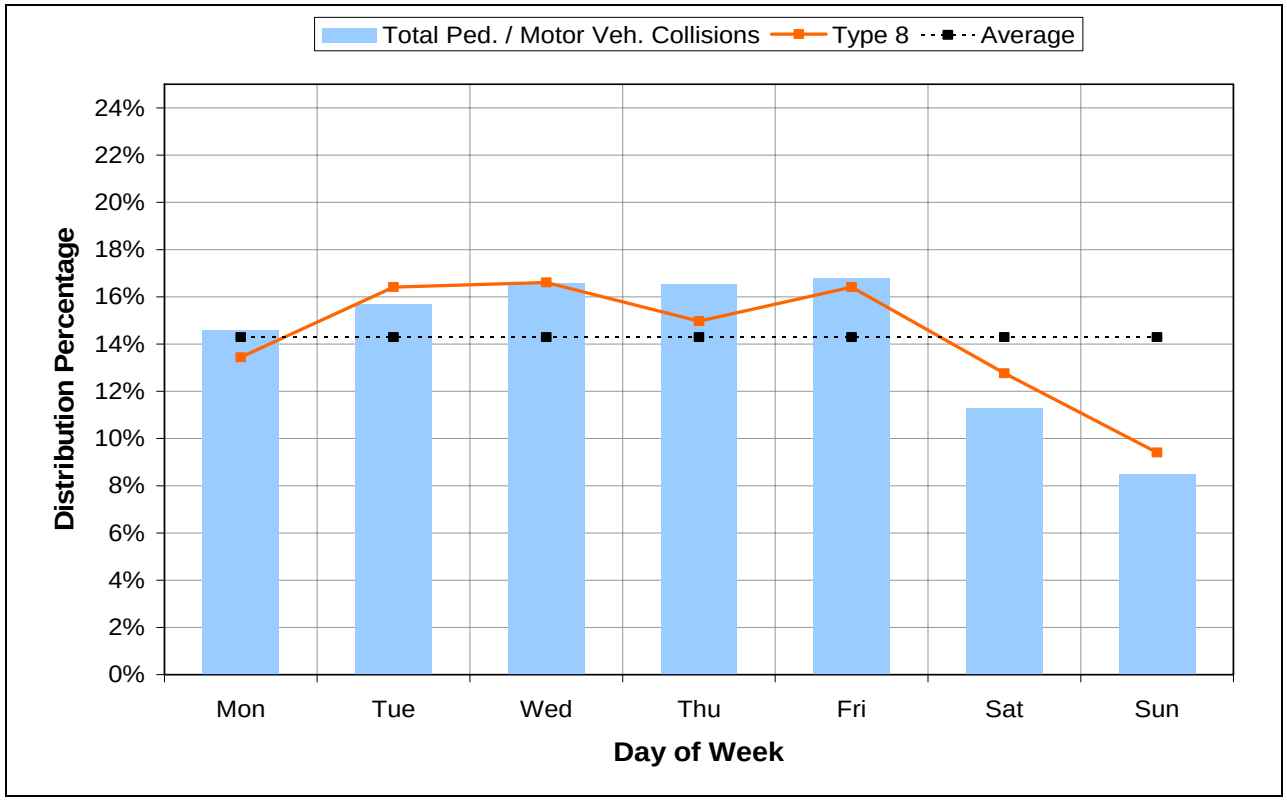
Road Surface Condition:



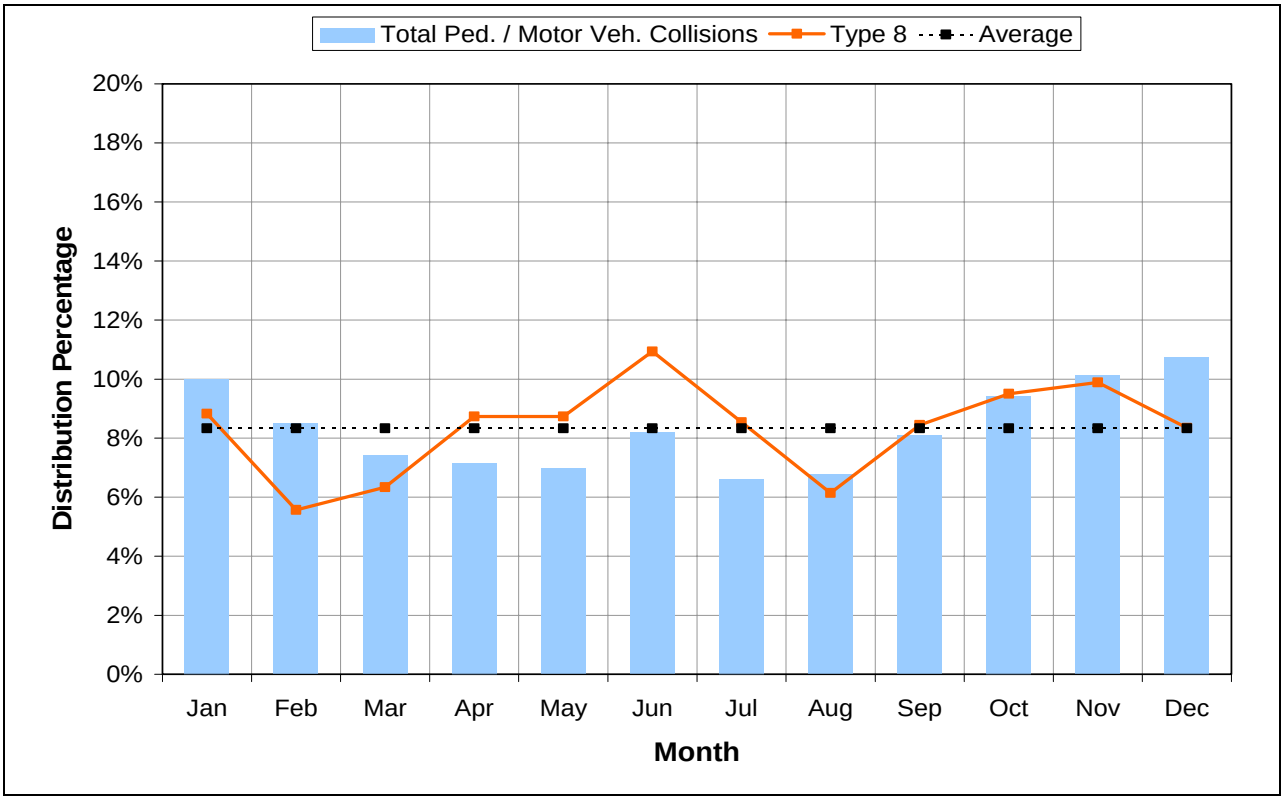
Temporal Pattern – Month of Year:



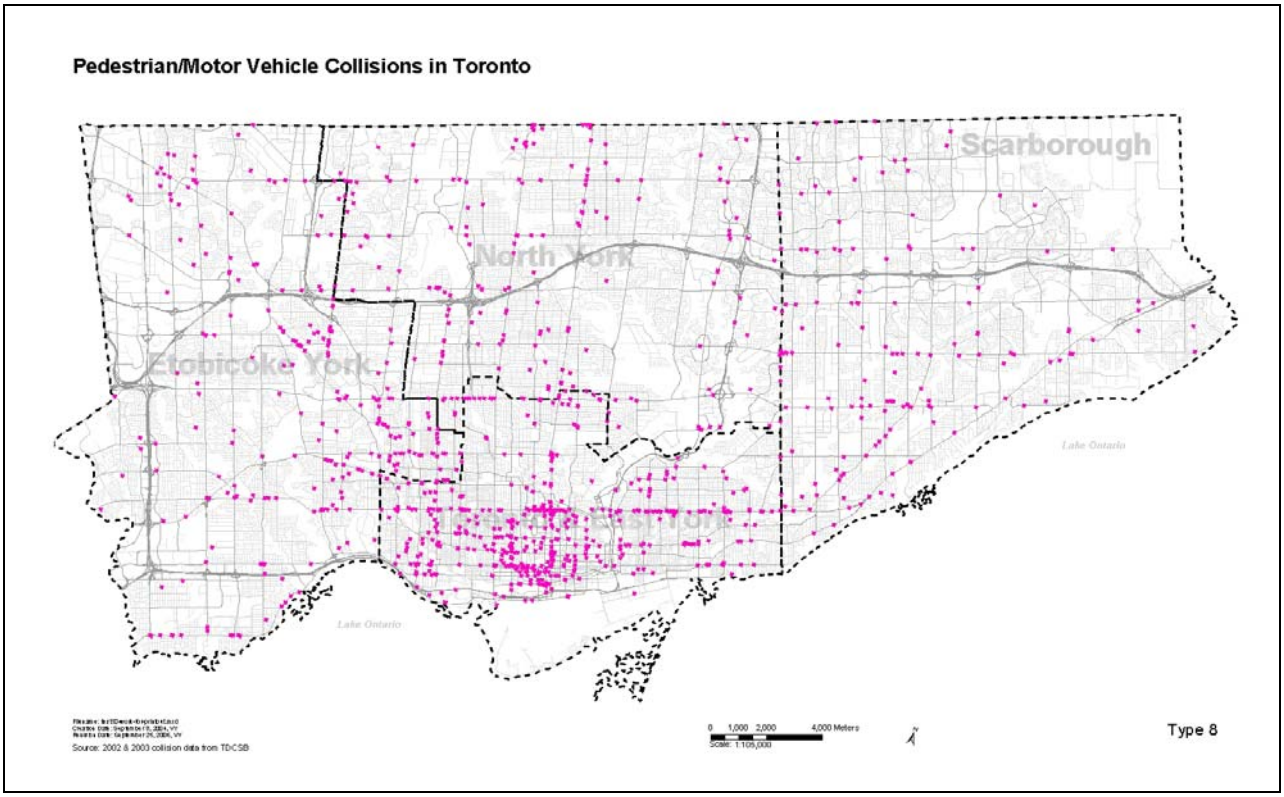
Temporal Pattern – Day of Week:



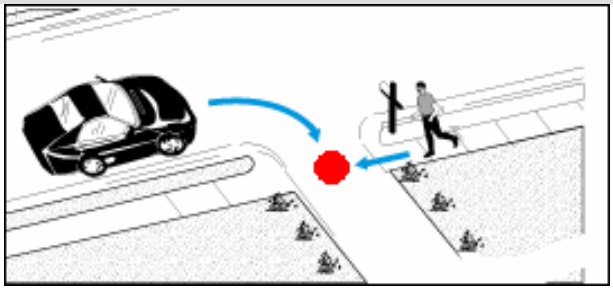
Temporal Pattern – Time of Day:

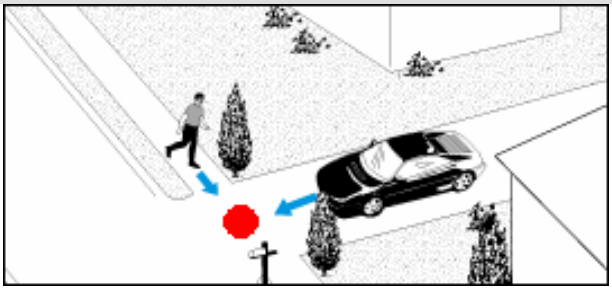


Geographic Distribution:



9. Pedestrian hit at private driveway



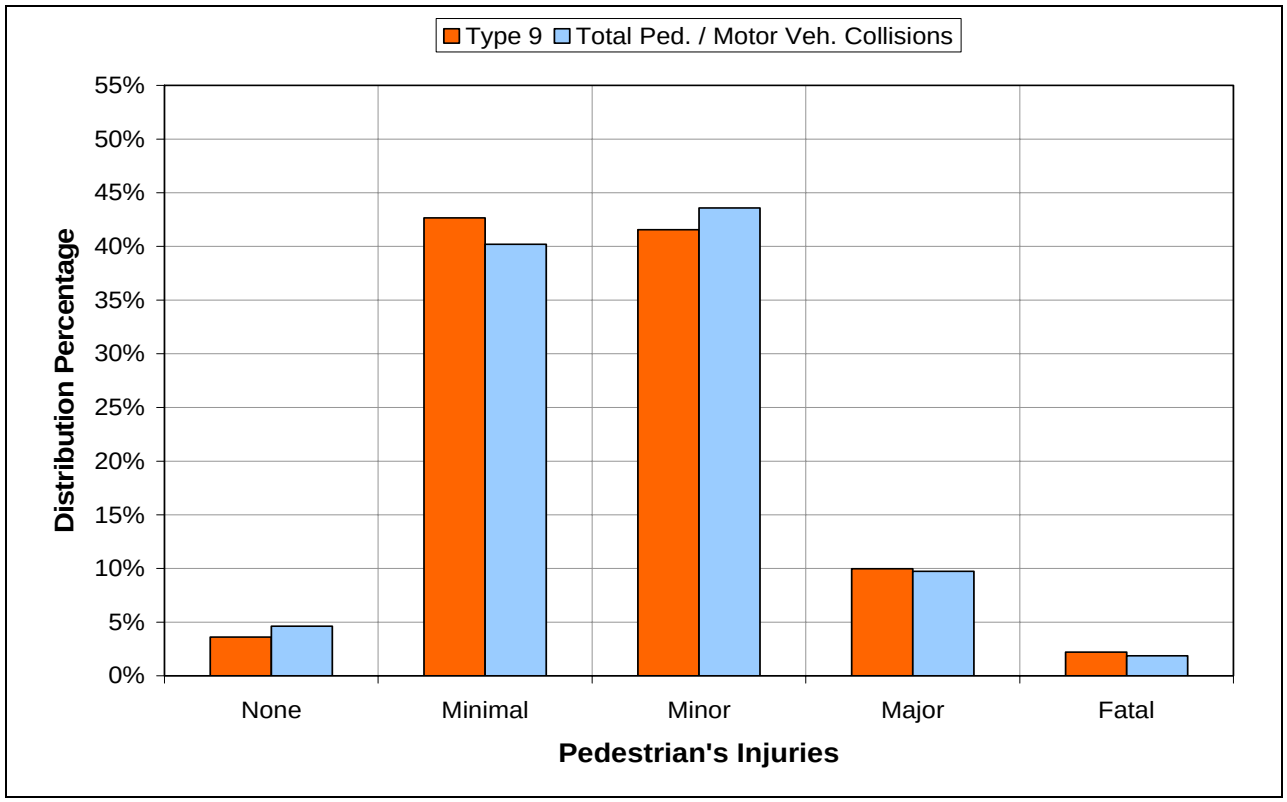


Description: A pedestrian and a vehicle collided on a private driveway. The pedestrian was crossing the driveway and was hit by a vehicle entering or exiting the driveway.

Frequency:

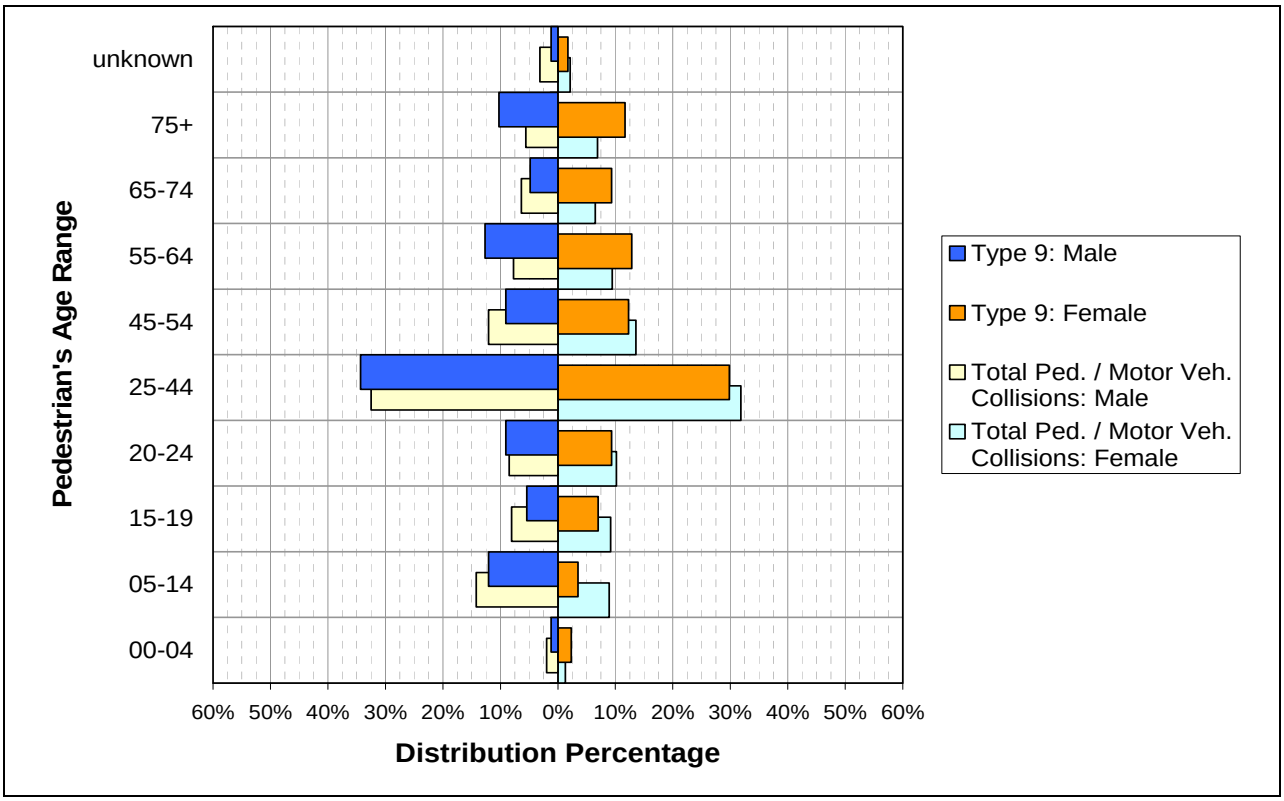
347 of 4,557 collisions 7% of all collisions Rank #6

Pedestrian's Injury:

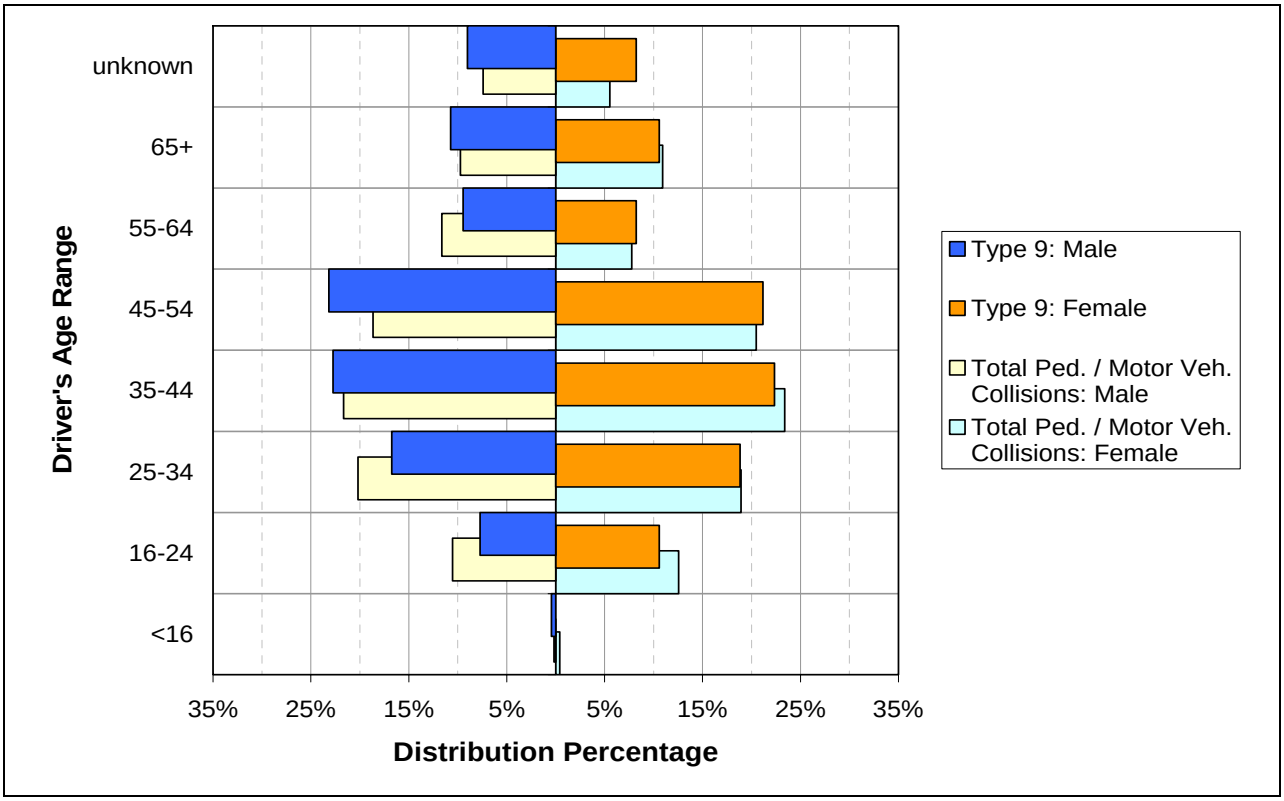


Type 9	4%	43%	41%	10%	2%
Total	5%	40%	44%	10%	2%

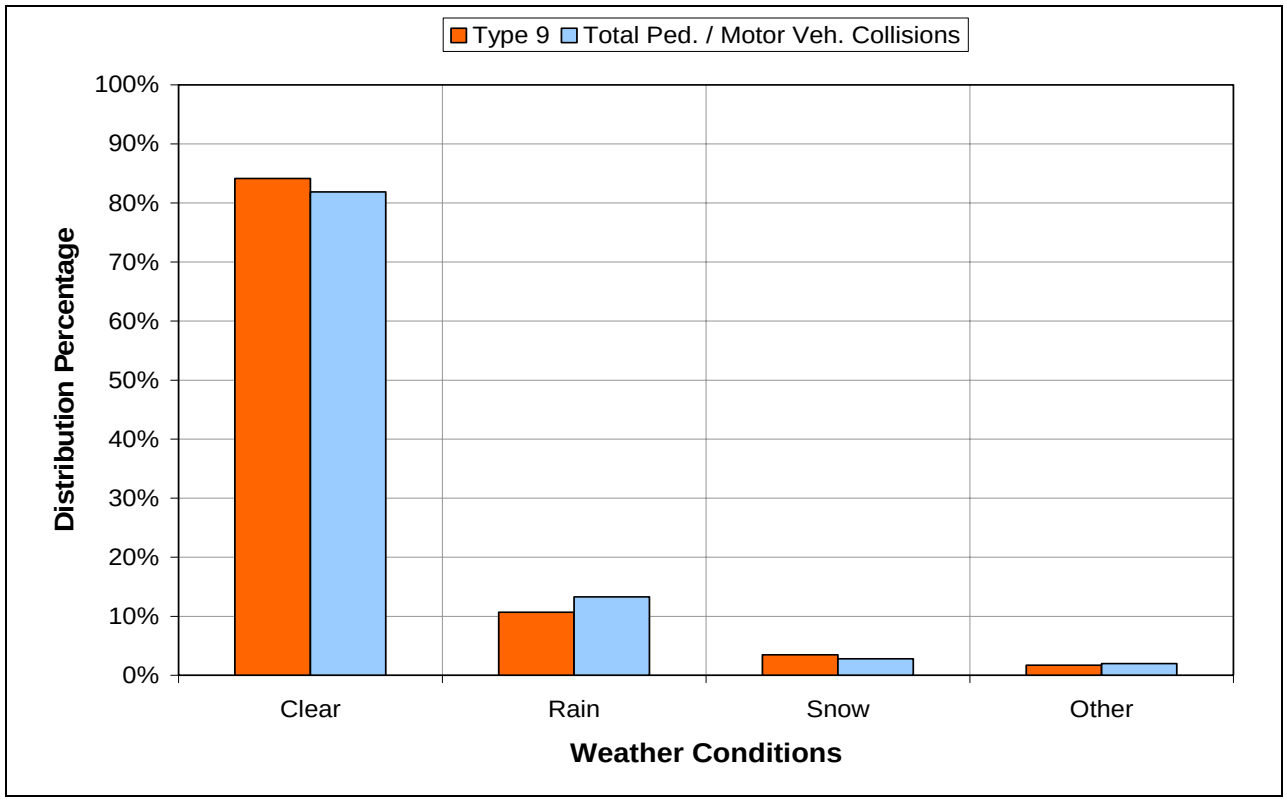
Pedestrian's Age Range:



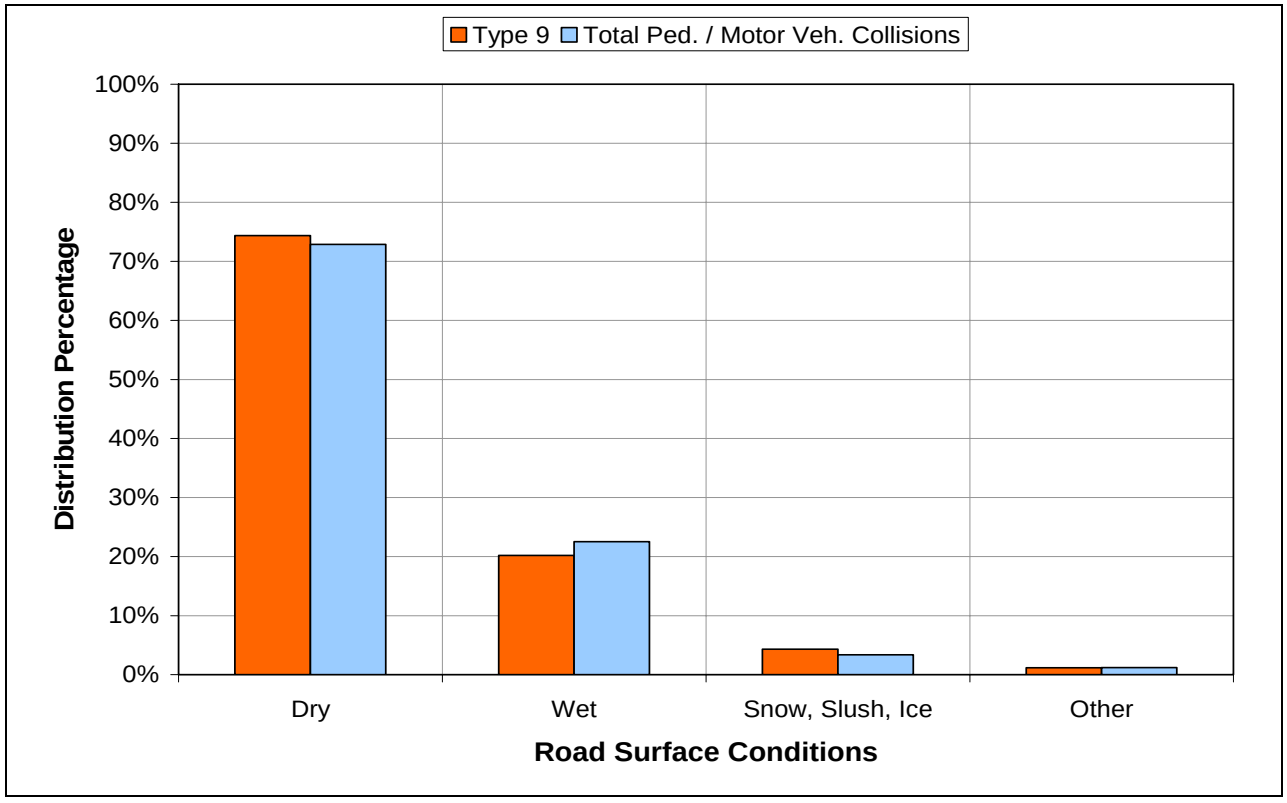
Driver's Age Range:



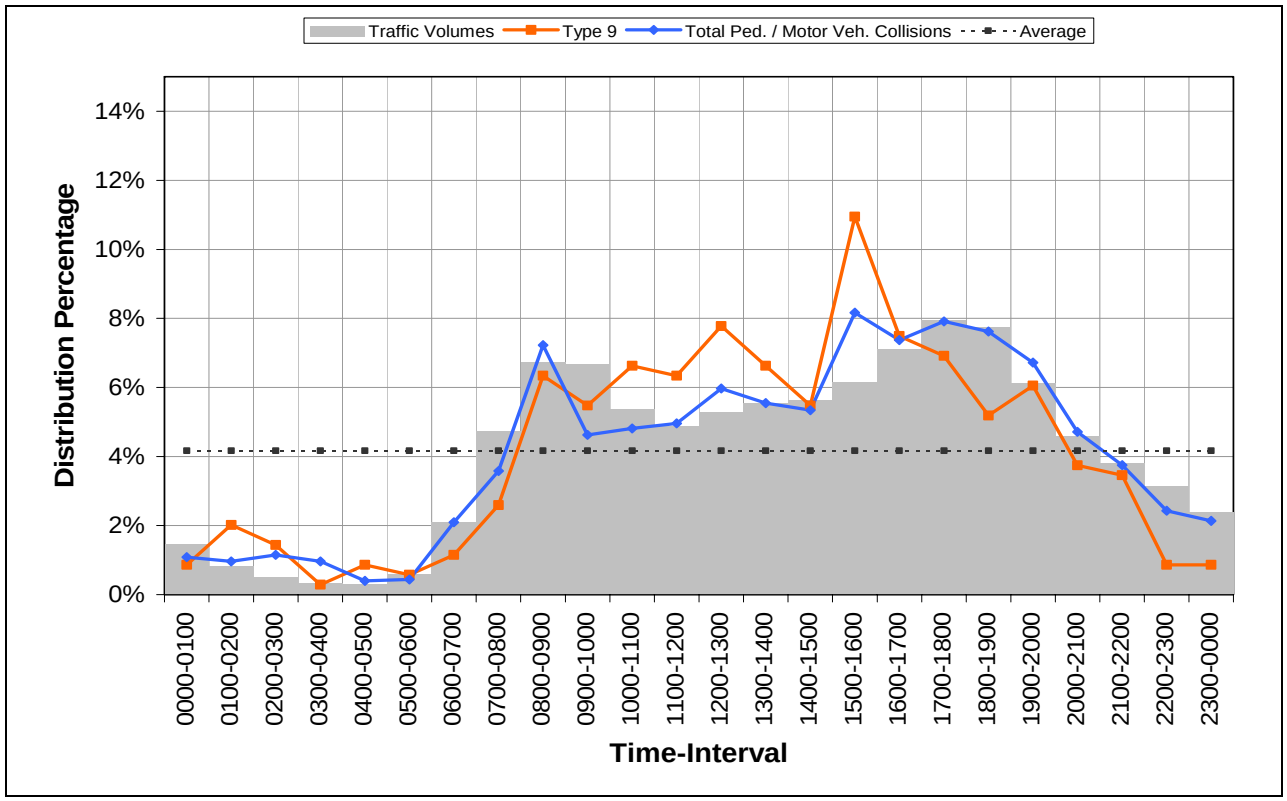
Weather Condition:



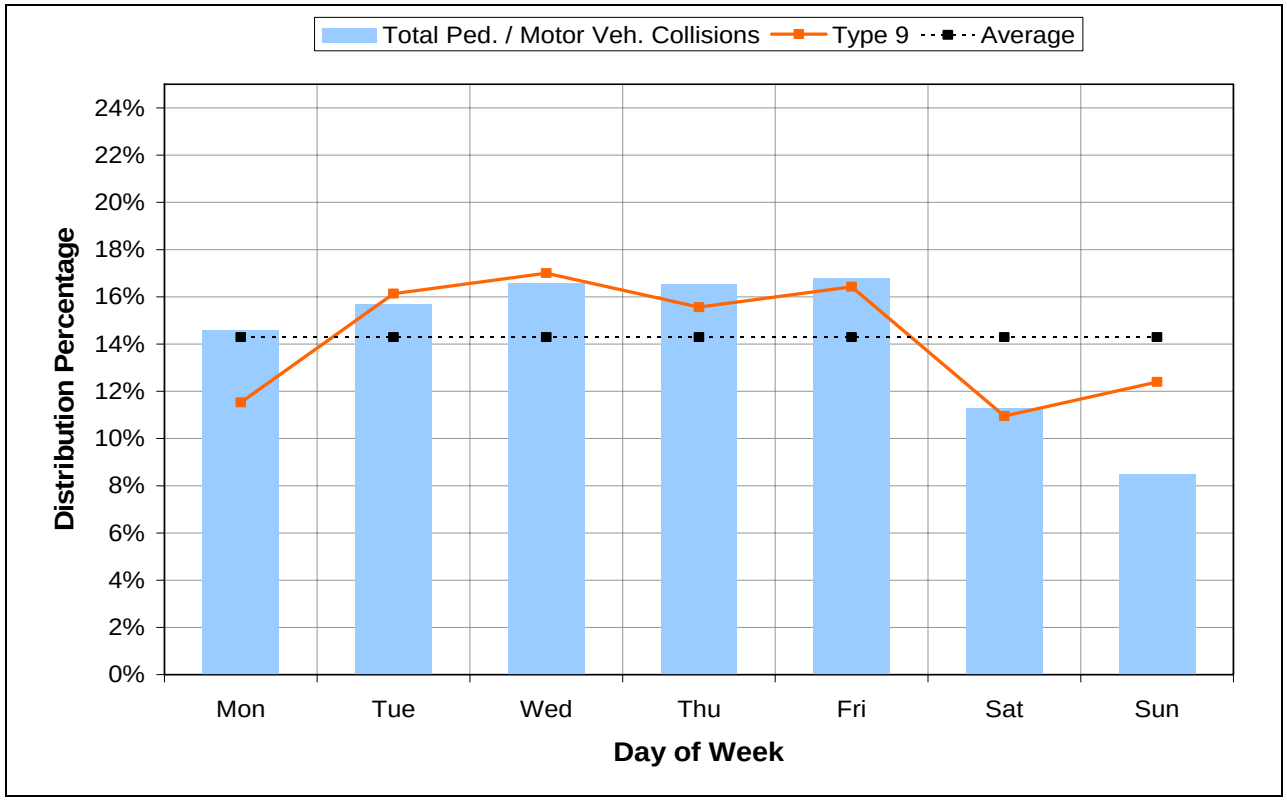
Road Surface Condition:



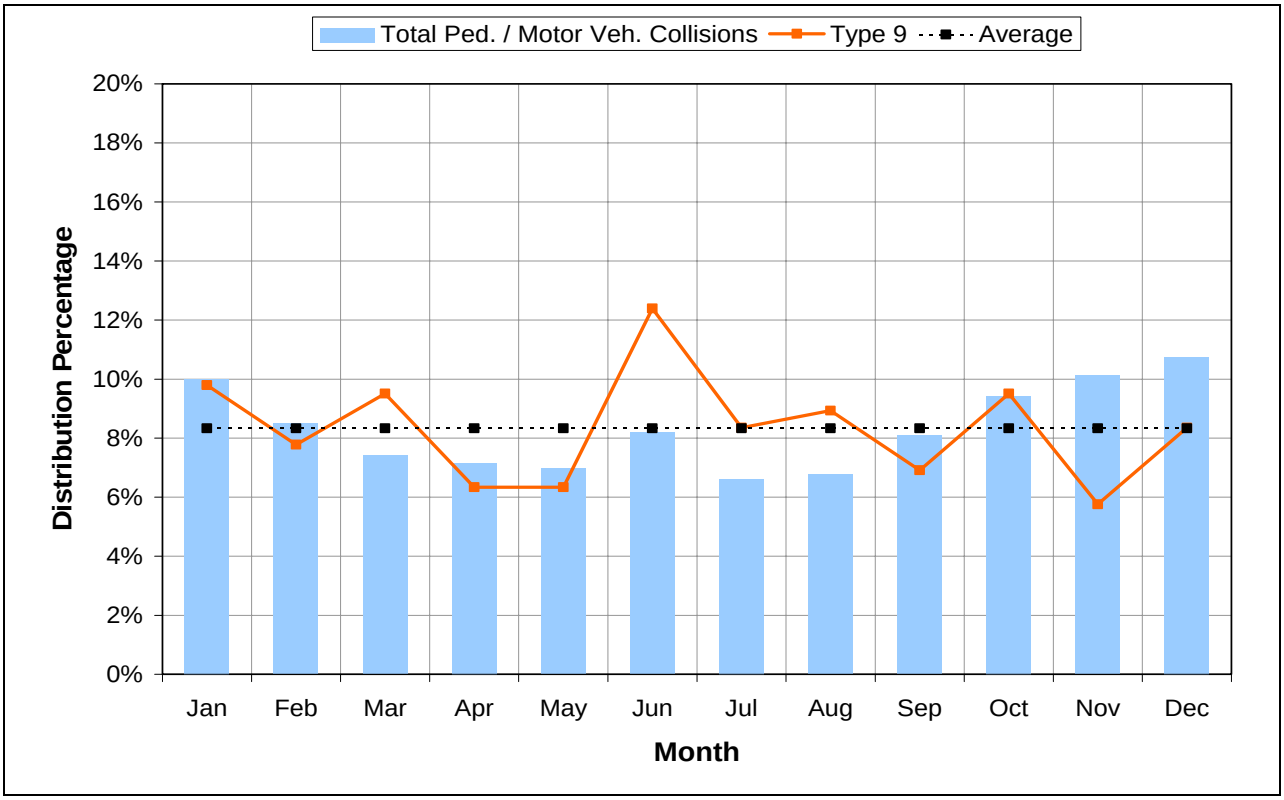
Temporal Pattern – Time of Day:



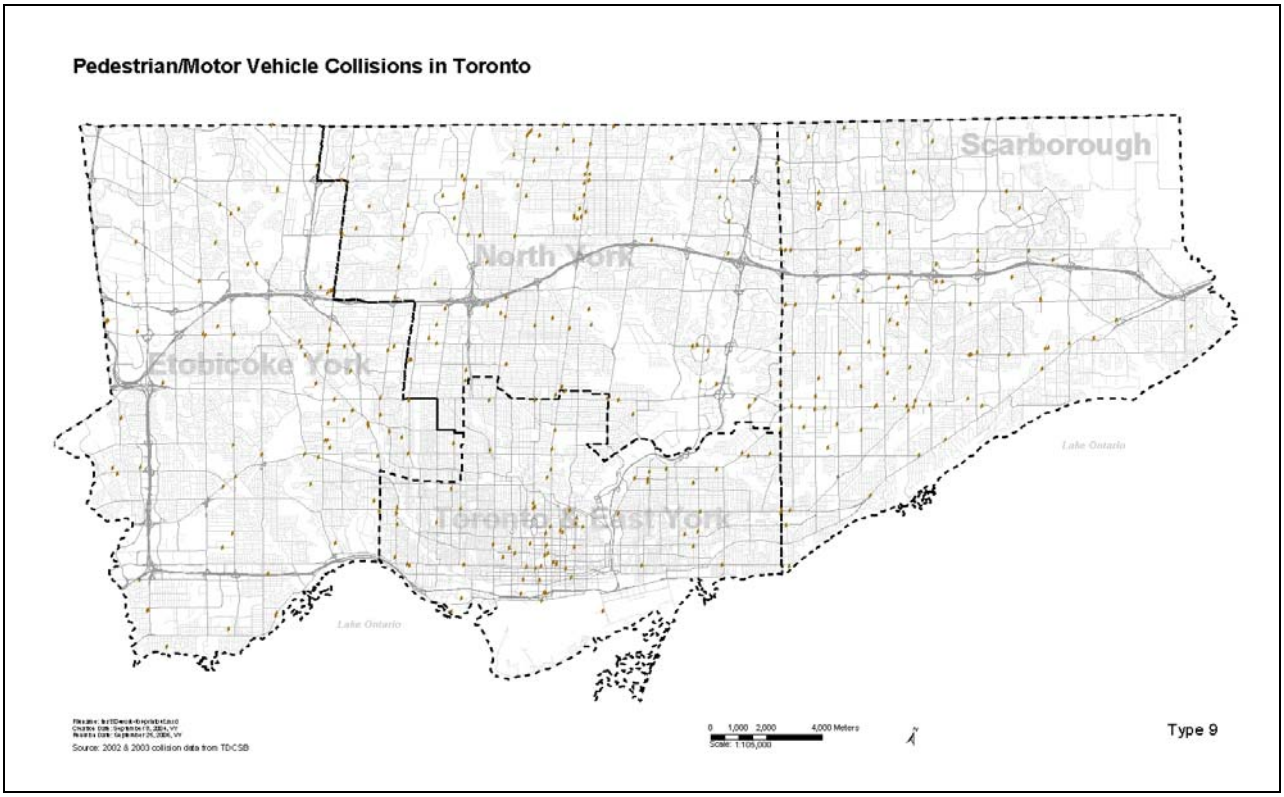
Temporal Pattern – Day of Week:



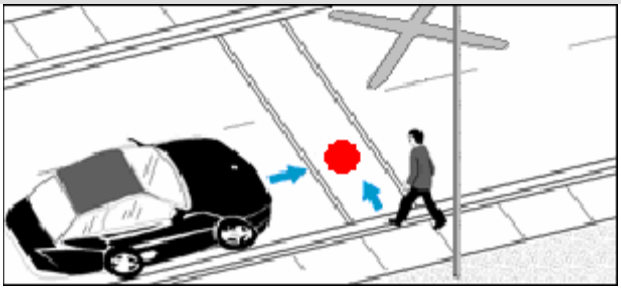
Temporal Pattern – Month of Year:



Geographic Distribution:



10. Pedestrian hit at pedestrian crossover (PXO)

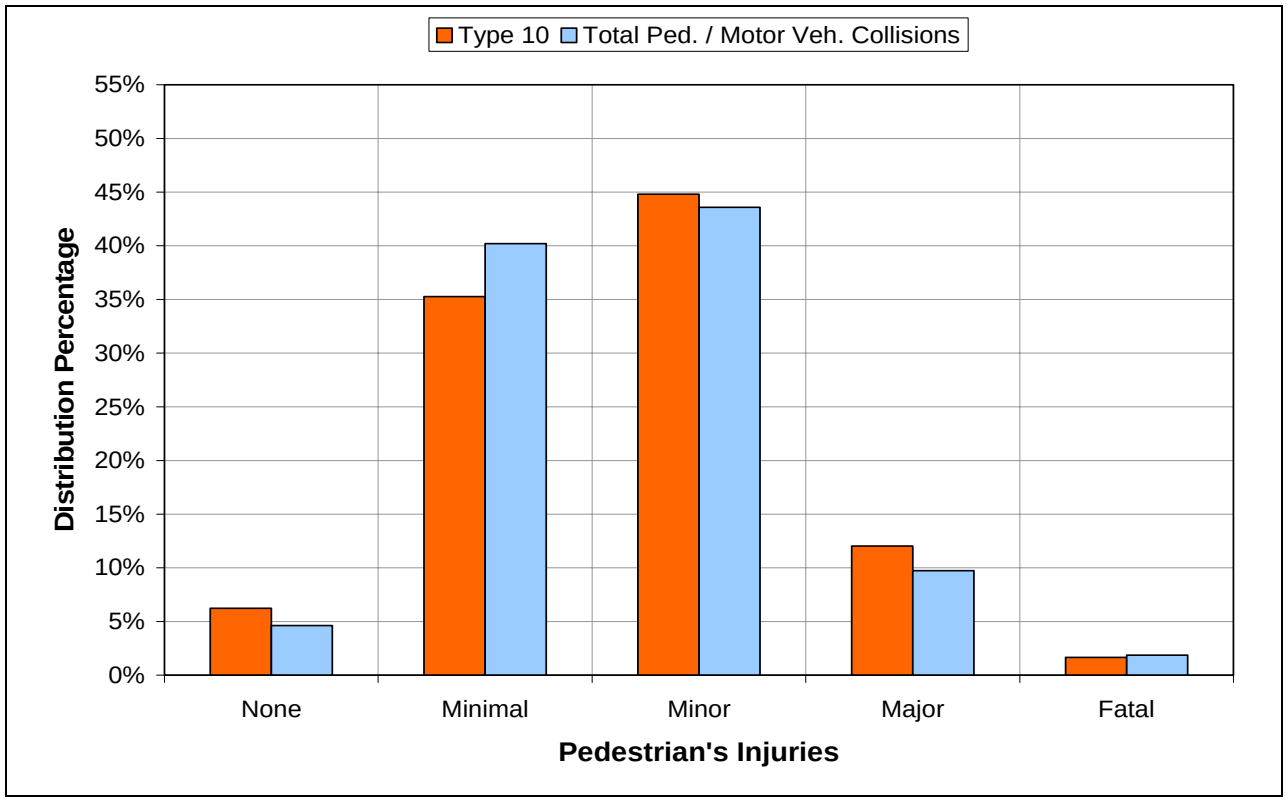


Description: A pedestrian and a vehicle collision at a pedestrian crossover.

Frequency:

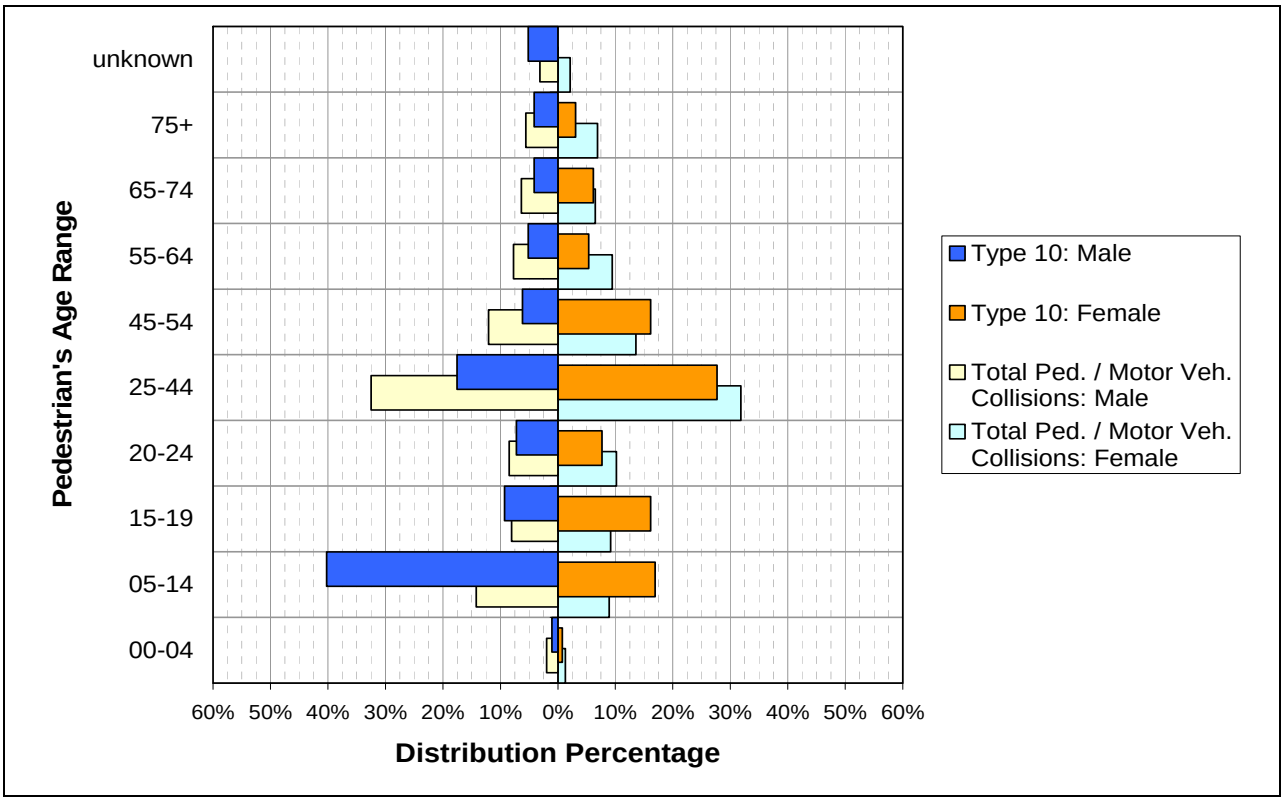
232 of 4,557 collisions 5% of all collisions Rank #7

Pedestrian's Injury:

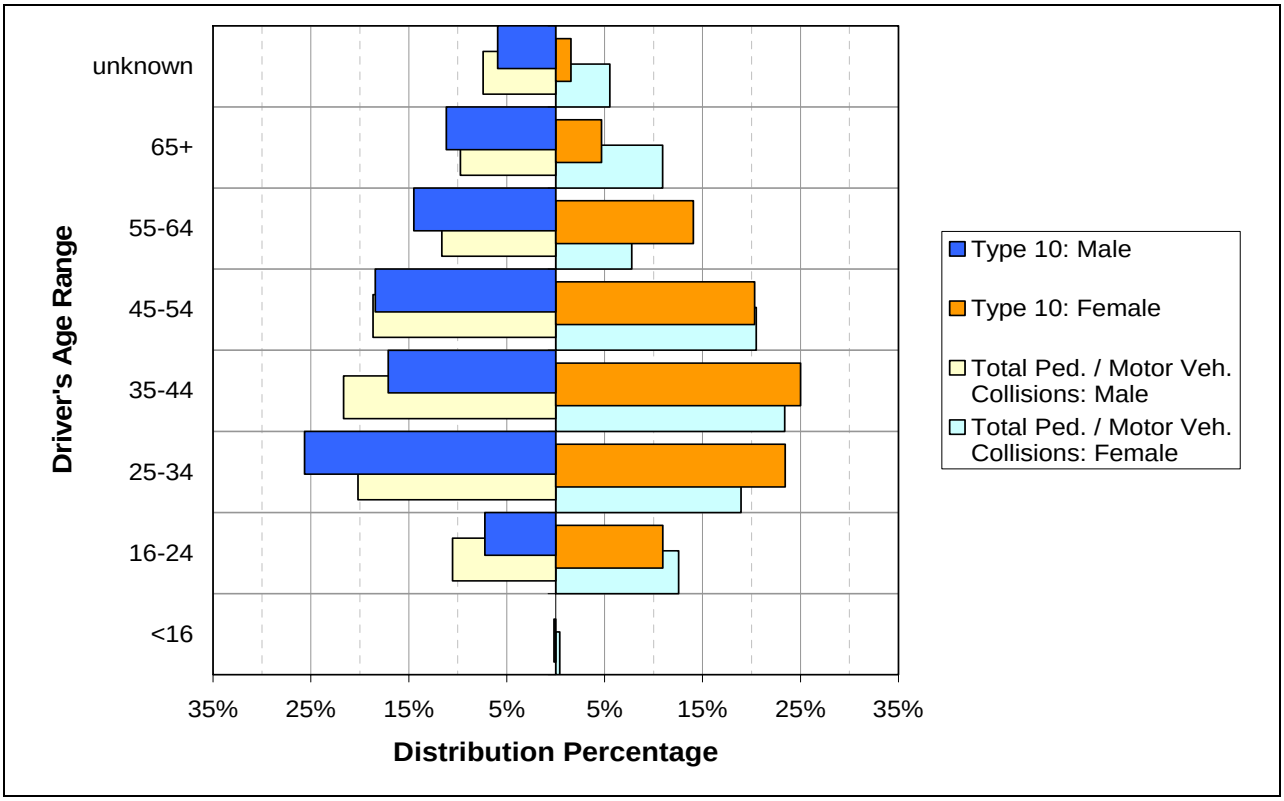


Type 10	6%	35%	45%	12%	2%
Total	5%	40%	44%	10%	2%

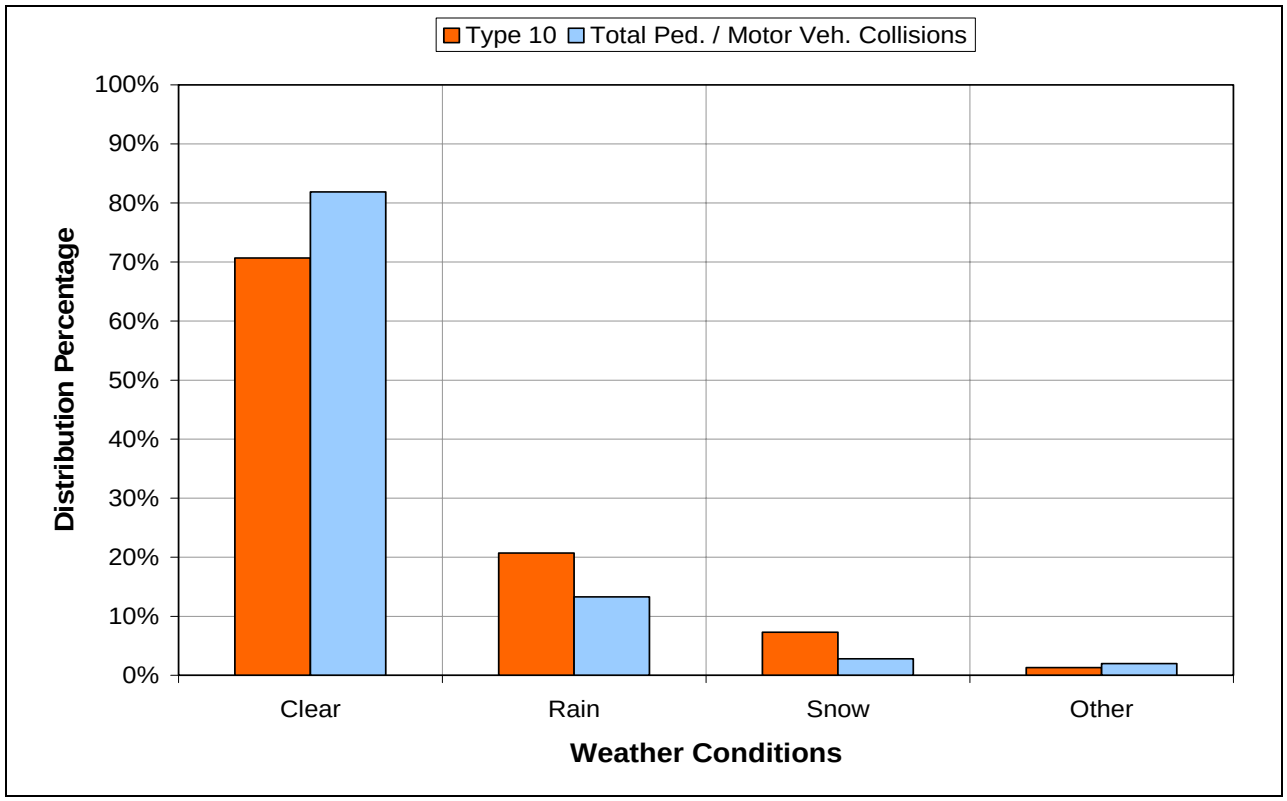
Pedestrian's Age Range:



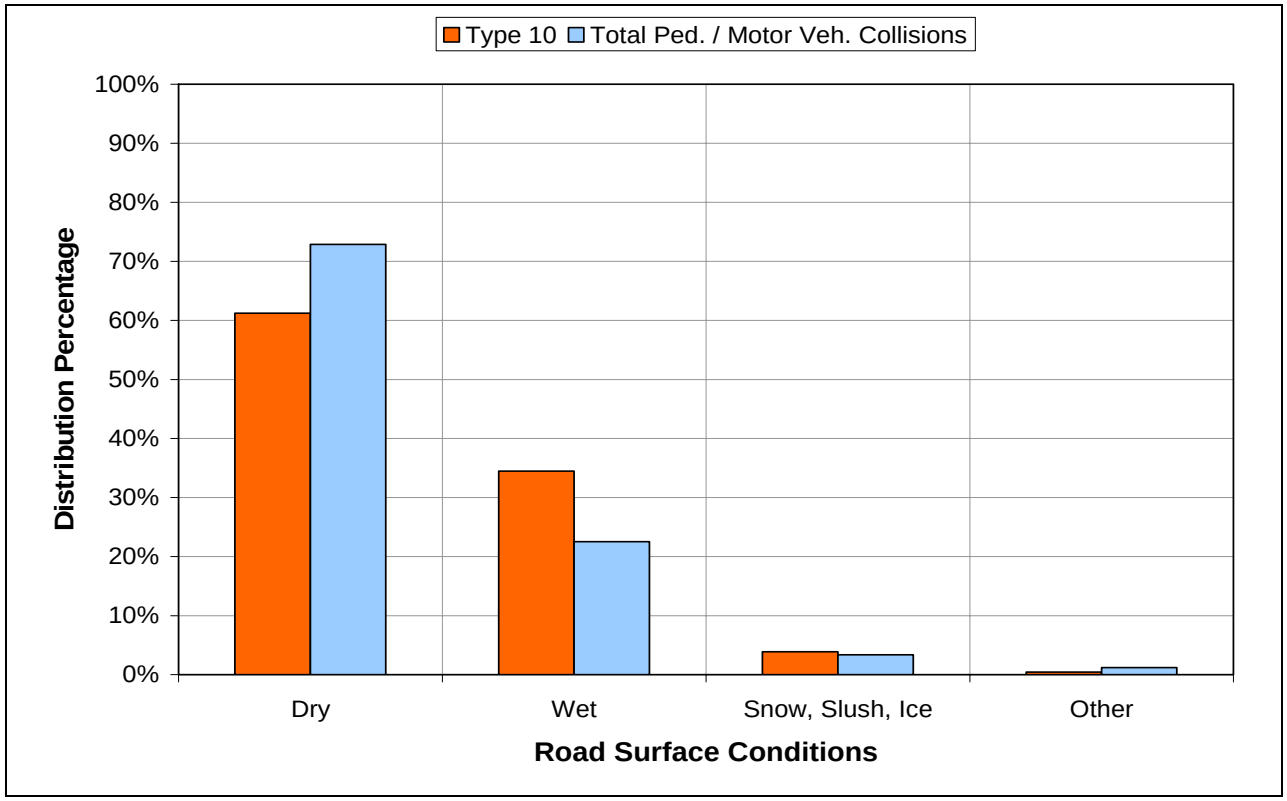
Driver's Age Range:



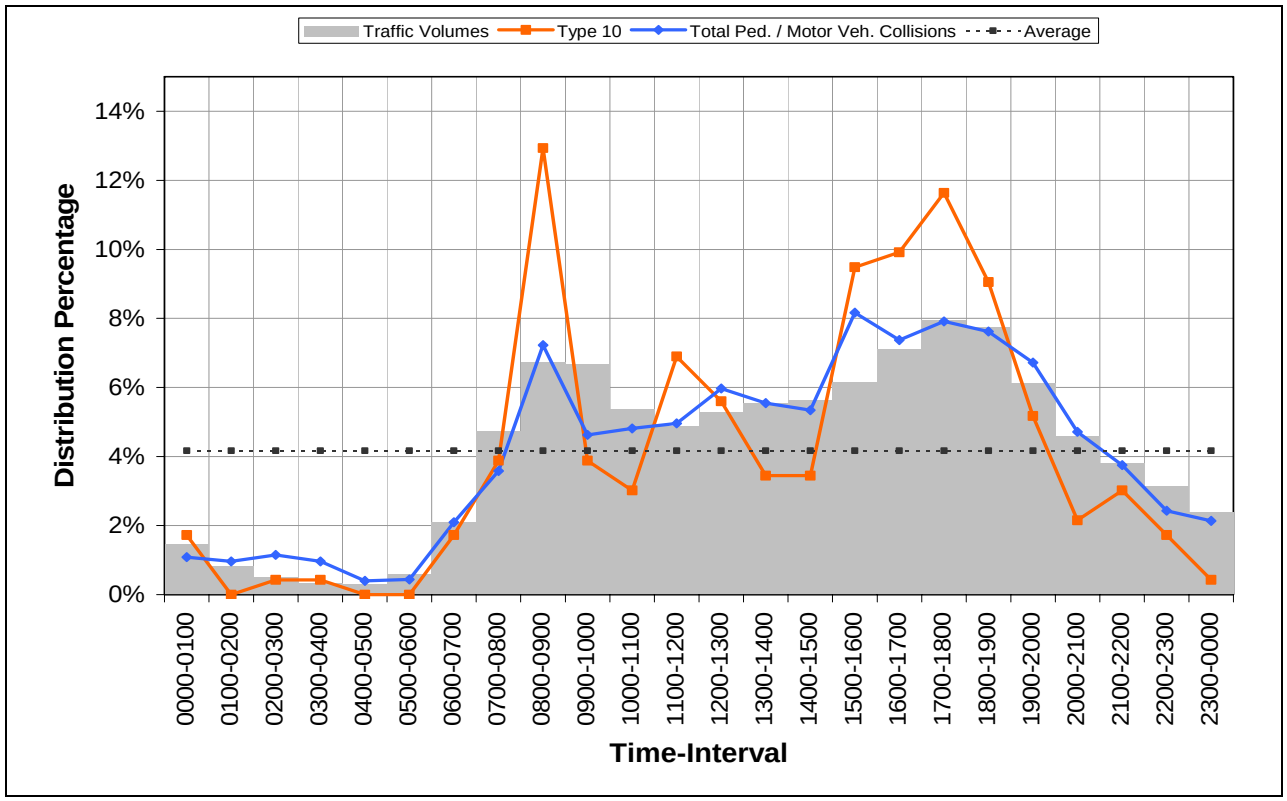
Weather Condition:



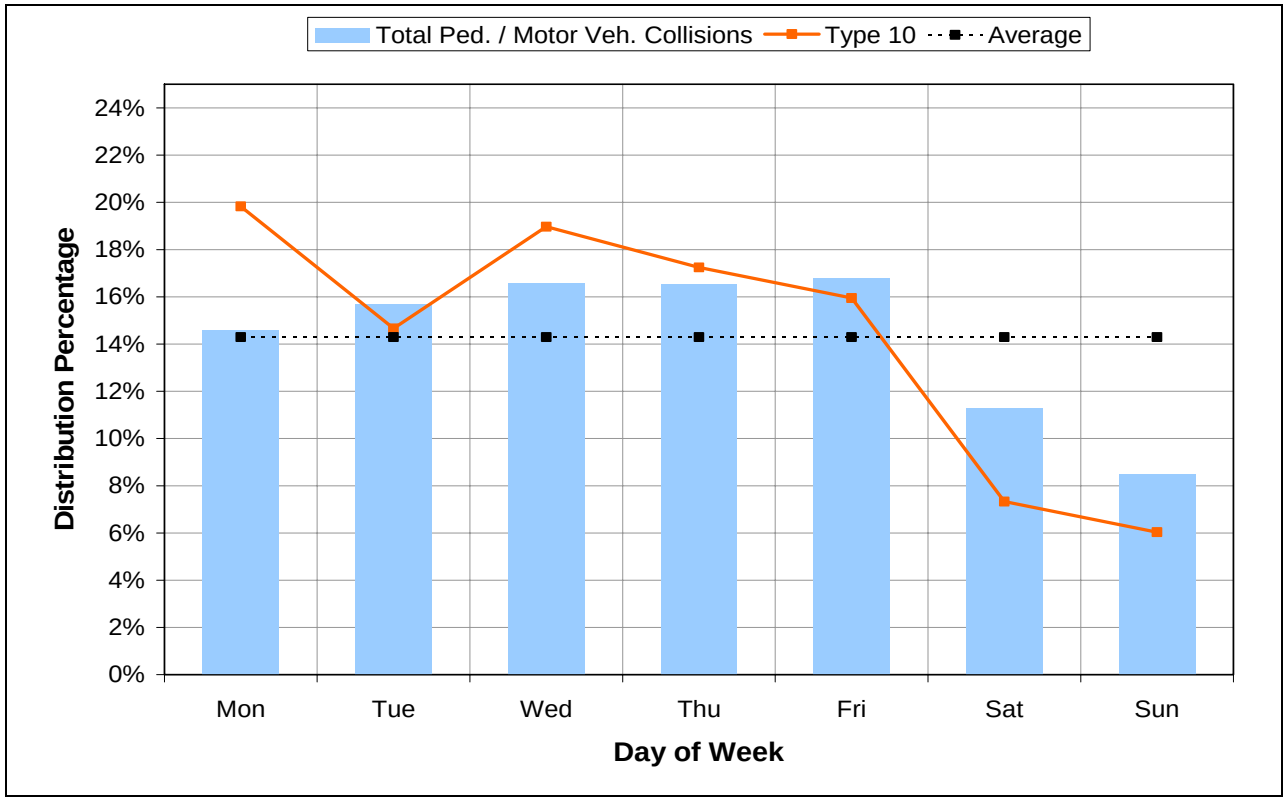
Road Surface Condition:



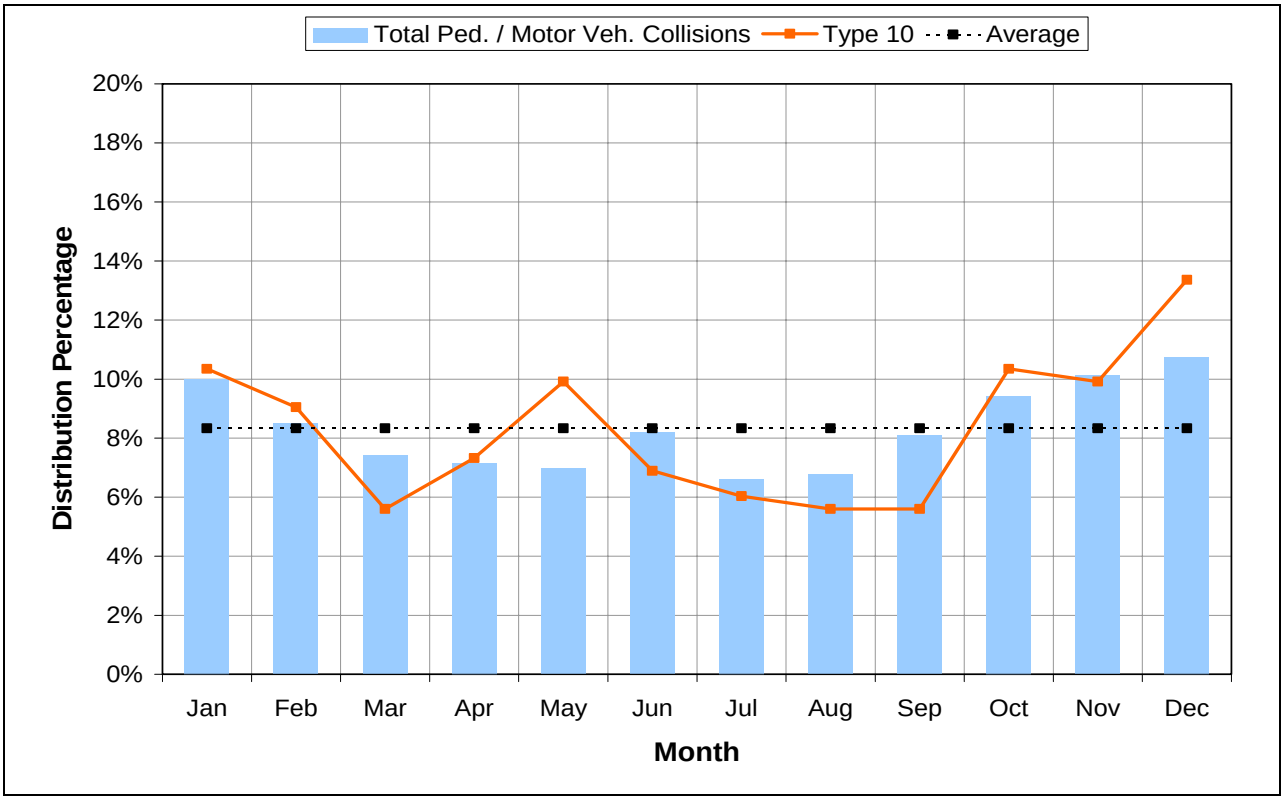
Temporal Pattern – Time of Day:



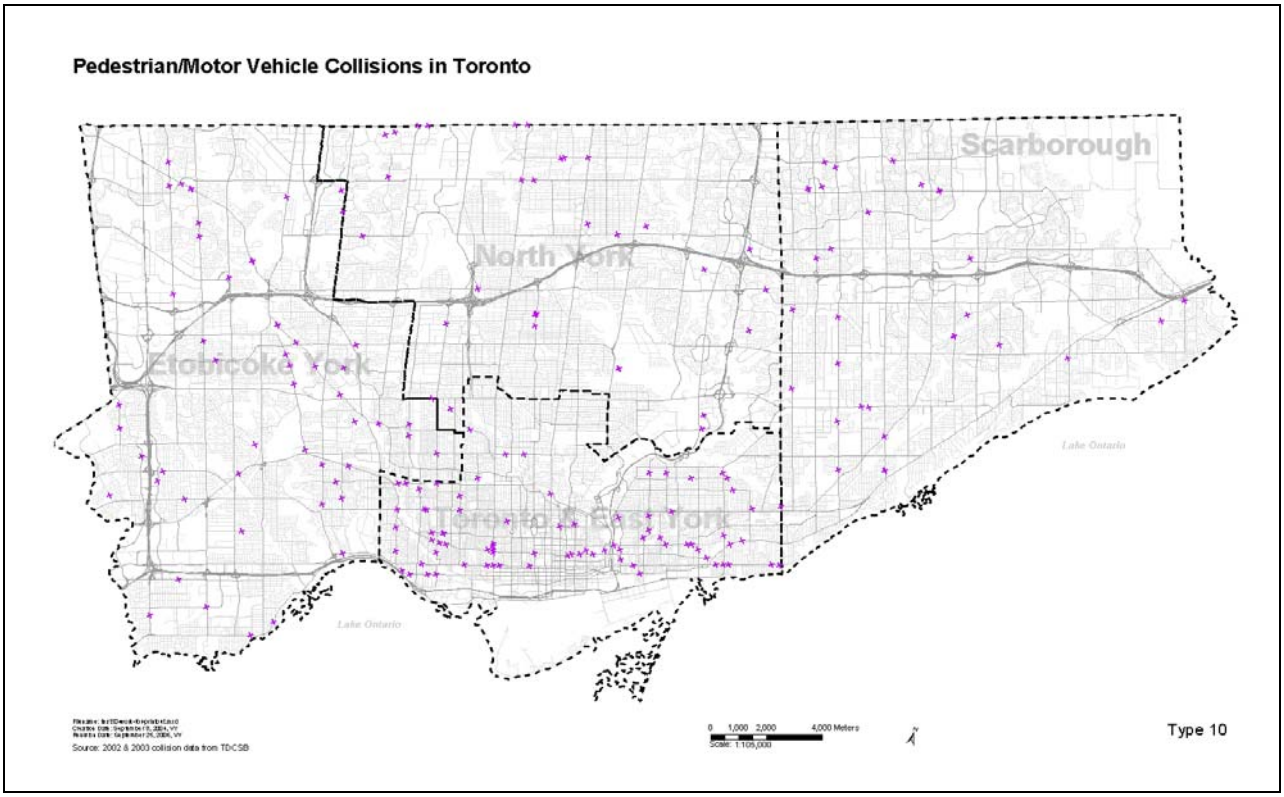
Temporal Pattern – Day of Week:



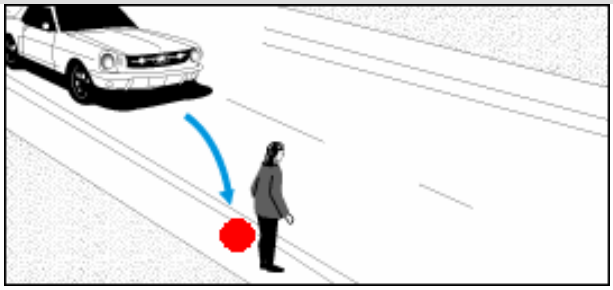
Temporal Pattern – Month of Year:



Geographic Distribution:



11. Pedestrian hit on sidewalk or shoulder

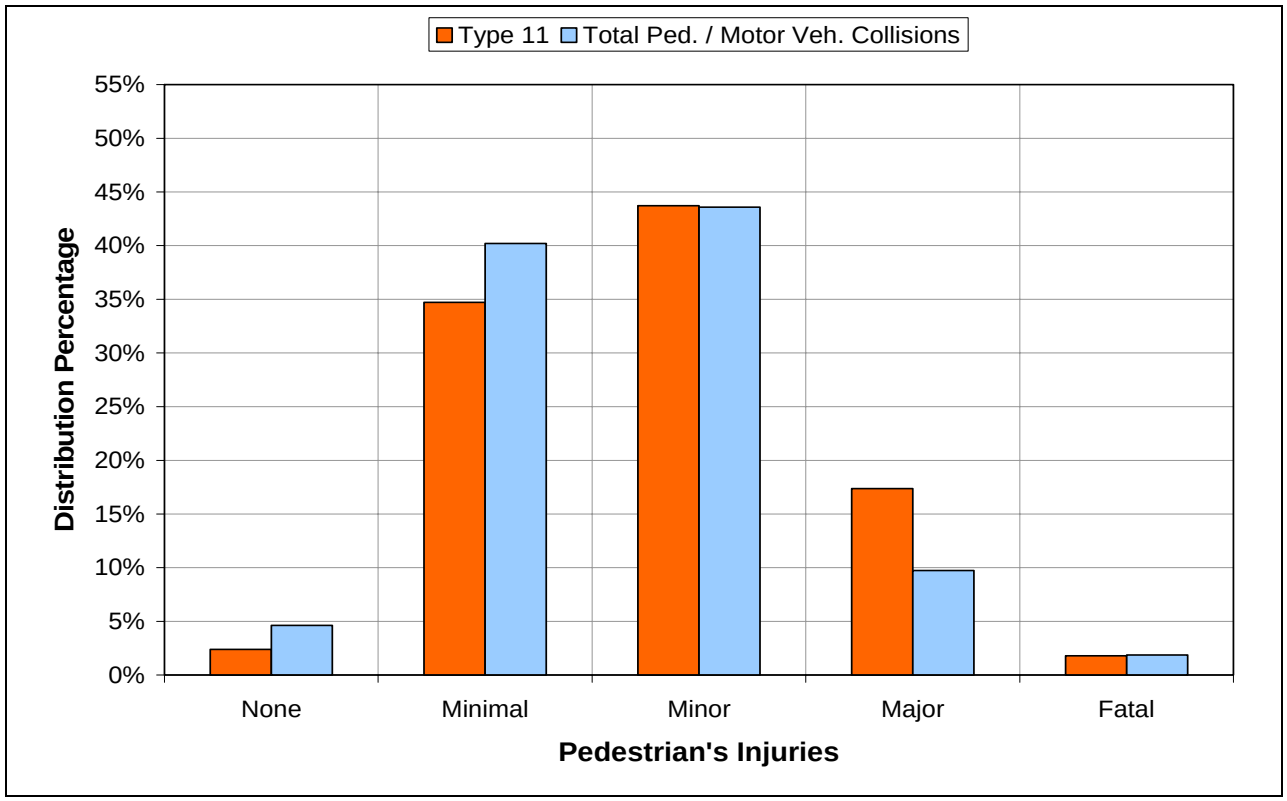


Description: A pedestrian and a vehicle collision on a sidewalk or shoulder.

Frequency:

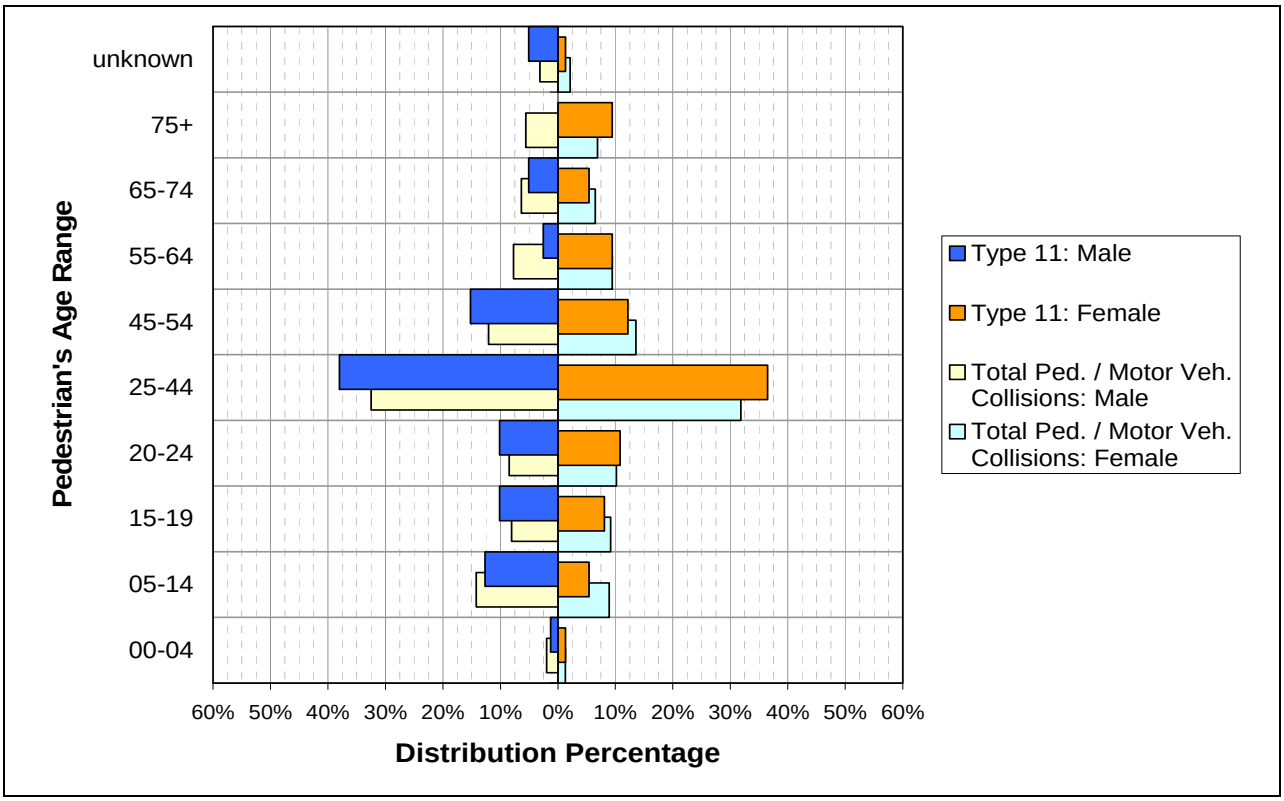
163 of 4,557 collisions 3% of all collisions Rank #11

Pedestrian's Injury:

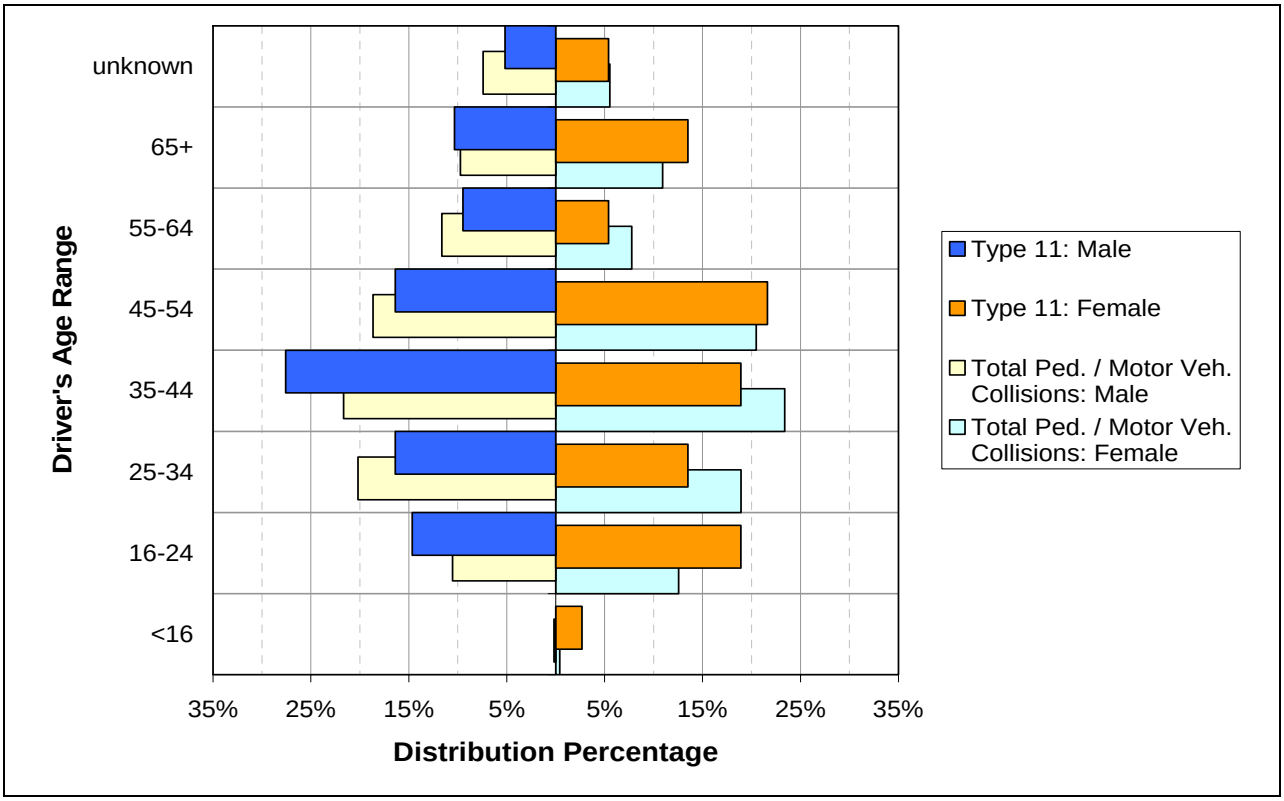


Type 11	2%	35%	44%	17%	2%
Total	5%	40%	44%	10%	2%

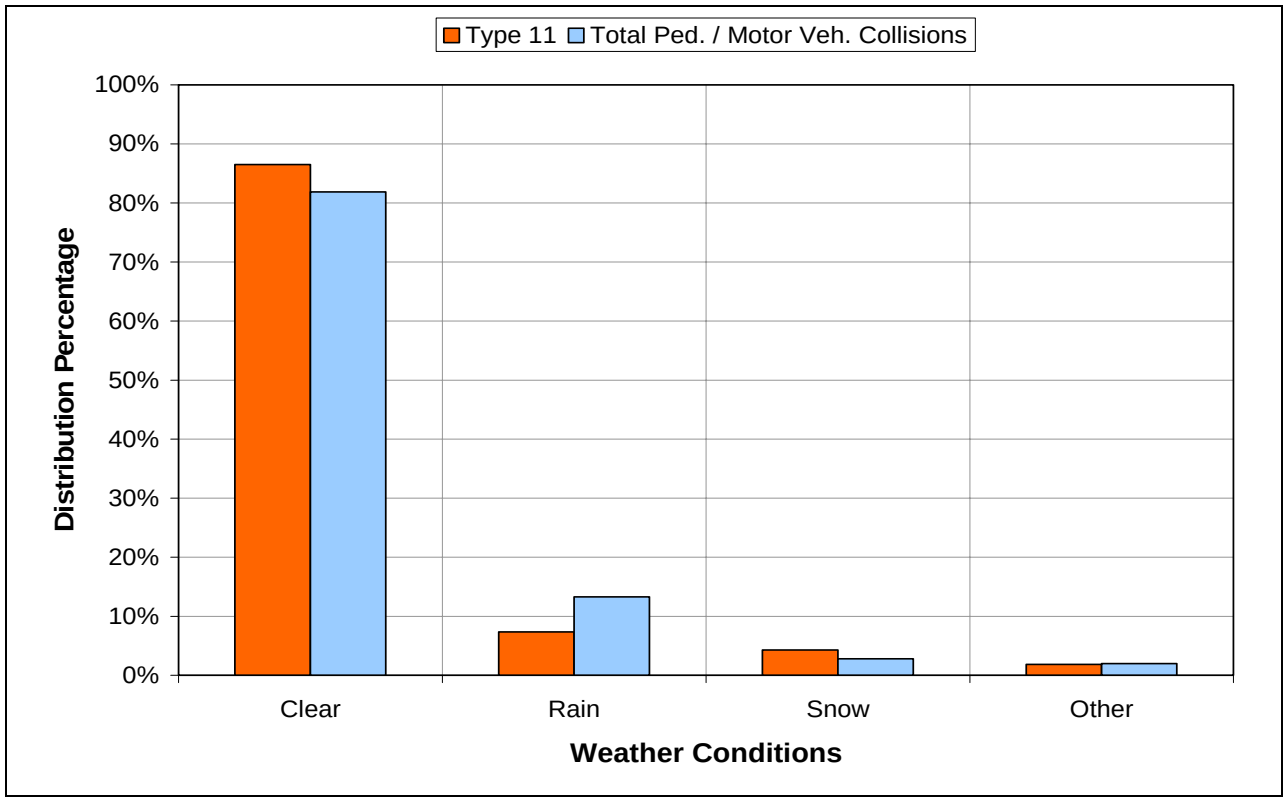
Pedestrian's Age Range:



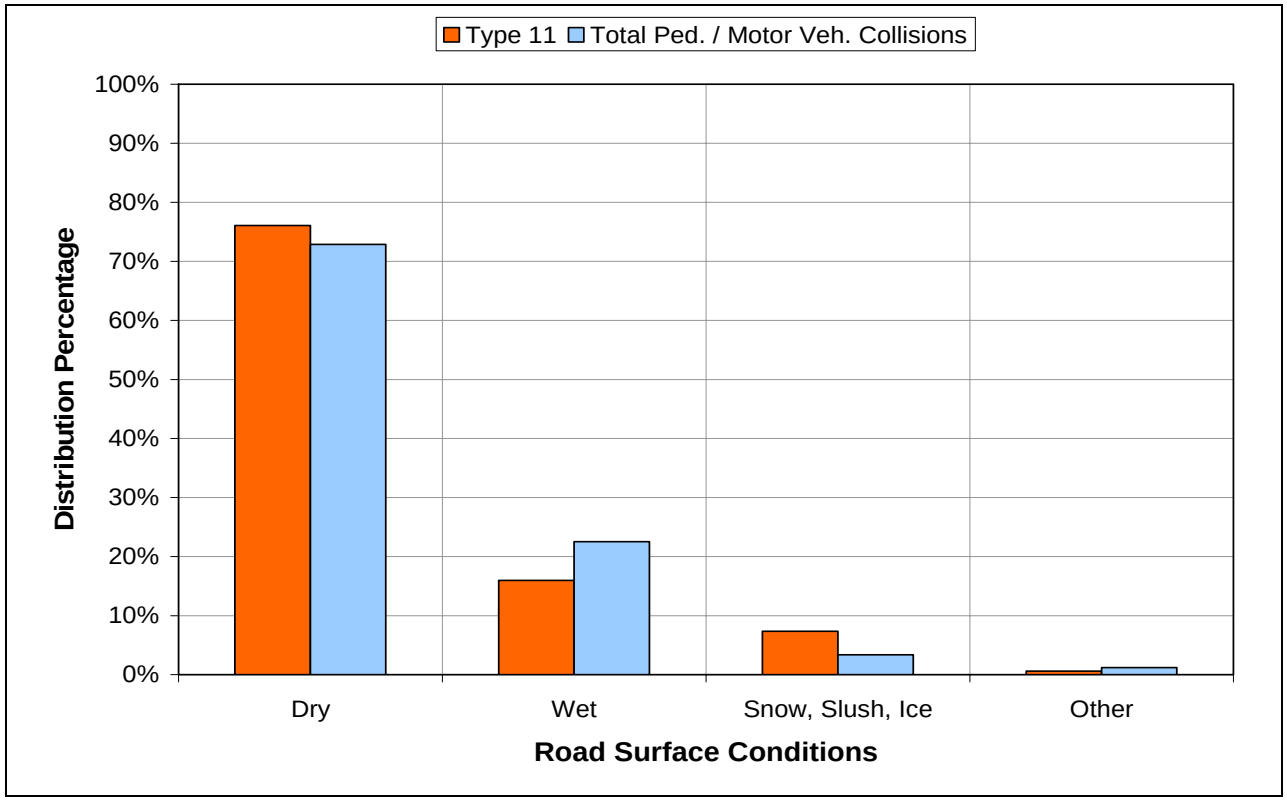
Driver's Age Range:



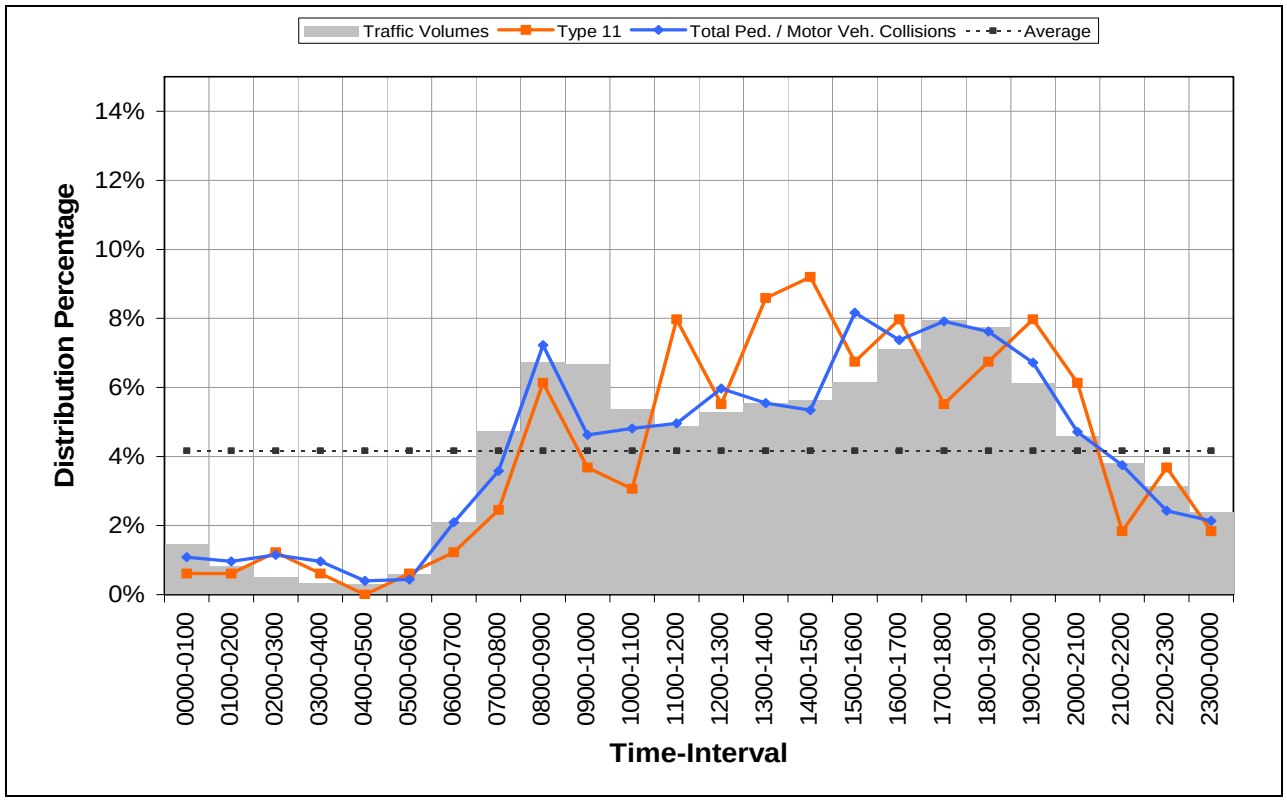
Weather Condition:



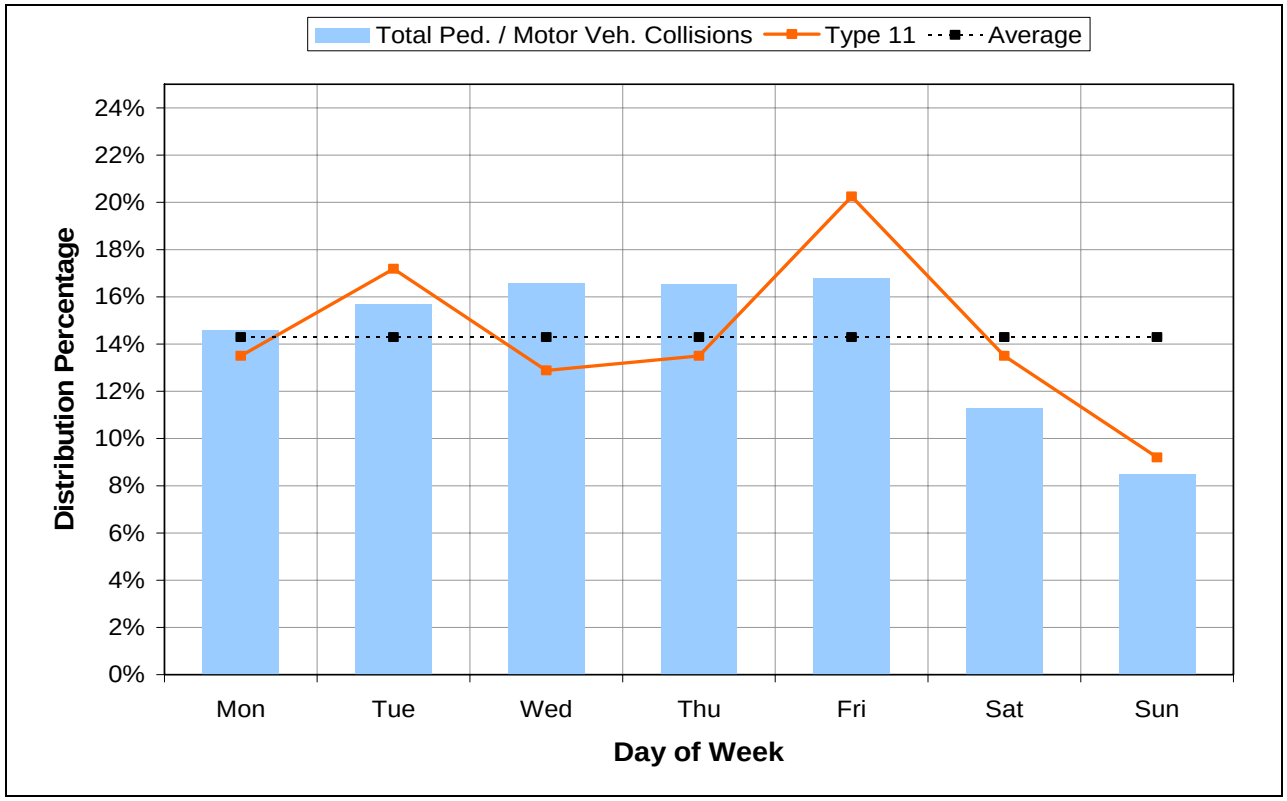
Road Surface Condition:



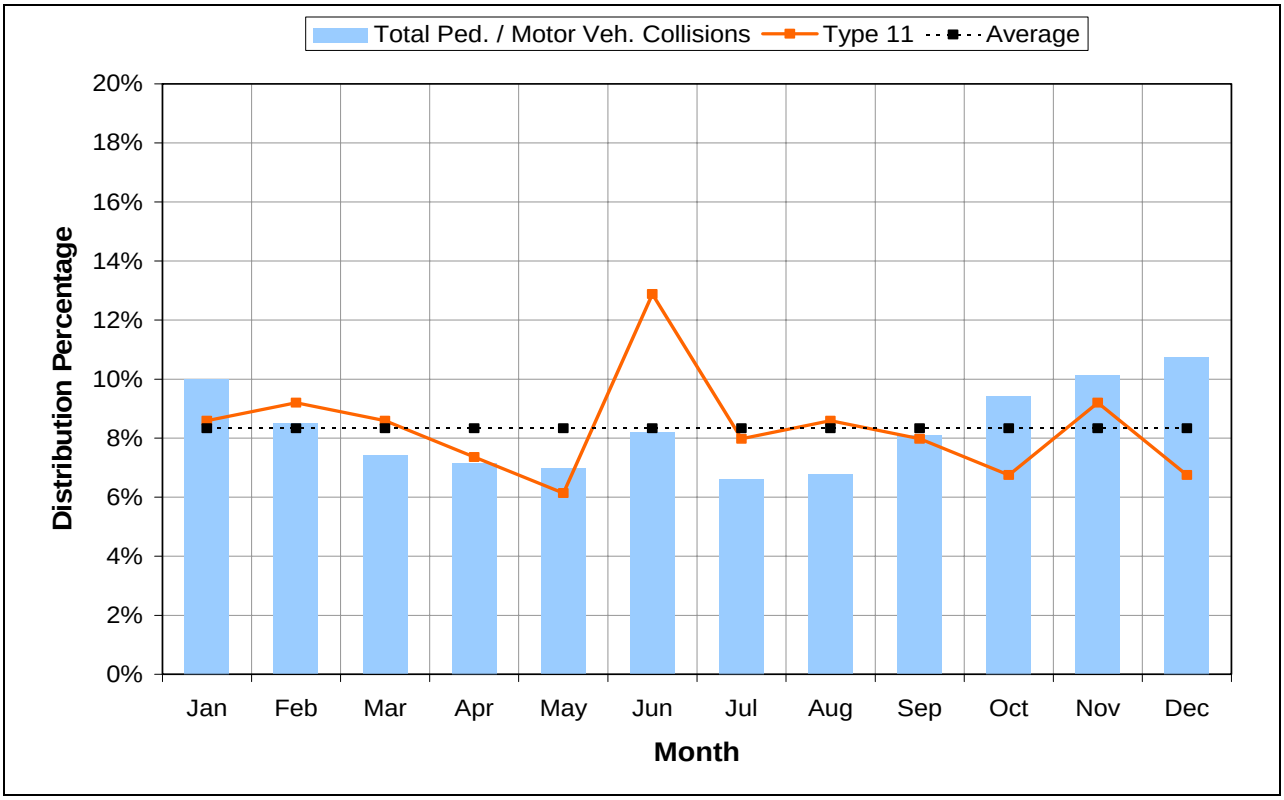
Temporal Pattern – Time of Day:



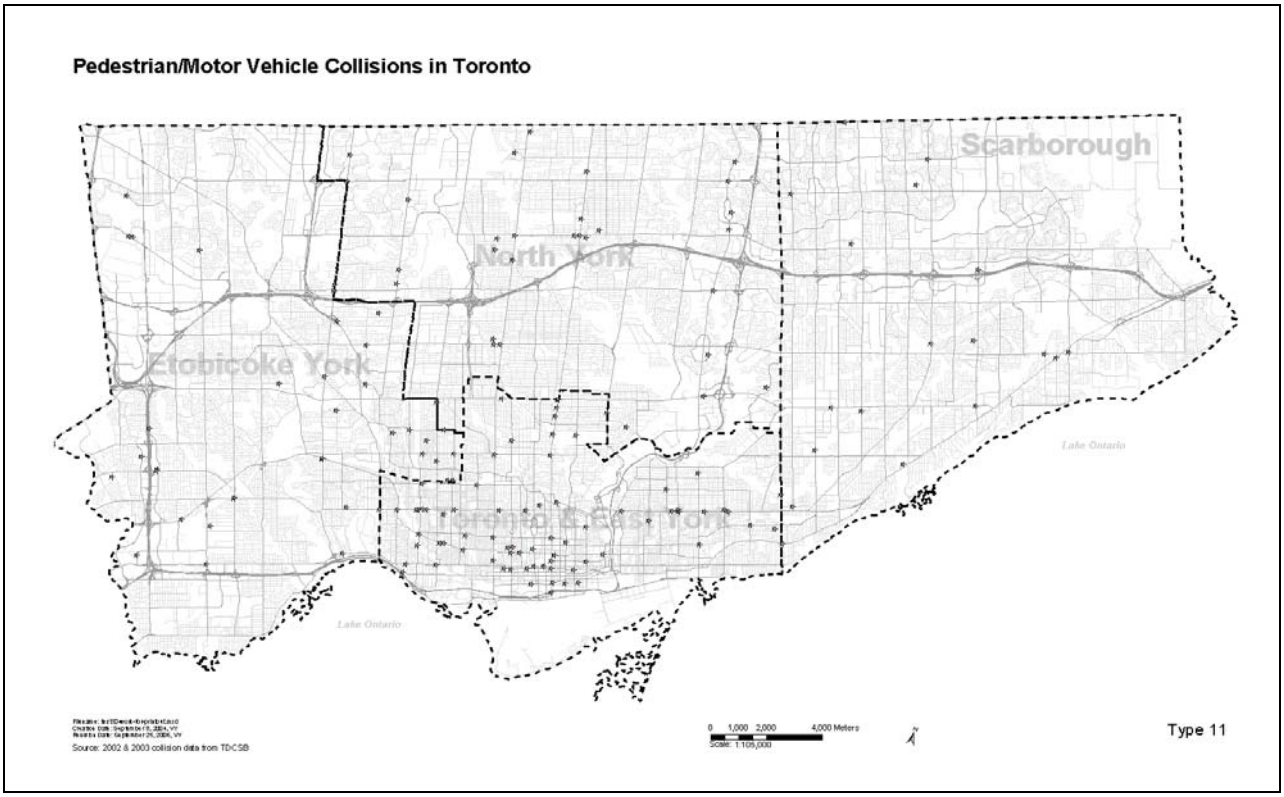
Temporal Pattern – Day of Week:



Temporal Pattern – Month of Year:



Geographic Distribution:



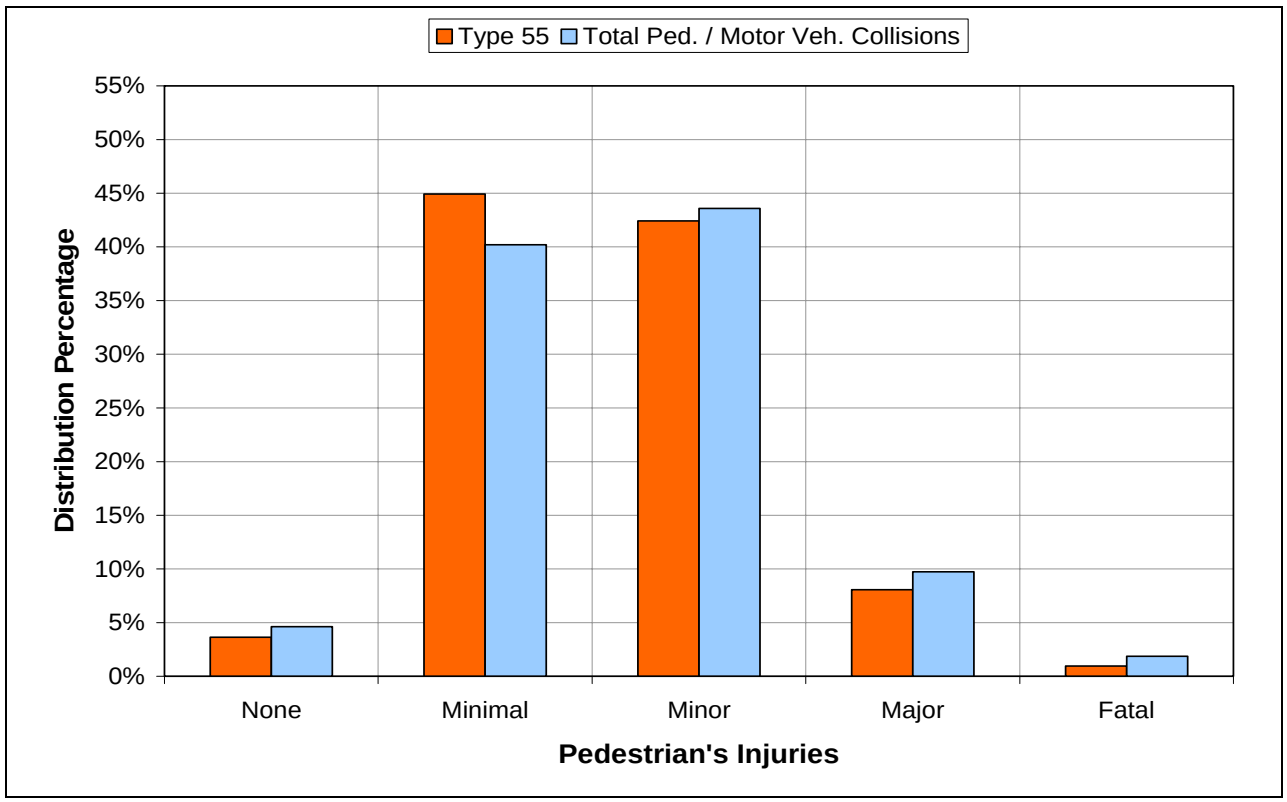
55. Pedestrian hit in parking lot

Description: A pedestrian and a vehicle collided in a parking lot (most parking lots are private property).

Frequency:

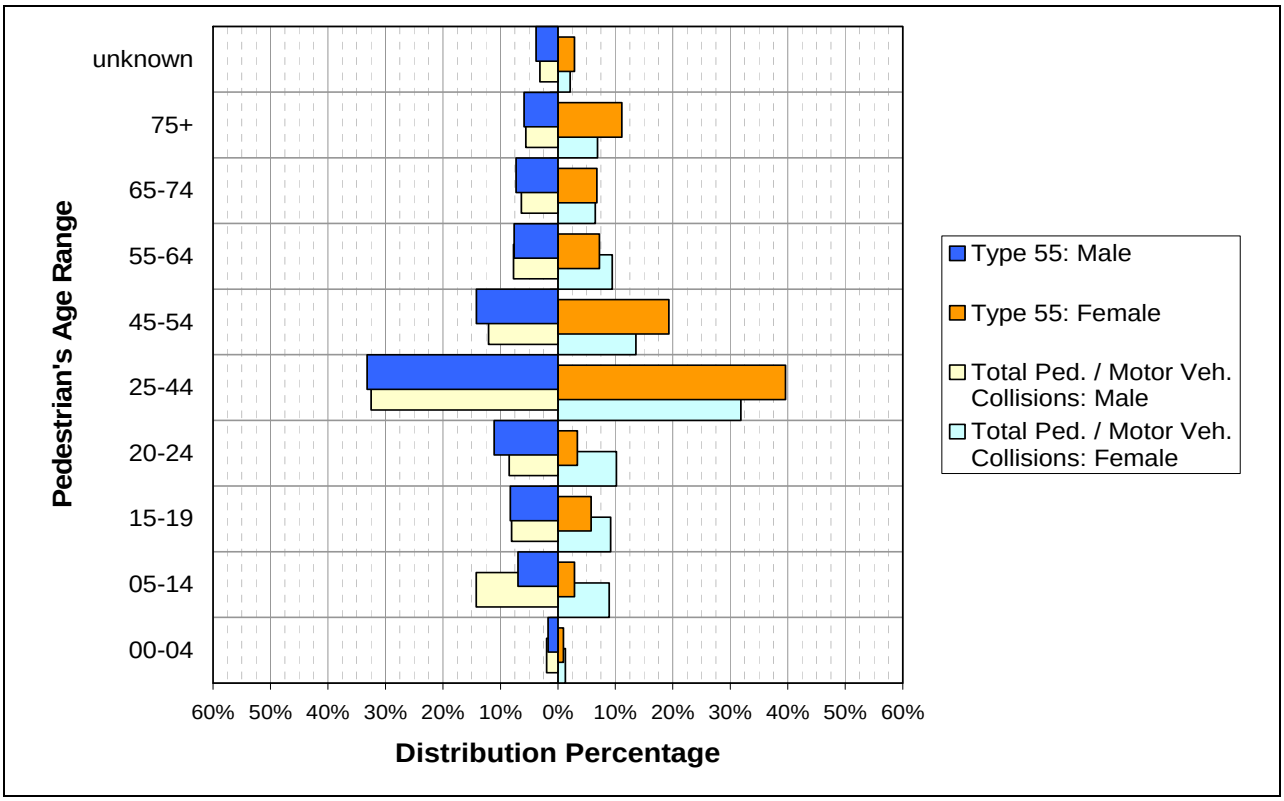
508 of 4,557 collisions | 11% of all collisions | Rank #4

Pedestrian's Injury:

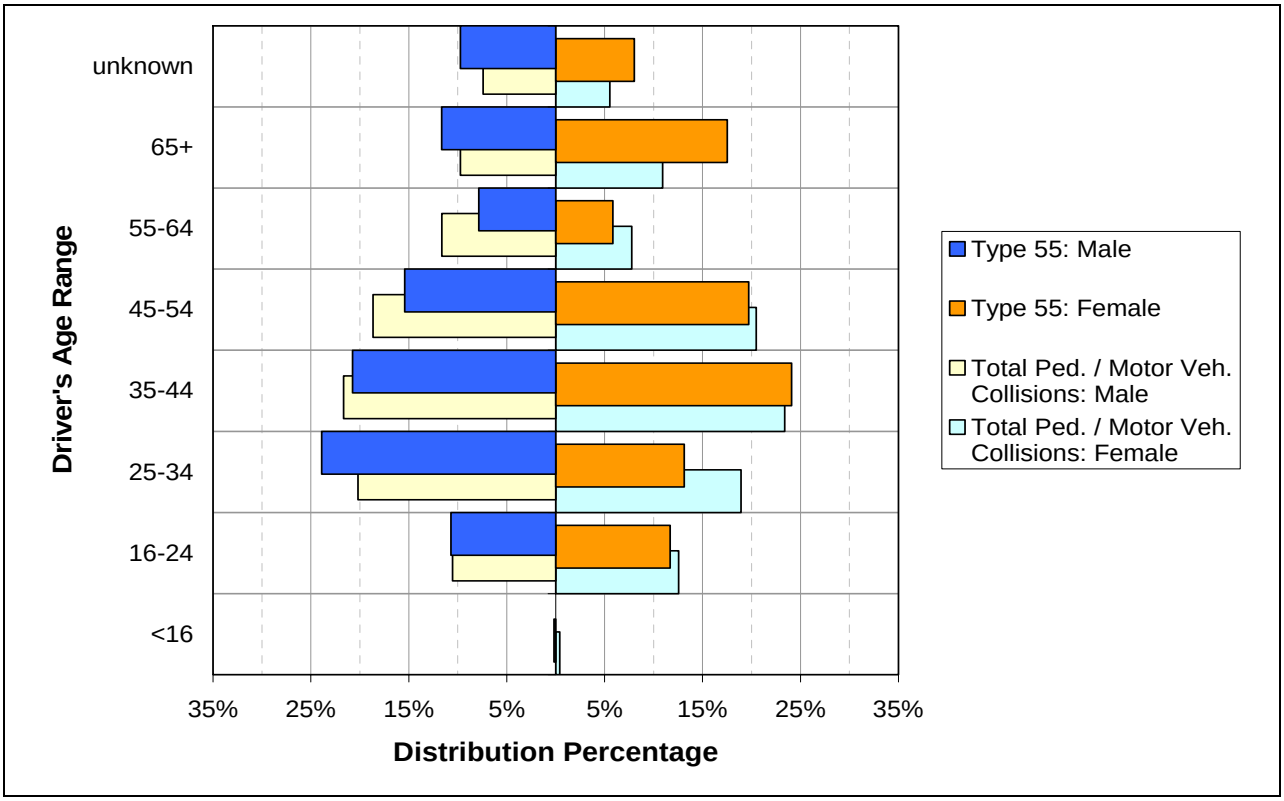


Type 55	4%	45%	42%	8%	1%
Total	5%	40%	44%	10%	2%

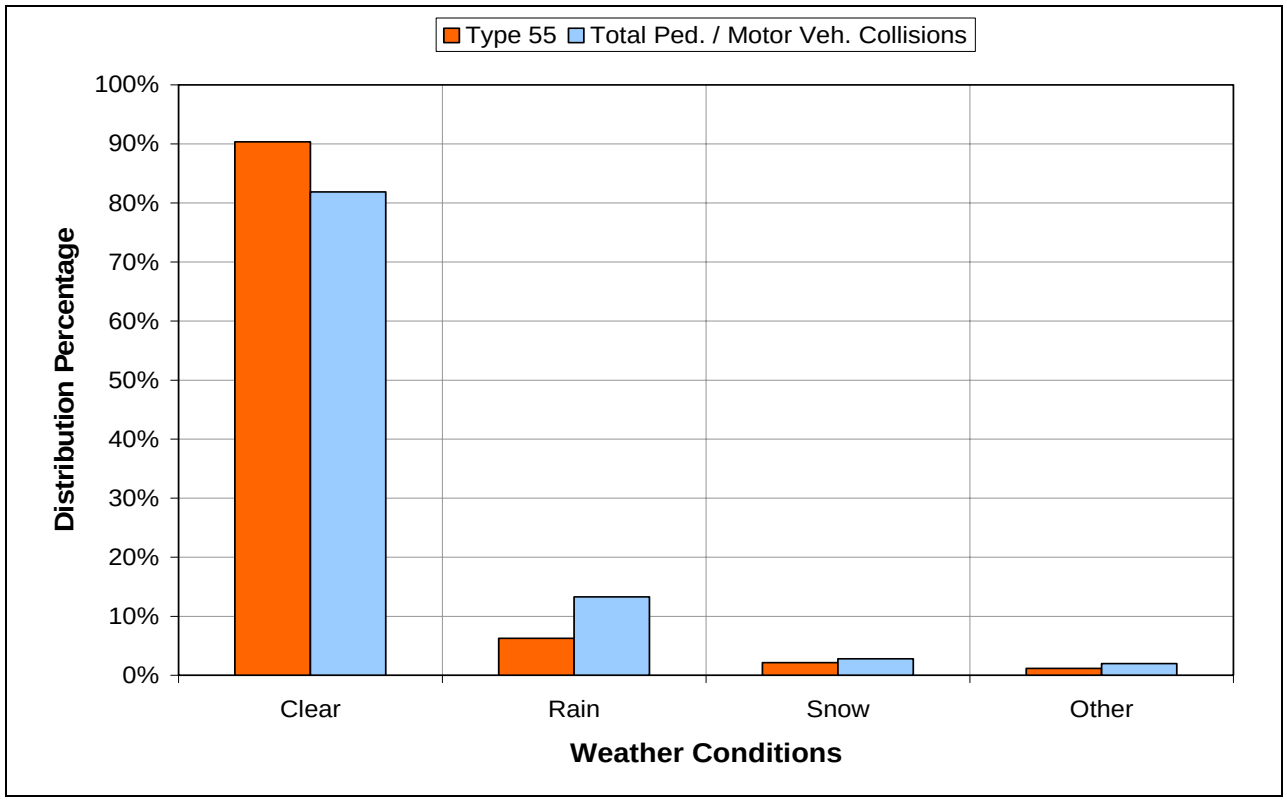
Pedestrian's Age Range:



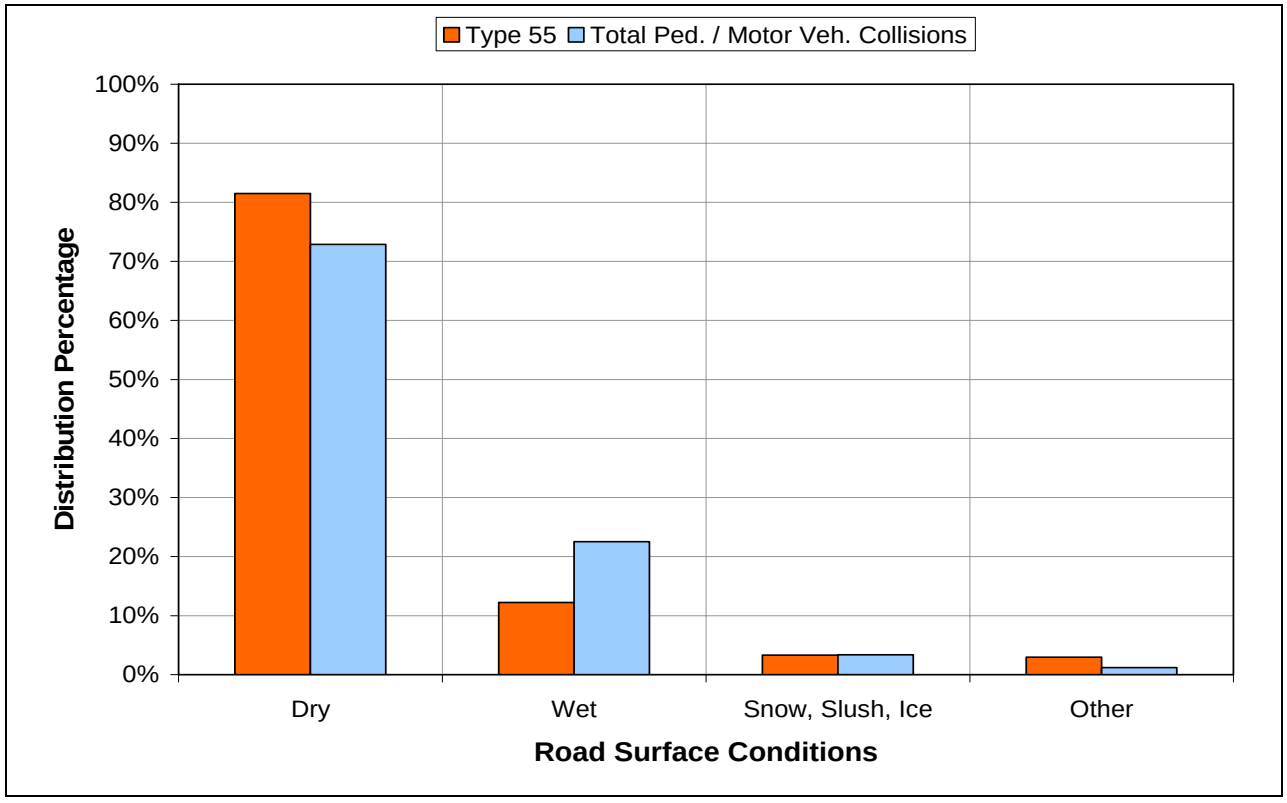
Driver's Age Range:



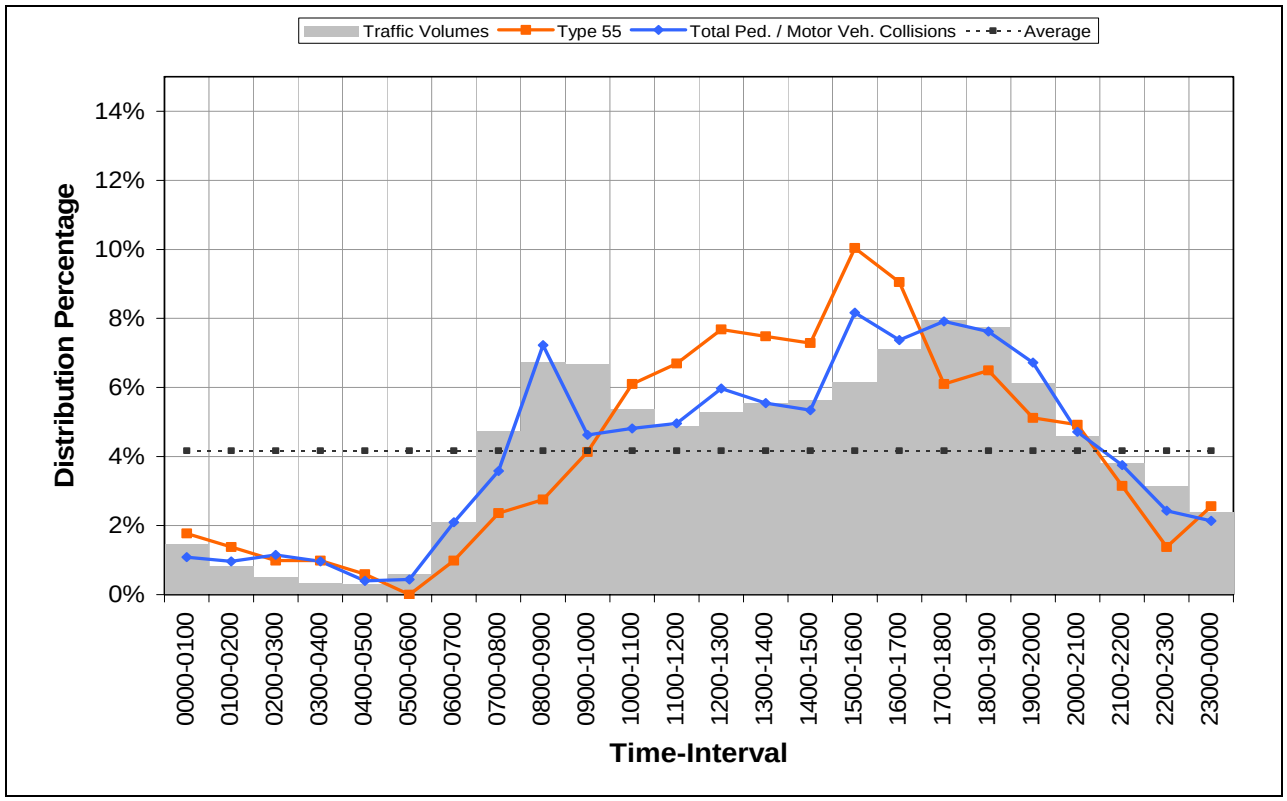
Weather Condition:



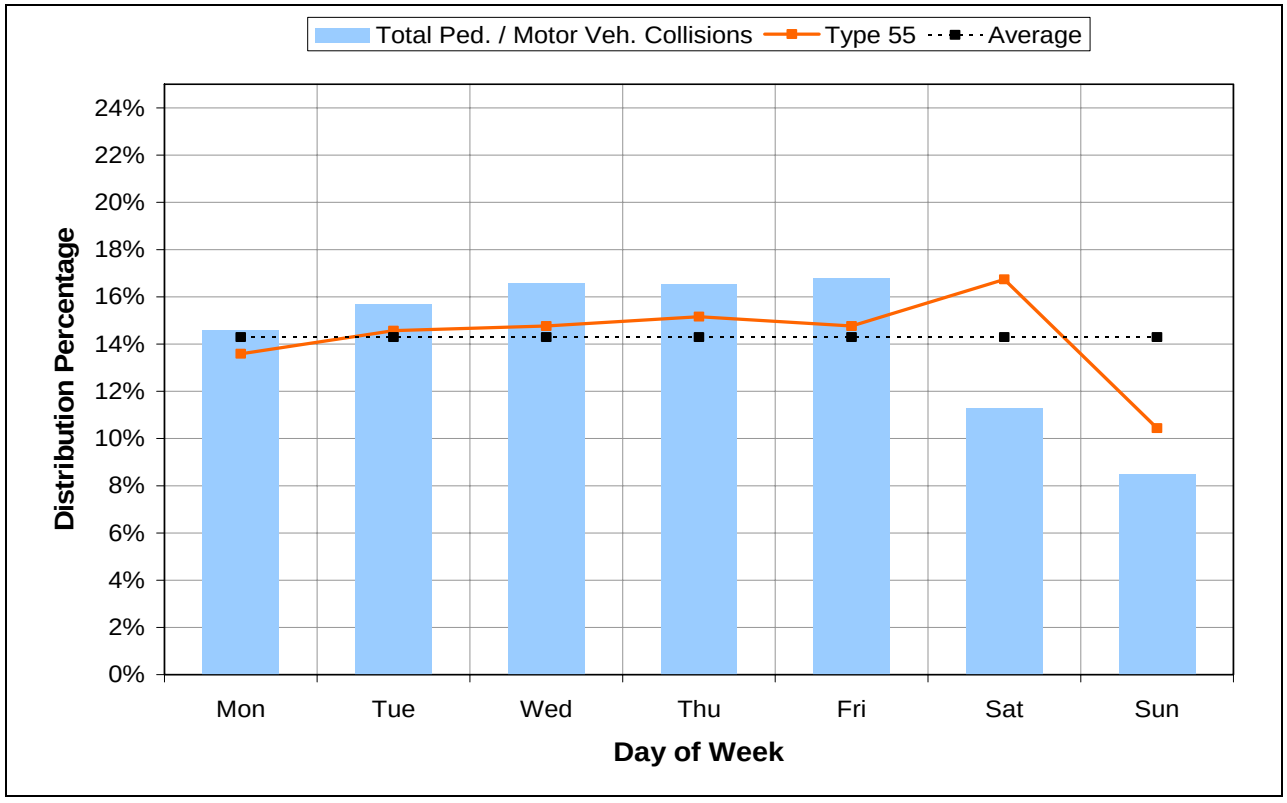
Road Surface Condition:



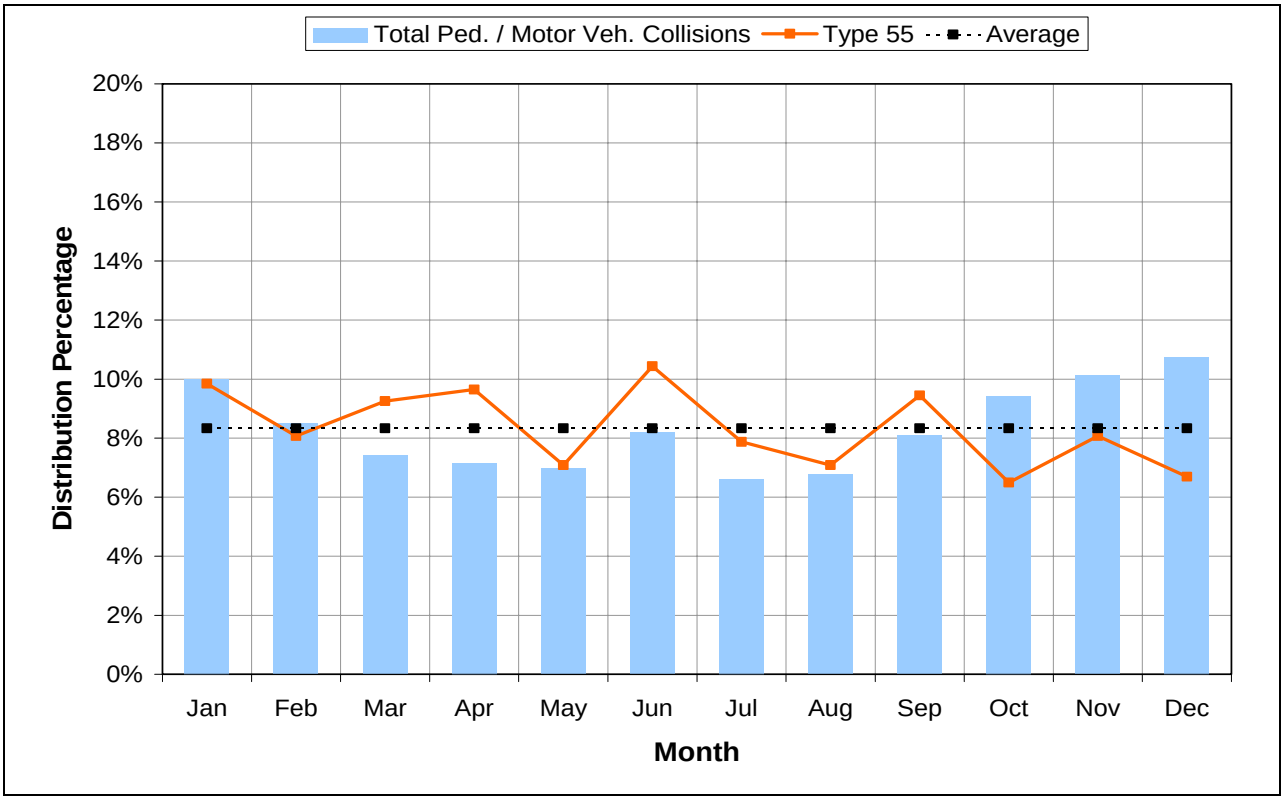
Temporal Pattern – Time of Day:



Temporal Pattern – Day of Week:



Temporal Pattern – Month of Year:



Geographic Distribution: