Transportation Advisory Board Report

Date: March 20, 2018

To: Transportation Advisory Board

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Subject: Utilizing Crash Data to Shape Mesa's Streets

Purpose

The purpose of this report is to present the process of crash data analysis within the City of Mesa and to demonstrate real-life cases of how the City of Mesa Transportation Department (Transportation Department) utilizes the respective data. Examples provided are based upon typical traffic studies policies and procedures.

Background

Note: City of Mesa and national statistics for 2017 vehicle crash data are not complete and may not be used in every example throughout this report.

Over 37,400 people lost their lives from motor vehicle crashes in 2016 within the United States, an increase of 5.6-percent from the previous year. Among these increases are pedestrian and bicyclist fatalities, which are at their highest since 1990. Data has become more crucial than ever before when investigating collisions, and new analysis tools are helping engineers design safer streets.

Collecting vehicle crash data allows agencies to attain a better understanding of traffic operational problems. Data helps identify risk factors, develop accurate improvement and corrective measures, and assess the effectiveness of safety programs. The Transportation Department typically acquires crash data through local police departments and analyzes it for use in multiple forms of traffic studies, implementing safety improvements, and structuring educational programs.

The crash data is analyzed for specific intersections, corridors, crash types, and for a holistic view of Mesa. Crash studies supplement a variety of traffic study requests that are received on a regular basis, such as requests for left turn arrows or traffic signals.

Crash statistics are also analyzed on an annual basis to reveal year-to-year trends and highlight potential areas of concern. Annual reviews include total City crash counts, crash type counts, intersection rankings, and a more in-depth look at fatal, serious injury, bicycle-related, and pedestrian-related crashes.

Discussion

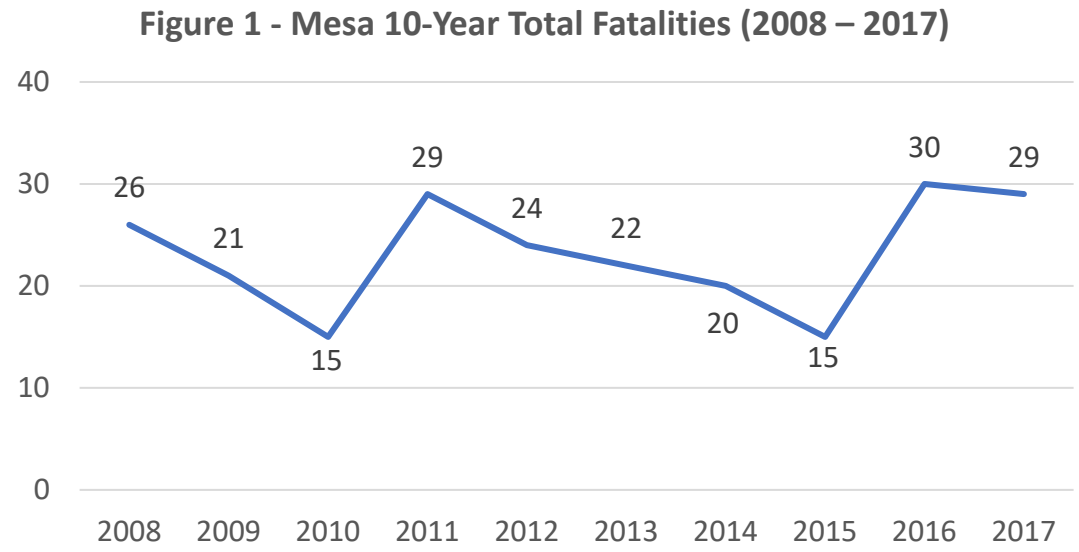
Typical crash analyses performed by Transportation Department staff can be summarized in two categories. These include annual analyses, summarized in annual reports with comparison to national trends and statistics, and case-by-case, in-depth crash reviews at specific intersections. A description of each is provided below.

Annual Analyses:

The City of Mesa breaks down motor vehicle crash data into the following four categories when developing annual statistics: fatal crashes, serious injury crashes, pedestrian crashes, and bicyclist crashes.

Fatal Crashes -

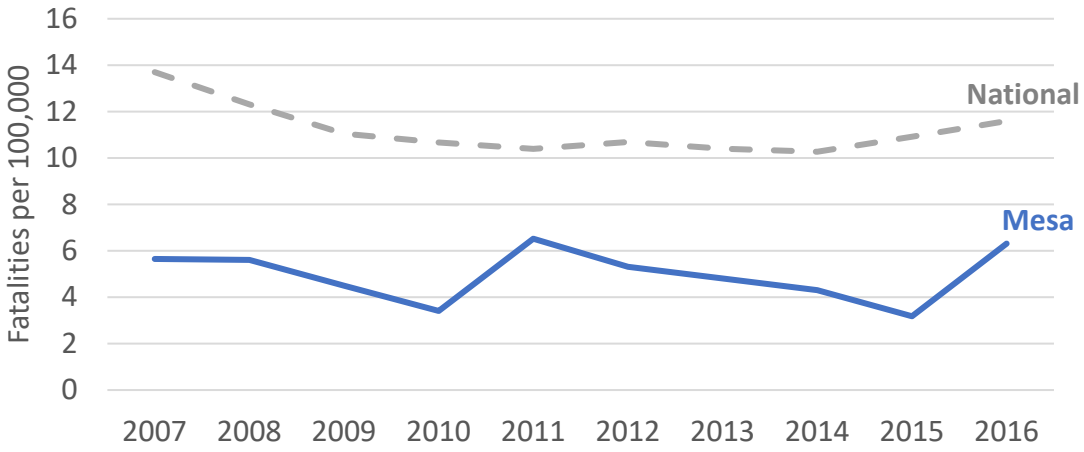
When analyzing fatalities caused by motor vehicle crashes, Mesa begins by viewing the trends over an interval. ***Figure 1*** represents a 10-year trend of Mesa traffic fatalities from 2008 to 2017.



Each fatal crash is thoroughly examined to determine the causes and contributing factors including impairment, time of day, and location. However, fatal crashes within

Mesa may vary significantly from year to year, so an analysis of fatalities by population is compared to national trends as shown in ***Figure 2***.

Figure 2 - Fatal Crashes Per 100,000 Population: Mesa vs. National

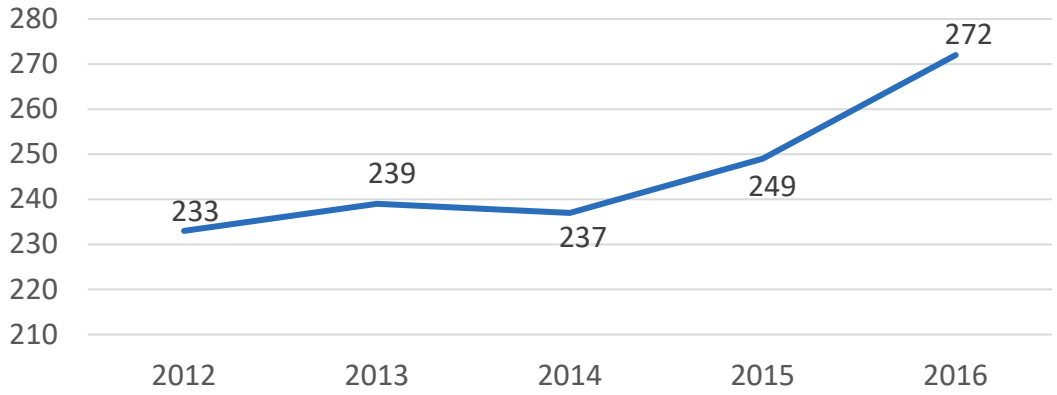


Mesa's trend for vehicle fatalities has mostly followed the national average over the past 10 years. The national fatality rate fell during the U.S. recession and continued to fall until 2012. Since then, motor vehicle fatalities have risen as an increasing number of drivers, pedestrians, and bicyclists have returned to the road. Mesa's crash history reflects these trends at a lower magnitude as the City remains under the national average.

Serious Injury Crashes -

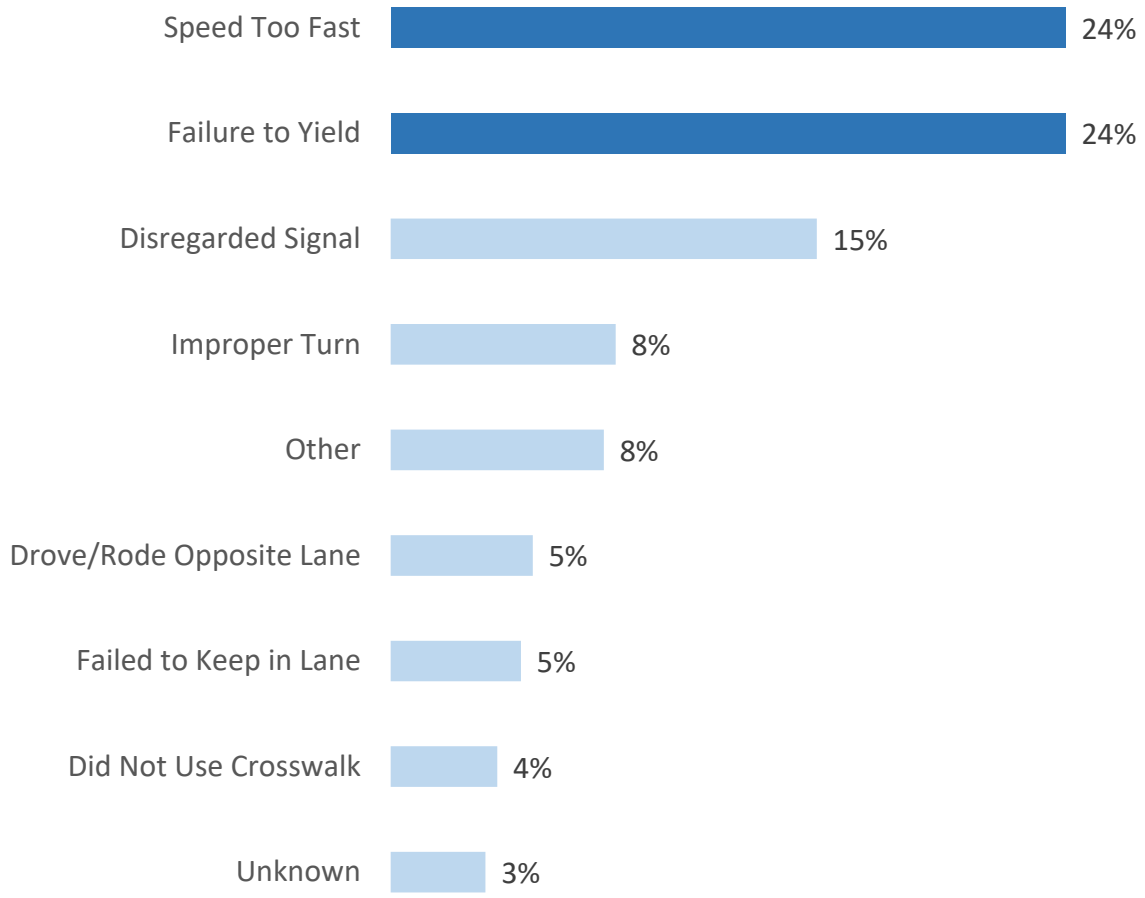
In addition to reviewing motor vehicle fatalities, the Transportation Department analyzes the trends of serious injury crashes throughout the City. Like fatalities, the analysis will begin with a general overview of motor vehicle serious injuries, as shown in ***Figure 3.*** However, unlike fatal crashes, which may be infrequent or isolated, serious injury crashes provide a larger sample size that allow us to identify patterns in driver behaviors. This gives Mesa the opportunity to determine possible countermeasures to remedy identifiable trends.

Figure 3 - Mesa 5-Year Motor Vehicle Serious Injury Crashes (2012 – 2016)



With over ten-times the volume of fatal crashes, more accurate data may be extracted, which leads to more informed decisions. Higher numbers will generally not fluctuate greatly over a long period of time, so any significant rise in crashes should be noted. Mesa experienced a large increase in crashes of all types in 2016, which prompted a thorough investigation of collision types and violations. ***Figure 4*** below provides an example of vehicle violations that led to a serious injury collision using serious injury crash data. As shown, nearly half of all serious injury crashes in 2016 were recorded with cited violations of driving too fast for road conditions or failing to yield to oncoming or conflicting traffic.

Figure 4 - Mesa 2016 Serious Injury Crashes – Cited Violations



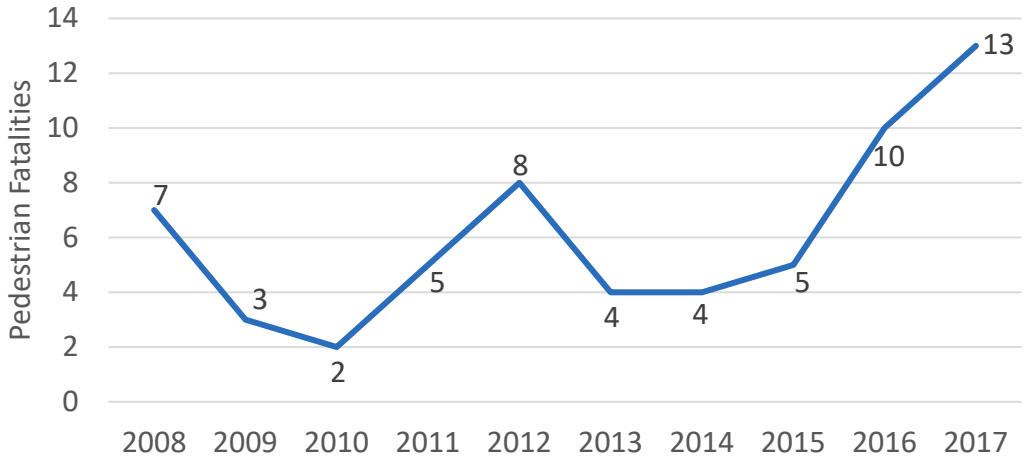
Using multiple sets of data like this, we can better connect the dots to understanding the causes of common motor vehicle crashes that result in serious injuries.

While identifying the crash types and violations is important, it is also essential to define the human behaviors that resulted in a collision. This is often the case in bicycle and pedestrian crashes, where inattentive or negligent behaviors may lead to dangerous consequences. Understanding driver and non-driver behaviors provide windows for creative thinking when designing streets.

Pedestrian Crashes -

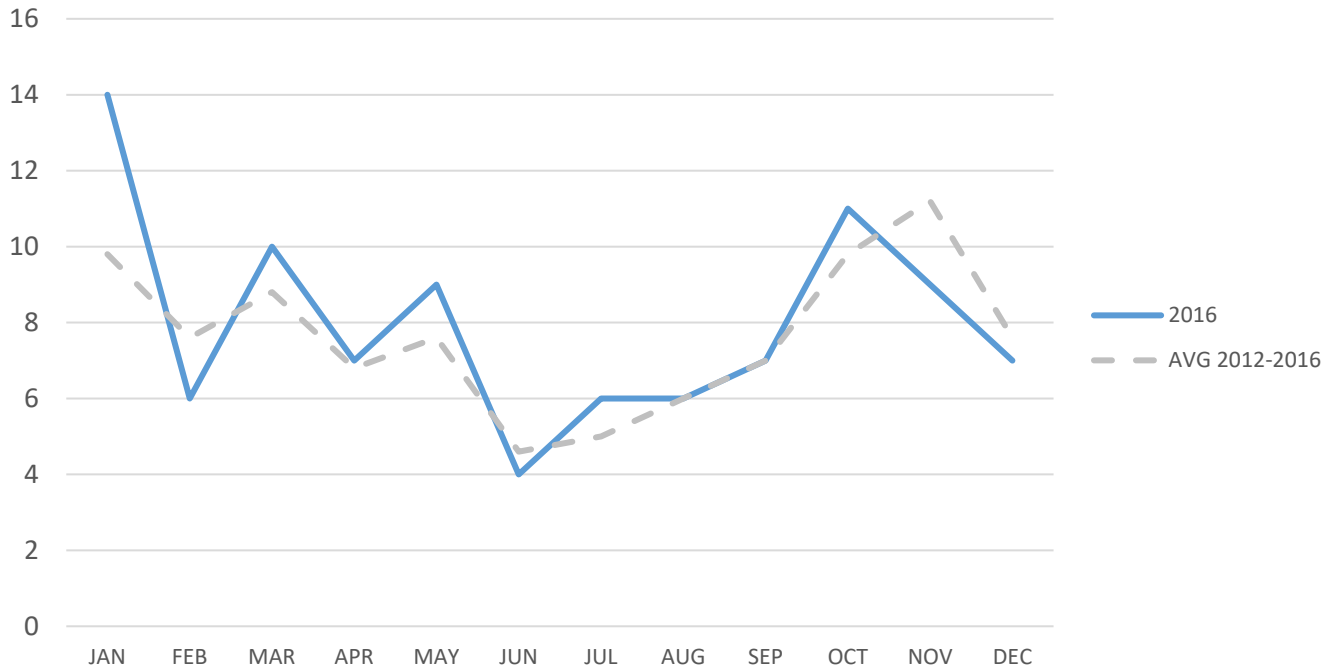
The City of Mesa has been experiencing an upward trend when looking at the number of pedestrian fatalities. ***Figure 5*** shows a 10-year view which illustrates the year-to-year irregularities, but nonetheless, an overall upward trend.

Figure 5 - Mesa 10-Year Pedestrian Fatalities



Pedestrian-related crashes are analyzed on a more detailed level to recover specific trends such as common crash types and high crash months. See ***Figure 6*** which presents the number of pedestrian-related crashes per month for the single year of 2016 compared to the 5-year average of this very same statistic. This figure highlights an intuitive relationship between weather and pedestrian crashes. There is an identifiable rise in crashes during cooler-weather months and fall during the hot-weather months, which is when Mesa's pedestrian activity is expected to be higher and lower, respectively.

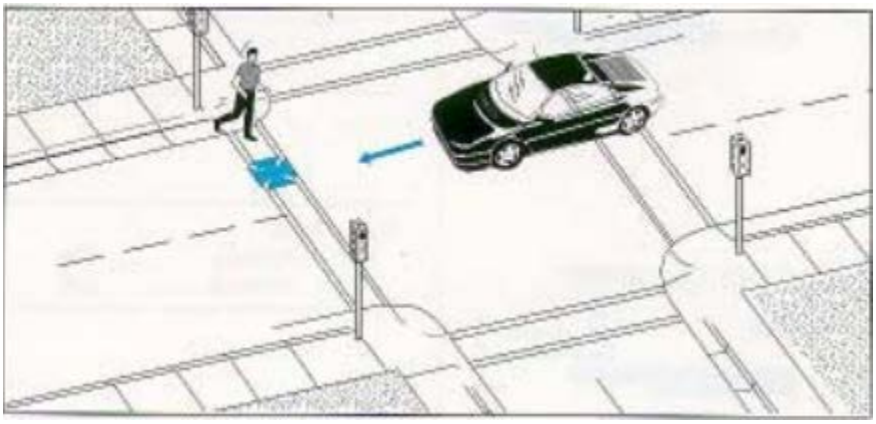
Figure 6 - Mesa 2016 Pedestrian Crashes by Month vs 5-Year Average



For 2016, the pedestrian-related crashes were analyzed to recover the specific motor vehicle and pedestrian movements prior to collision. This highlighted the most prominent circumstances that led to collisions and are summarized below:

Pedestrian Dash Out – Jaywalking or against traffic signal: 42.7%

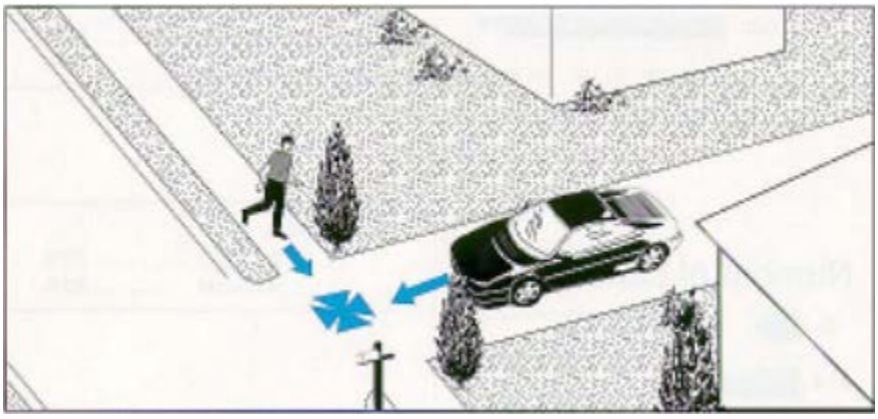
Figure 7-1



Source: "Intersection Dash." *Pedestrian Crash Types: a 1990's Informational Guide*

Motorist Right Turn – Perpendicular pedestrian travel (either direction): 32.3%

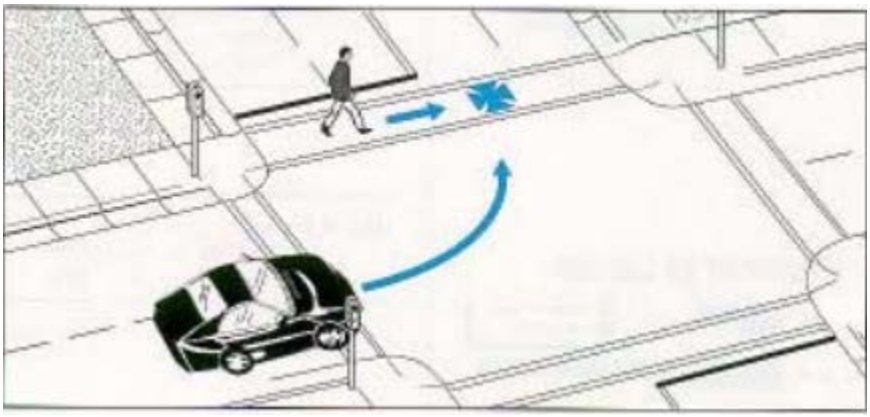
Figure 7-2



Source: "Not in Roadway." *Pedestrian Crash Types: a 1990's Informational Guide*

Motorist Left Turn – Parallel pedestrian travel (either direction): 17.7%

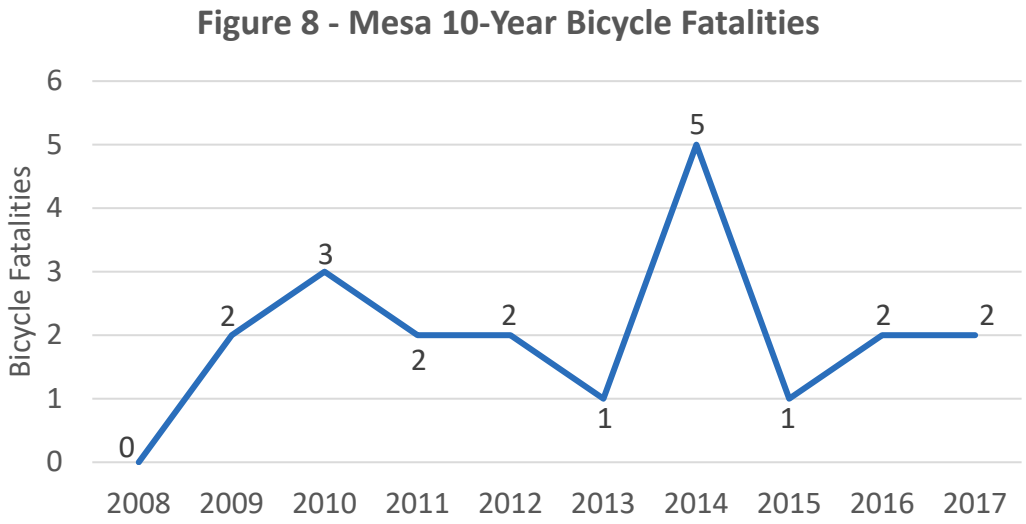
Figure 7-3



Source: "Vehicle Turn/Merge." *Pedestrian Crash Types: a 1990's Informational Guide*

Bicycle Crashes -

Like pedestrian-related fatalities, bicyclist-related fatalities show year-to-year irregularities when looking over a 10-year period. Other than a spike in 2014, Mesa has managed to keep the number of bicycle fatalities low. By population, the number of bicycle fatalities has been declining, yet the overall number of bicycle fatalities per year has remained nearly the same as shown in ***Figure 8***.



Again, a more detailed analysis of bicycle-related crashes recovers useful trends such as high crash months and the most common crash types for a given year. See ***Figure 9*** and the following summary of prominent crash circumstances involving bicyclists.

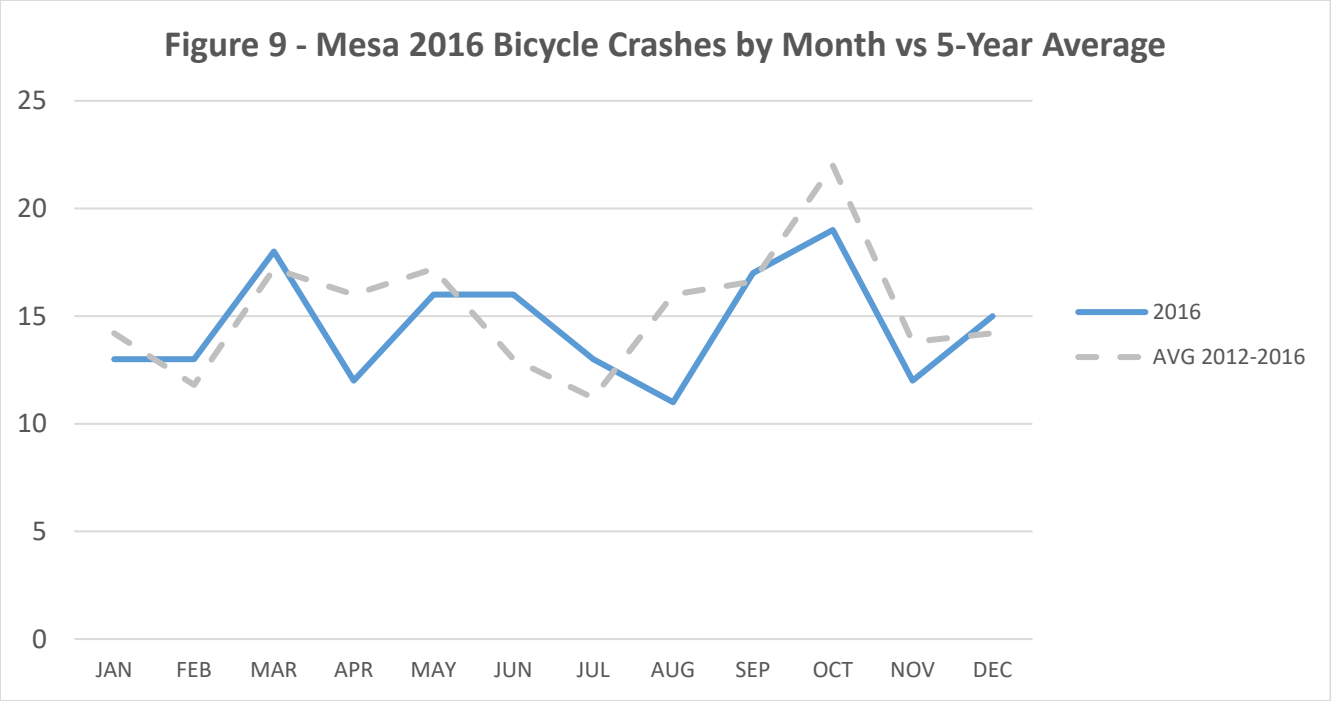
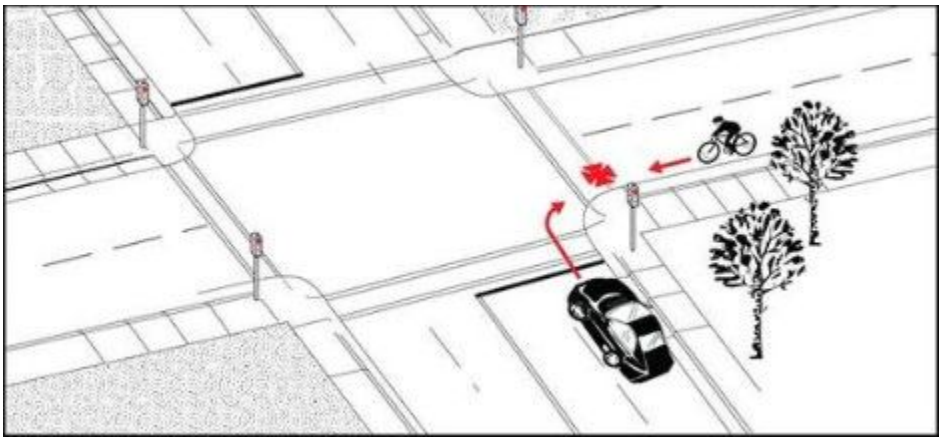


Figure 9 above shows a trend like ***Figure 6*** with an identifiable peak in bicyclist-related crashes occurring in the Spring and Fall months. However, the rises and falls throughout the entire calendar year are at a lesser magnitude showing that bicyclist activity and crashes in Mesa are more consistent year-round when compared to pedestrians.

Like pedestrian crashes, the bicycle-related collisions were analyzed to determine the specific motor vehicle and bicyclist's movements prior to collision. This provided an understanding of the behaviors that led to collisions and are summarized below:

Motorist Right Turn – bicycle travelling in perpendicular direction: 43.4%

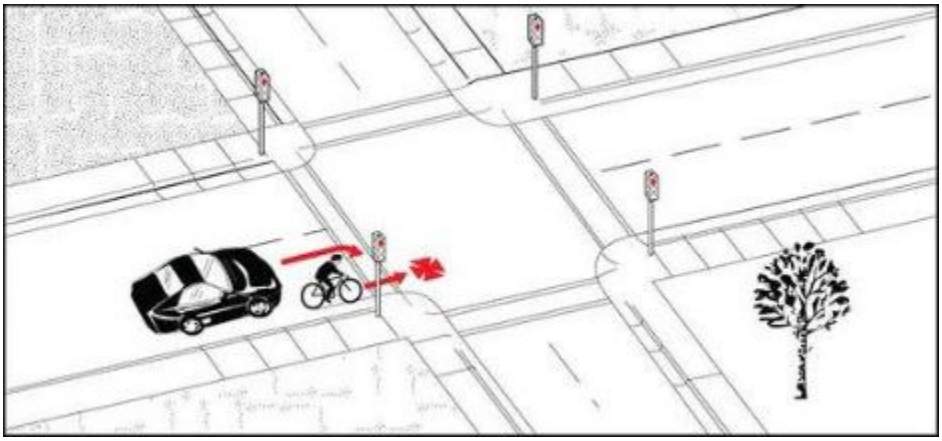
Figure 10-1



Source: "Motorist Right Turn-Perpendicular Bicycle." *Bicycle Crash Types: A 1990's Informational Guide*

Motorist Right Turn – bicycle travelling in the same direction: 10.9%

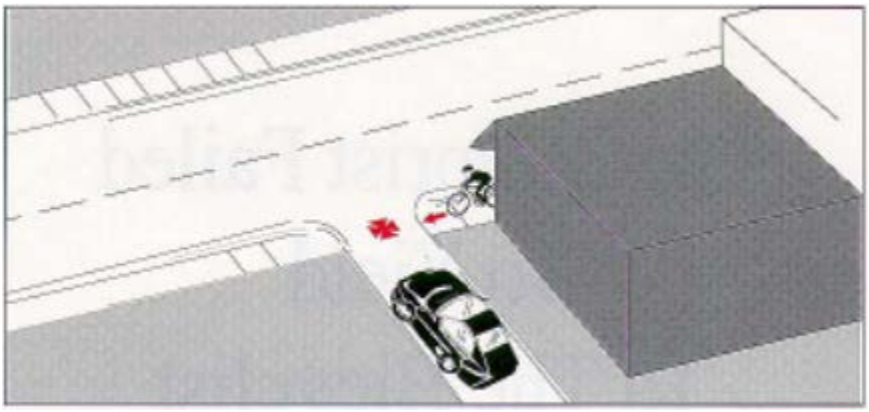
Figure 10-2



Source: "Motorist Right Turn." *Bicycle Crash Types: A 1990's Informational Guide*

Motorist Drive Out – driveway or alley: 10.9%

Figure 10-3



Source: "Drive Out at Midblock." *Bicycle Crash Types: A 1990's Informational Guide*

Specific Intersection Analyses:

An in-depth crash analysis is performed at specific intersections in Mesa when presented with certain circumstances. This can include intersections that are highly ranked for a specific crash type over an annual basis, intersections where a safety issue has been brought to staff's attention, or if a request has been submitted for an intersection. One example of a popular request is for the installation of a left turn arrow at a signalized intersection. The study to determine if a left turn arrow is warranted includes an in-depth look at the intersection's crash history with attention on all crashes that can be deemed correctable by the installation of a left turn arrow. If an identifiable crash trend is determined, that alone can warrant the installation of left turn arrows for a signalized intersection. For situations when a safety issue has been presented at a specific intersection, staff will perform a crash review to identify any trends regarding crash type, vehicle directions, time of day, and other details to determine if a countermeasure should be implemented. Depending on what trends can be identified, the possible countermeasures can include traffic signal timing or phasing modifications, street cross-section modifications, signing or pavement marking installation, lighting improvements, or pavement reconstruction. Such crash reviews are also done as part of the design process for any major roadway improvements project.

Next Steps

The crash studies and data analysis, as described above, allow staff to identify key areas where a safety improvement or initiative should be implemented. This can be

pursued in many ways, all which relate to the categories of engineering, education, or enforcement. Examples of each category are provided below.

Engineering:

Physical street improvements can be designed and constructed to remedy specific crash types or invoke safe travel for motor vehicles, bicyclists, and pedestrians. This can include the installation of raised median for motor vehicle access management, protected left turn phasing for signalized intersections, traditional bike lanes or separated bike lanes on arterial streets, or multi-use pathways that provide bicyclists and pedestrians with alternate, off-street routes. Recent examples in Mesa include the Fiesta District/Southern Avenue street improvements, Stadium Connector separated bike lane, and Rio Salado Pathway and Porter Park Pathway multi-use pathways.

Education:

Educational events, publications, public service announcements, and messages can be presented in numerous settings and can be catered to reach specific road users, demographics, or areas within the City of Mesa. Mesa's Bike and Pedestrian Team frequently holds public educational events that focus on teaching safety for pedestrians and bicyclists and issues publications such as ***Spoke Life MESA***. Also, public service announcements are released by Mesa's Transportation Public Information Officer through social media outlets to draw awareness. Lastly, Mesa uses variable message boards to convey traffic information, such as upcoming street closures, or initiatives, such as awareness for driving under the influence.

Enforcement:

The Mesa Police Department frequently puts out public service announcements to combat recognized trends regarding traffic violations and may choose to allocate more resources to particular locations. This may include locations where a specific traffic violation is commonly observed, such as left turns out of a private driveway where a left turn prohibition is in place because of its proximity to a major signalized intersection. Another example is the public service announcement that Mesa Police released regarding the dangers of crossing major arterial roadways mid-block, outside of a marked crosswalk. This announcement was released in response to the high number of fatal pedestrian-related crashes that occurred in the first half of 2017 involving pedestrians crossing outside of marked crosswalks.

Alternate Methods of Analysis

The Transportation Department is making strides to begin analyzing crashes proactively as opposed to the traditional method of taking a reactive approach. Instead of looking

purely at crashes that have already occurred at a subject site (historic crash data), we have started to apply analytical methods in analyzing crashes citywide. These methods are known as predictive analysis which includes a "focus on estimating the expected average number and severity of crashes at sites with similar geometric and operational characteristics" (*2010 Highway Safety Manual, 1st Edition, Volume 1, Chapter 1-2*). We are utilizing a software called ***SPF Tool*** which allows us to take a proactive approach towards analyzing intersections and locations in Mesa on a normalized level, given a site's characteristics. This can include a comparison of all four-leg arterial-arterial intersections within Mesa, normalized on entering traffic volumes and lane configurations. Such a comparison would produce an expected number of crashes for a subject site in this category and would reveal how that number relates to the actual number of crashes that were observed. It provides a basis for categorizing certain locations as higher risk without just focusing on one high crash count year that occurred in the past. This method, coupled with traditional analysis of historic crash data, is expected to provide a strong basis to prioritizing safety improvement projects within Mesa.