FY 2018

Traffic Safety and Operations Study
City of Belpre

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Wood-Washington-Wirt Interstate Planning Commission

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1.0 Introduction

1.1 Purpose and Need

The Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU), Moving Ahead for Progress in the 21st Century (MAP-21), and Fixing America's Surface Transportation (FAST) Act identify the need to preserve existing transportation systems to achieve maximum efficiency from existing facilities. As such and in accordance with the goals of the Wood • Washington • Wirt Interstate Planning Commission (WWW) has prepared this Traffic Safety and Operations Study (Study) for the City of Belpre (City), Ohio to serve as an update to previous Study conducted by WWW in FY2015. The City is located in the Mid-Ohio Valley Region along the Ohio River and is included in the transportation network of the WWW.

WWW continually studies the existing transportation system to ensure the demands created by the increasing population and traffic volumes are adequately addressed. Conjunctive to prior studies completed by the WWW in 2001, 2004, 2008, 2012, and 2015 this Study identifies high crash locations and supplements recommendations to improve performance, operational efficiency, and safety based on data from 2014-2016. Information was gathered from various sources including the Ohio Department of Transportation (ODOT), the Ohio Department of Public Safety, FHWA's Older Driver Highway Design Handbook, previous Studies, the Comprehensive Long Range Multimodal Transportation Plan Update 2040 (WWW, 2040), ITE's Transportation Planning Handbook, FHWA's Objectives and Strategies for Improving Safety at Unsignalized and Signalized Intersections, www.trafficcalming.org, as well as field observations conducted by WWW staff.

1.2 Project Background

Crash records for Washington County from 2014 to 2016 were downloaded from ODOT's GIS Crash Analysis Tool (GCAT) via their website. This crash data was

refined to determine which intersections within the City experienced ten or nearly 10 crashes during the study period. Those intersections were ranked and comprised the long list of intersections (long list), which became the foundation for the remainder of the Study. The long list is shown in Table 1-1.

Table 1-1: Long List of Intersections

Intersection	No. of Crashes
LEE STREET & WASHINGTON BOULEVARD	36
FARSON STREET & SR7	17
SR7 RAMPS NEAR THE MEMORIAL BRIDGE	16
STONE ROAD & WASHINGTON BOULEVARD	9
CLEMENT AVENUE & SR7	9
FOURTH STREET & MAIN STREET	9

The initial ranking shown in Table 1-1 was based on the first download of data and raw crash numbers. The initial data from GCAT was found to have some location errors. Therefore, the individual OH-1 forms were downloaded to ascertain the exact location of crashes. This examination resulted in the removal of some crashes from the assigned intersection and/or the reassignment of some crashes to another intersection.

The Long List of Intersections was compared against the TIP/STIP, and eligible CMAQ project lists to eliminate locations where projects are already programmed or in development for future funding. There were no projects included at these locations at the time the Study began. As a result, the intersections in the long list were finalized and included for further analysis. Typically, WWW only includes crash locations on the final list that had more than 10 crashes during the study period. Due to the brevity of the list, additional locations were included with only 9 crashes. The number of injuries, crash severity, and severity index were tabulated for each of the intersection on the final list and ranked according to each category (see Section 1.3). The Final List of Intersections and their ranking can be found in Table 1-2.

The Study methodology described above has been depicted in a process flow chart and provided in Figure 1-1. A location map of the final list of intersections has been provided in Figure 1-2.

Table 1-2: Final List of Intersections

Intersection	Number of Accidents		Number of Injuries/Fatalities		Severity Index		Crash Rate		TOTALS	Overall Rank	Previous Rank
	Value	Rank	Value	Rank	Value	Rank	Value	Rank			
LEE STREET & WASHINGTON BOULEVARD	36	1	13	1	0.361	4	2.412	1	7	1	1 (FY15) and 4 (FY12)
FARSON STREET & SR7	17	2	7	2	0.412	3	0.797	2	9	2	
STONE ROAD & WASHINGTON BOULEVARD	9	4	4	3	0.444	1	0.558	4	12	3	2 (FY15) and 5 (FY12)
CLEMENT AVENUE & SR7	9	5	2	4	0.222	5	0.484	5	19	4	3 (FY15) and 3 (FY12)
FOURTH STREET & MAIN STREET	9	6	1	5	0.111	6	0.796	3	20	5	
SR7 RAMPS NEAR THE MEMORIAL BRIDGE	16	3	7	2	0.438	2	0.380	6	13	N/A	

Figure 1-1: Belpre Traffic Safety and Operations Process Flow Chart

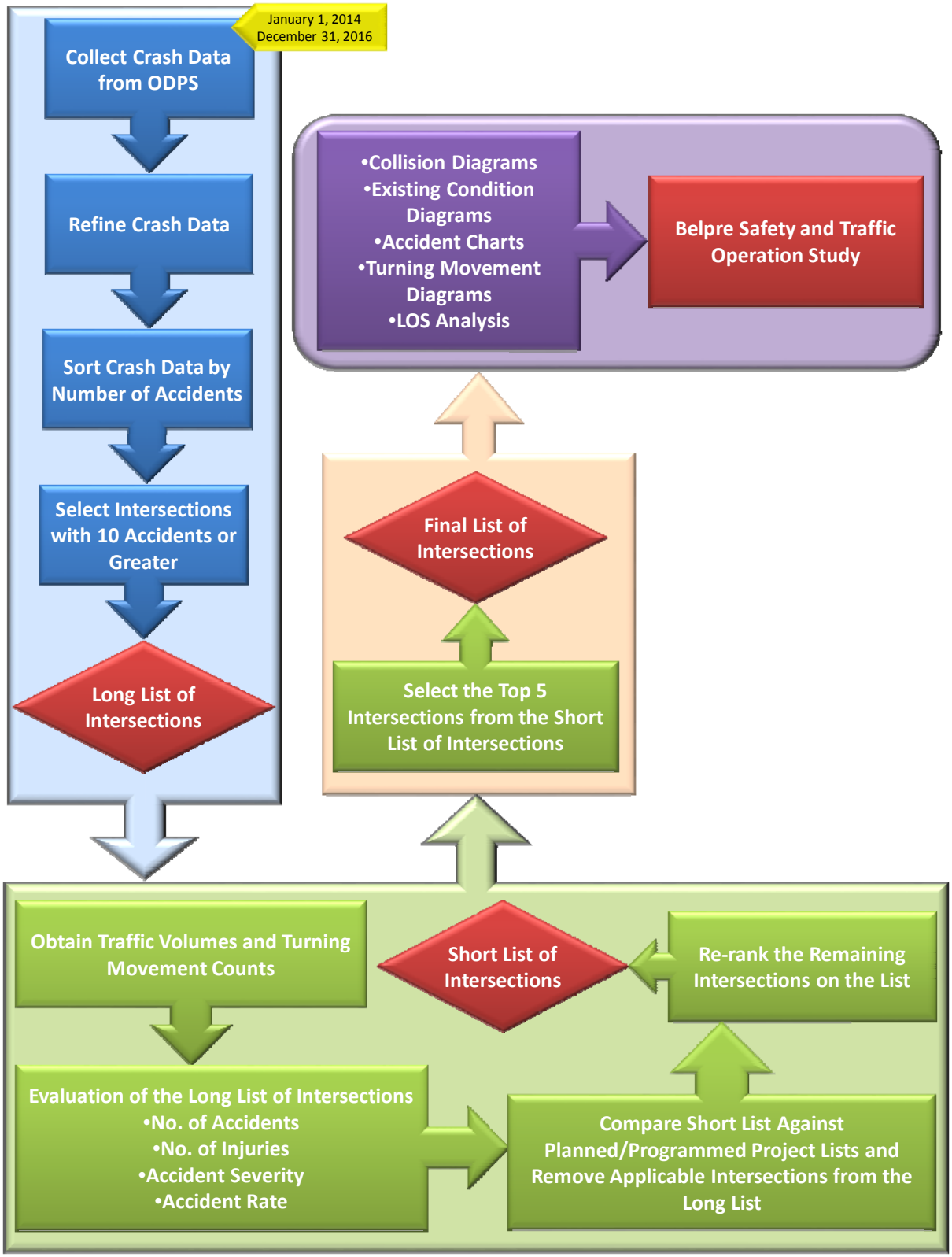
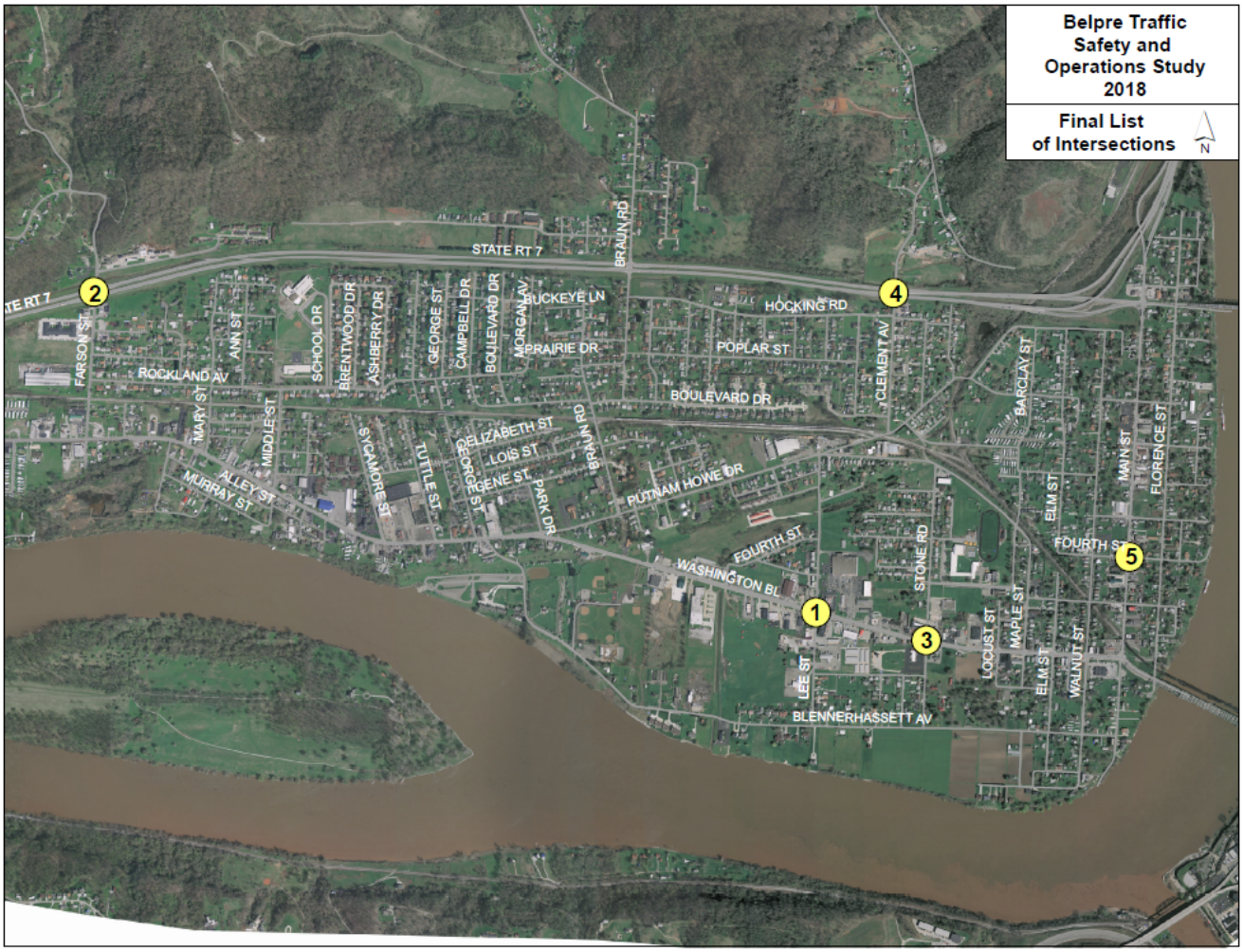


Figure 1-2: Location Map of the Final List of Intersections



1. Lee Street and Washington Boulevard
2. Farson Street and SR7
3. Stone Road and Washington Boulevard
4. Clement Avenue and SR7
5. Fourth Street and Main Street

1.3 Evaluation Criteria

Crash records, ADT volumes, turning movement counts, straight line diagrams, severity indices, crash rates, intersection surveys, and collision diagrams were used to complete this Study. The following sub-sections describe those elements.

1.3.1 Crash Data Analysis

Crash data from Ohio's Department of Transportation GIS Crash Analysis Tool was utilized to collect crash data and generate crash diagrams for the final list of intersections. Ohio's Department of Public Safety was used to collect and evaluate individual crash records. During the process of collecting crash data, discrepancies in crash locations and coding were noted. These inconsistencies were clarified by analyzing each crash on an individual basis to determine the appropriate signature for each crash. In some instances, the crash definition and/or fingerprint could not be determined nor did it fit into one of the available categories. These were included as part of the study analysis as "other" or "unknown" type crashes.

1.3.2 Traffic Volumes

Average daily traffic (ADT) for the long list of intersections was established based on turning movement counts collected in the field by WWW staff. ADT counts and peak hour turning movement counts were required for the detailed analysis of the intersections. Therefore, traffic counts were taken during the morning peak hours (7:00 AM to 9:00 AM) at each location. These counts were multiplied by four to obtain an 8-hour count, which was then adjusted using 24-hour and seasonal factors to estimate ADT. Crash rates are discussed in Section 1.3.2.

ADT counts were utilized to calculate crash rates, generate vehicle turning movement diagrams, and to run the Highway Capacity Software (HCS) model for the final list of intersections. Vehicle turning movement diagrams have been provided in this report for the final list of intersections and display the ADT volume of through, left turn, and right turn traffic for all intersection approaches.

1.3.3 Crash Rate

The crash rate establishes the number of crashes per million vehicles that pass through a location. It is important because it allows a comparison between spot locations regardless of size and volume. Crash rates were calculated using the following formula:

Crash rate = $[(T)(10^6)] \div [(ADT)(n)(365)]$

where, T = the total number of crashes for the study period

ADT = the average daily traffic volume (vehicles per day)

n = the number of years studied

365 = the conversion from years to days.

Crash rates for the short list and final list were ranked from highest to lowest.

1.3.4 Severity Index

Crash severity is a contrast of the number of injuries at an intersection and the total number of crashes at that same intersection. Severity indices were calculated for the short list and final list, which were ranked from highest to lowest.

1.3.5 Ranking Process

Having determined the number of crashes, number of injuries, crash rates, and severity indices for the final list, an overall rank was established. The rank value for each measure was totaled. The totals were arranged in order from lowest to highest to determine the priority ranking. Other qualitative considerations may have been used as decisive factors in the prioritization of improvement locations. Therefore, the final ranking may have been modified by WWW staff based on the physical conditions, constraints, planned and programmed improvements, and the needs of an intersection.

1.3.6 Level of Service

Level of Service (LOS) is a qualitative measure describing the operational conditions within a traffic stream and it is generally described in terms of travel speed, travel time, freedom to maneuver, traffic interruptions, and driver comfort, convenience, and safety. Specifically, LOS criteria for unsignalized and signalized intersections are stated in terms

of the average stopped delay per vehicle. For this study area, LOS C and above are acceptable values for intersections. LOS was calculated for the final list of intersections and can be found for each intersection in the following sections of this report.

WWW operations and safety studies typically use Highway Capacity Software (HCS) to calculate LOS. The *Highway Capacity Manual* recommends, when possible, using field observations to estimate LOS for unsignalized intersections and to verify conditions on signalized intersections.

LOS can be described in the following manner according to the *Policy on Geometric Design of Highways and Streets* describes the general operating conditions for each LOS in the following manner:

LOS A – Free flow of traffic, with low volumes and high speeds.
LOS B – Reasonably free flow of traffic, but speeds beginning to be restricted by traffic conditions
LOS C – Traffic is still in the stable flow zone but most drivers are restricted in freedom to select their own speed.
LOS D – Traffic is approaching unstable flow and drivers have little freedom to maneuver.
LOS E – There is unstable flow. There may be short traffic stoppages.
LOS F – Unstable flow. Stop and go traffic.

1.4 Study Summary

Field observations, field surveys, and crash histories were utilized to determine the possible cause of crashes at each of the locations on the final list of intersections. Each intersection has a distinct set of parameters and characteristics that are relative to the type and number of crashes occurring at that location.

As of the publication of this Study, improvements were already programmed at several of the intersections included in the final list of intersections. Additional corridor wide

improvements such as traffic calming, access management strategies, and signal optimizations that included intersection awareness enhancements should be employed throughout the City to enhance safety, capacity, and efficiency.

Washington Boulevard is a minor arterial that serves as a major thoroughfare and destination for the City and community. Washington Boulevard acts as a business corridor and is designated as US Business Route 50. There are approximately 60 access points along Washington Boulevard from the Parkersburg-Belpre Bridge to 4th Street. There are approximately 130 access points from 4th Street and Washington Boulevard to Drag Strip Road and Washington Boulevard. In general, this is a contributing factor in the crash history along the corridor. As an overall safety consideration there are several "corridor" related safety issues to consider for improvement, as well as, the individually ranked intersections discussed further in the later Sections of this report.

Younger drivers were a factor of consideration during the examination of crash data. As indicated by the collision diagrams, crashes involving younger drivers were prevalent at some intersections and countermeasures to address education and enforcement in concert with enforcement tactics should be considered. The number of older drivers was not identified in the collision diagrams, but was noted by WWW staff when looking at the crash data. WWW recommends referencing FHWA's Older Driver Highway Design Manual when safety improvements are made at the subject intersections.

Along Washington Boulevard, motorists tend to swerve in and out of travel lanes to avoid the delay caused by turning vehicles. This generates several conflicts. Vehicles switching lanes to avoid the delay of a turning vehicle can sideswipe an unsuspecting vehicle traveling in the adjacent travel lane. An additional conflict can be created when a motorist behind a vehicle toggling travel lanes is suddenly aware of a stopped vehicle in the path of motion when the sight distance is opened up by the vehicle switching lanes. In concert with accelerated speeds, this instance can have severe repercussions in a rear end crash.

ADA (Americans with Disabilities Act) accessibility guidelines should be incorporated into intersection improvements at the planning stage of project development throughout the City. This should include a detailed survey of the existing pedestrian facilities, origin and destination studies, and pedestrian surveys. Any deficiencies found within the scope of a planned project should be addressed and improvements implemented through the design process. In some instances, this may involve expanding the project boundaries to incorporate pedestrian related improvements. Bicycle and pedestrian related improvements are discussed where applicable throughout the report sections.

Education and enforcement strategies should be developed with the police department to further encourage pedestrian and bicycle safety within and around the City.

While not examined with the same study methodology as the final list of intersections due to the expanse of the area, the SR7 ramps should be considered for future improvements. Specifically, the NB SR7 ramp on approach to the Memorial Toll Bridge and Main Street. This area has been included for discussion in the final section of this Study.

WWW has prepared this report to determine the intersections within the City of Belpre with traffic safety concerns for planning purposes. Further study may be required to determine whether or not additional countermeasures or improvements should be implemented.

The transportation planning process under MAP-21 identified requirements for transitioning to a performance and outcome based planning process. This strategic approach to decision making is based on the development and monitoring of performance based data to measure the outcome of investment decisions developed through the planning and programming process. These requirements were continued in FAST-Act with the establishment of national performance goals in the following seven areas:

- Safety – To achieve a significant reduction in traffic fatalities and serious injuries on all public roads.
- Infrastructure Condition – To maintain the highway infrastructure asset system in a state of good repair.
- Congestion Reduction – To achieve a significant reduction in congestion on the National Highway System.
- Freight Movement & Economic Vitality – To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.
- Environmental Sustainability – To enhance the performance of the transportation system while protecting and enhancing the natural environment.
- Reduce Project Delivery Delays – To reduce project costs, promote jobs and the economy, and expedite the movement of people and goods by accelerating project completion through eliminating delays in project development and delivery, including reducing regulatory burdens and improving agencies' work practices.
- System Reliability – To improve the efficiency of the surface transportation system.

This planning approach was developed to strengthen the accountability and transparency of the decision-making process, and to promote the most efficient use of federal transportation funds in meeting these national goals. This Study is intended to support this initiative and incentivize improvements to meet the national, state, and local goals.

The following Intersection Data Fact Sheets are from Ohio's Strategic Highway Safety Plan (2014-2019) and was obtained from their website for reference purposes.

EVERY MOVE YOU MAKE

TOWARD ZERO DEATHS

OHIO STRATEGIC HIGHWAY SAFETY PLAN

A Comprehensive Plan to Reduce Fatalities and Serious Injuries | 2014-2019

EVERY MOVE YOU MAKE TOWARD ZERO DEATHS

OHIO Strategic Highway Safety Plan

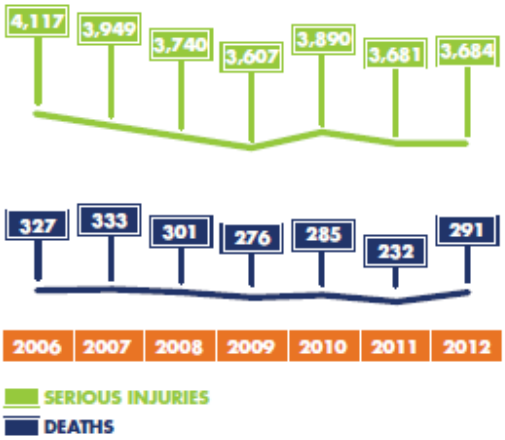
INTERSECTION DATA FACT SHEET

OVERVIEW OF INTERSECTION-RELATED CRASHES

Between 2006 and 2012, 2,045 people died and 26,668 people were seriously injured in intersection-related crashes.

Since Ohio's first SHSP was adopted in 2006, serious injuries declined by 11 percent and deaths decreased 12 percent.

These crashes represent about 26 percent of all traffic deaths and 37 percent of all serious injuries in Ohio each year. Intersections posed a risk to all road users - vehicle occupants, pedestrians and bicyclists, and motorcycle riders. The risks increase based on the size, complexity and speed of the intersecting roadways.



AT FAULT DRIVERS IN CRASHES

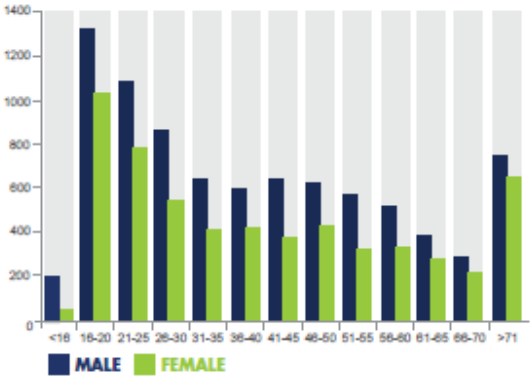
Male drivers were at fault in the majority of intersection related deaths and serious injuries.

Males accounted for 8,430 total deaths and serious injuries as compared to 5,738 for females.

Male drivers between the ages of 16-25 accounted for the highest number of deaths and serious injuries, but another spike occurred among men ages 26-30. A noticeable spike occurred among drivers over 71, which may be attributed to difficulty in judging gaps in traffic.

Note: all data from 2008-2012, except Overview section

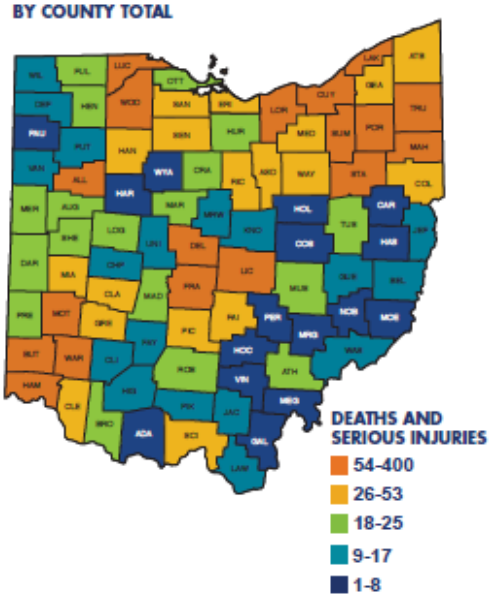
INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY DRIVER AGE AND GENDER



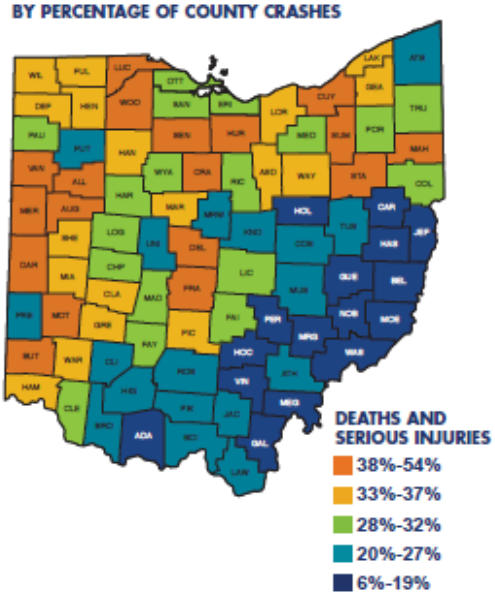
WHERE CRASHES OCCURRED

These maps rank Ohio counties by the number of deaths and serious injuries that occurred at intersections. Warm colors indicate more crashes relative to cool colors. **Most urbanized counties have a higher number of serious crashes at intersections. However, many rural counties have a higher percentage of serious injury crashes at intersections when compared to the total number of serious crashes occurring within the county each year.**

INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY COUNTY TOTAL

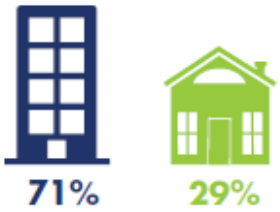


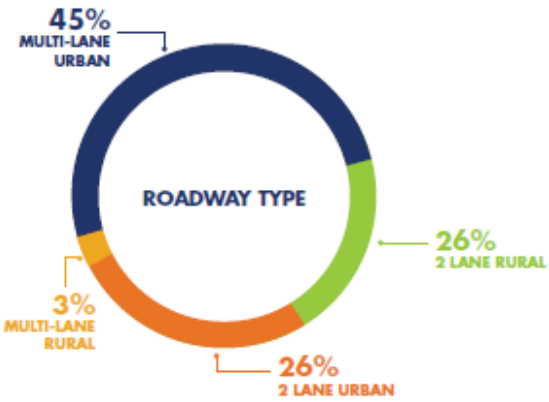
INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY PERCENTAGE OF COUNTY CRASHES



INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY ROADWAY TYPE

The number of intersection-related deaths and serious injuries on urban roads with multiple lanes is nearly double the amount on two-lane rural roads.



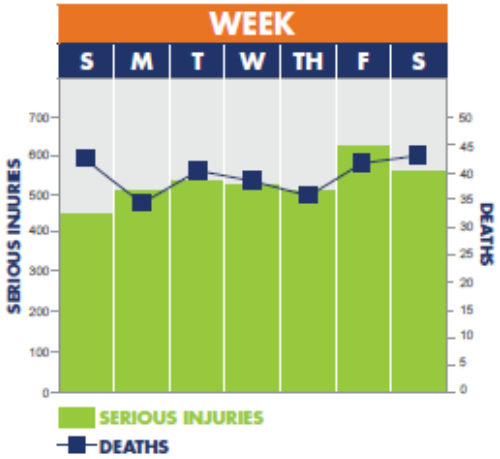


Note: all data from 2008-2012, except Overview section

WHEN CRASHES OCCURRED

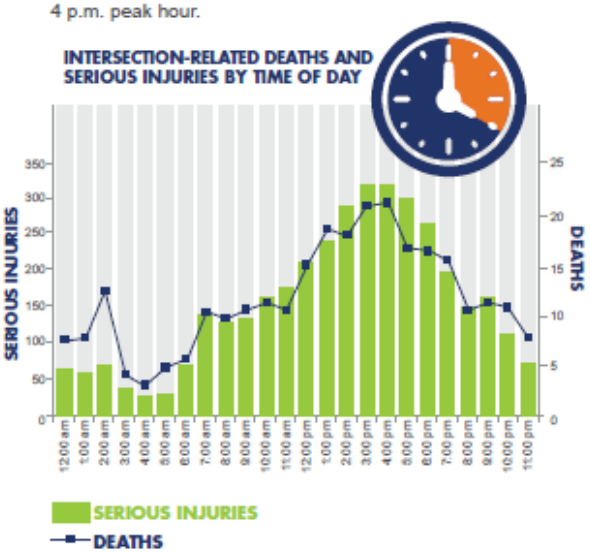
Intersection-related deaths and serious injuries were fairly evenly distributed throughout the week.

INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY DAY OF THE WEEK



Intersection crashes that resulted in a death and/ or serious injury peaked in the afternoon between 2-7 p.m. as a result of rush-hour traffic. An average of 321 serious injuries and 20 deaths occurred at the 4 p.m. peak hour.

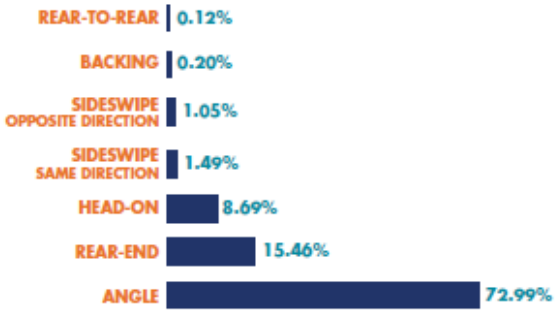
INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY TIME OF DAY



CONTRIBUTING FACTORS

The most significant cause of serious injuries and deaths at Ohio intersections involved angle crashes, which typically occurred when one vehicle failed to either stop or yield the right of way.

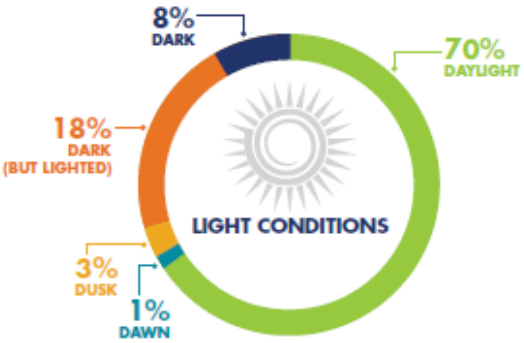
INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY COLLISION TYPE



Note: all data from 2008-2012, except Overview section

Lighting did not seem to have a significant effect on intersection-related crashes. Only 8 percent of deaths and serious injuries in intersection-related crashes occurred during dark conditions where there was no lighting.

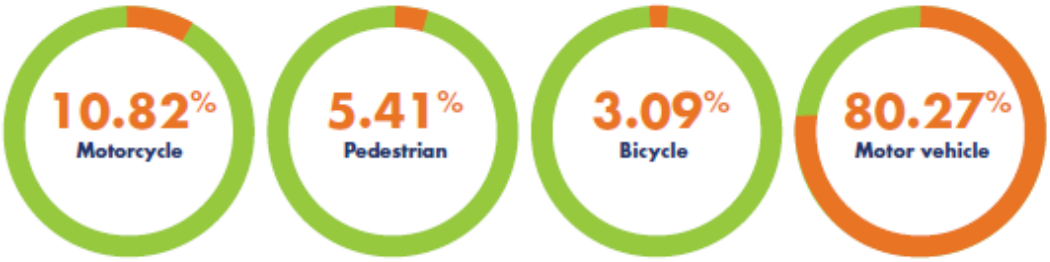
INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY LIGHT CONDITION



CONTRIBUTING FACTORS CONTINUED

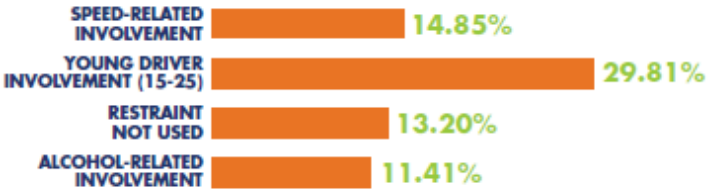
Collisions between two or more motor vehicles represented the highest number of deaths and serious injuries at intersections, with a total of 16,047, followed by motorcycle-involved crashes with 2,163.

INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY VEHICLE TYPE



Young drivers were, on average, disproportionately involved in serious injuries and deaths at Ohio intersections. This is likely caused by their lack of driving experience, which can lead them to make mistakes such as misjudging the speed of oncoming traffic when turning. Among drivers of all ages, speeding, not wearing a seat belt and driving under the influence of alcohol were also significant factors in intersection-related serious injuries and deaths.

INTERSECTION-RELATED DEATHS AND SERIOUS INJURIES BY RELATED SHSP EMPHASIS AREAS



AN AVERAGE OF 11 PEOPLE DIED OR WERE SERIOUSLY INJURED EACH DAY IN INTERSECTION CRASHES.

Note: all data from 2008-2012, except Overview section

EVERY MOVE YOU MAKE TOWARD ZERO DEATHS

OHIO Strategic Highway Safety Plan

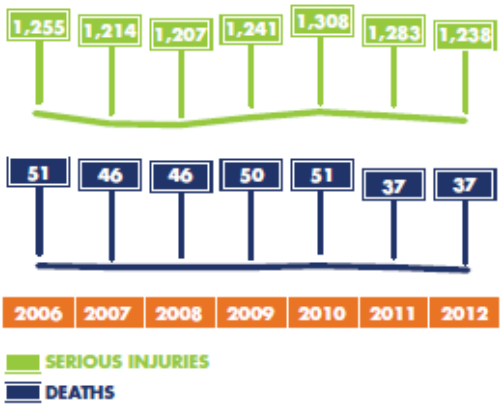
REAR END DATA FACT SHEET

OVERVIEW OF REAR END RELATED CRASHES

Between 2006 and 2012, 318 people died and 8,746 people were seriously injured in rear end crashes.

Since Ohio's first SHSP was adopted in 2006, fatalities have declined by 27 percent. Serious injuries fluctuated during the same time period, but declined 1 percent.

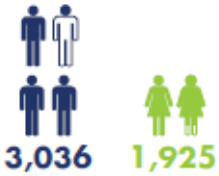
Rear end crashes account for about 4 percent of Ohio's fatalities and around 13 percent of serious injuries each year.



AT FAULT DRIVERS IN CRASHES

Data indicate that male drivers are more likely to be at fault in rear end crashes resulting in deaths or serious injuries.

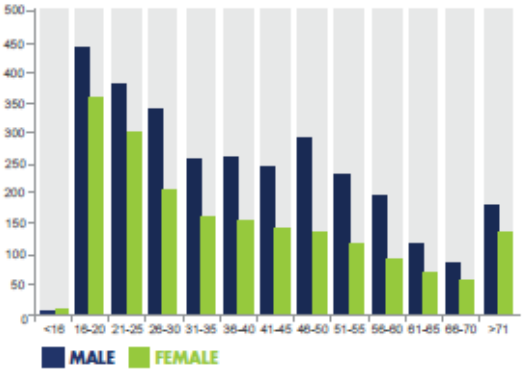
From 2008 to 2012, male drivers were at fault in 3,036 rear end related deaths and serious injuries versus 1,925 female drivers.



Male drivers between the ages of 16-30 accounted for the highest number of fatalities and serious injuries, with another spike among men ages 46-50.

Note: all data from 2008-2012, except Overview section

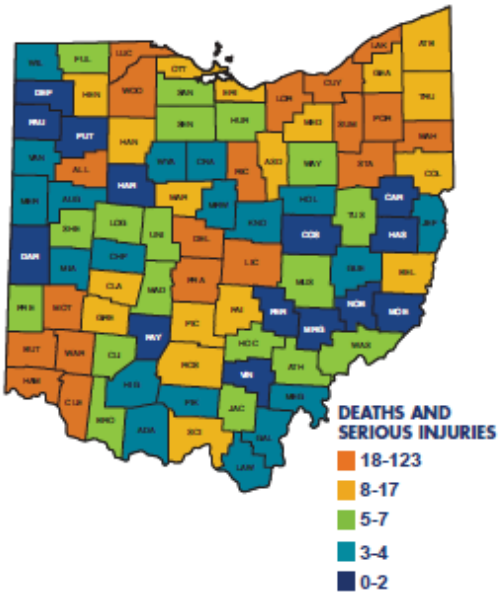
REAR END RELATED DEATHS AND SERIOUS INJURIES BY DRIVER AGE AND GENDER



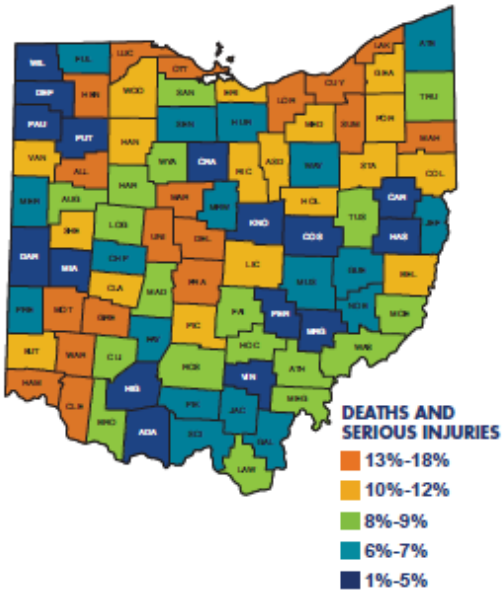
WHERE CRASHES OCCURRED

These maps rank Ohio counties by the number of deaths and serious injuries attributed to rear end crashes. Warm colors indicate more crashes relative to cool colors. **Most urbanized counties have a higher total number of rear end serious crashes.**

REAR END RELATED DEATHS AND SERIOUS INJURIES BY COUNTY TOTAL

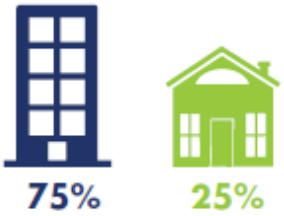


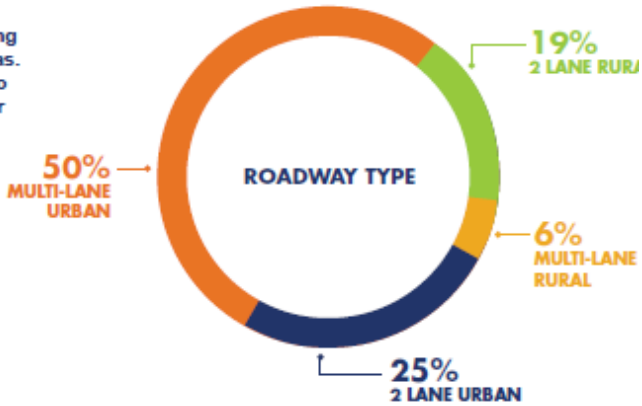
REAR END RELATED DEATHS AND SERIOUS INJURIES BY PERCENTAGE OF COUNTY CRASHES



REAR END RELATED DEATHS AND SERIOUS INJURIES BY ROADWAY TYPE

The vast majority of rear end crashes involving serious injuries or deaths occur in urban areas. Urban areas are more congested and prone to frequent stops and starts that can lead to rear end crashes.



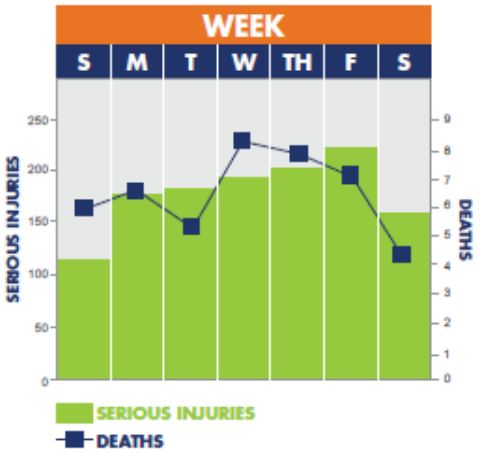


Note: all data from 2008-2012, except Overview section

WHEN CRASHES OCCURRED

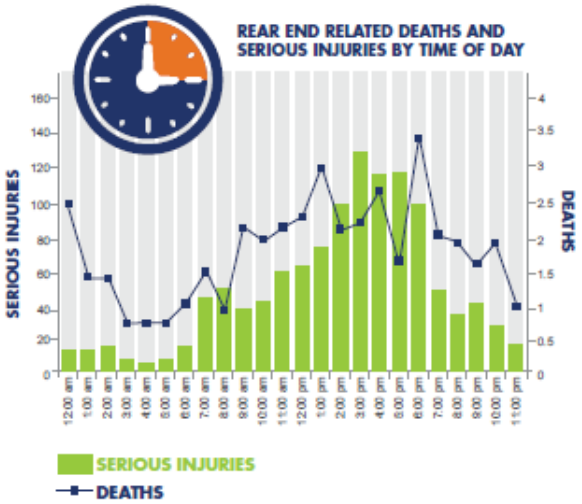
Fatalities and serious injuries related to rear end crashes peaked from Wednesday - Friday and experienced slight decreases over the weekend, likely due to less travelers on the road. An average of 224 serious injuries and 7 fatalities occurred on Fridays.

REAR END RELATED DEATHS AND SERIOUS INJURIES BY DAY OF THE WEEK



The highest number of crashes occurred between 3-5 p.m. with an average of 136 serious injuries and 2 fatalities happening around 3 p.m. each year. This is due to high traffic volumes during this time of day.

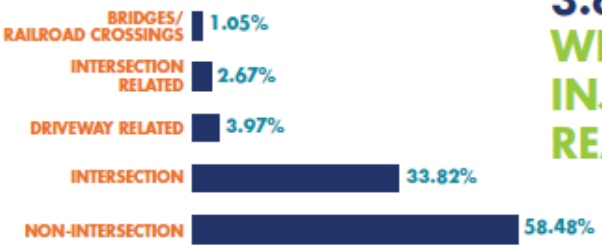
REAR END RELATED DEATHS AND SERIOUS INJURIES BY TIME OF DAY



CONTRIBUTING FACTORS

Many deaths and serious injuries occur at intersections where motorists frequently stop or slow down to turn. However, more than half of all serious rear end crashes are not intersection-related. Many of these crashes are on high-speed roads such as interstates or freeways, where sudden stops caused by incidents and congestion can lead to serious injuries and deaths.

REAR END RELATED DEATHS AND SERIOUS INJURIES BY LOCATION



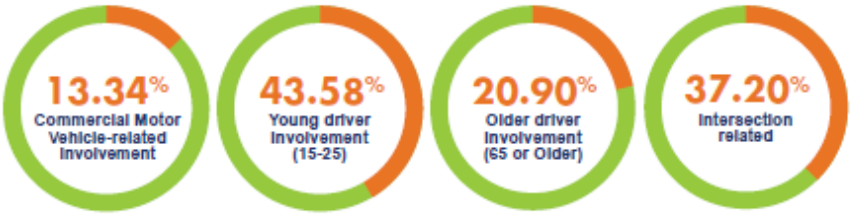
Note: all data from 2008-2012, except Overview section

AN AVERAGE OF 3.6 PEOPLE DIED OR WERE SERIOUSLY INJURED EACH DAY IN REAR END CRASHES.

CONTRIBUTING FACTORS CONTINUED

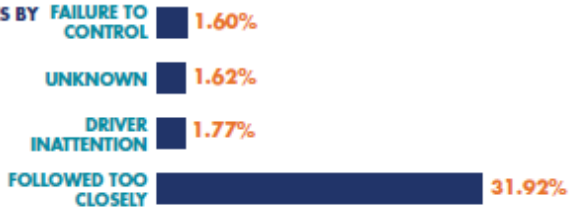
Many of the fatalities and serious injuries related to rear end crashes are due to driver inexperience. Young drivers are involved in 44 percent of the crashes. Approximately one third of the crashes happen at intersections and older drivers are also involved in a high number of rear end crashes.

REAR END RELATED DEATHS AND SERIOUS INJURIES BY RELATED SHSP EMPHASIS AREAS



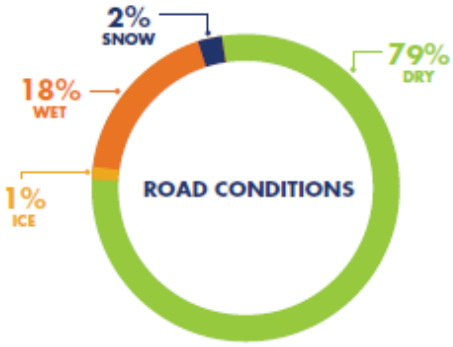
Over 31 percent of the time, rear end fatalities and serious injuries were the result of a driver following too closely to another vehicle. This correlates with the fact that rear end crashes are typically less severe than angle or head on crashes.

REAR END RELATED DEATHS AND SERIOUS INJURIES BY CONTRIBUTING CIRCUMSTANCES



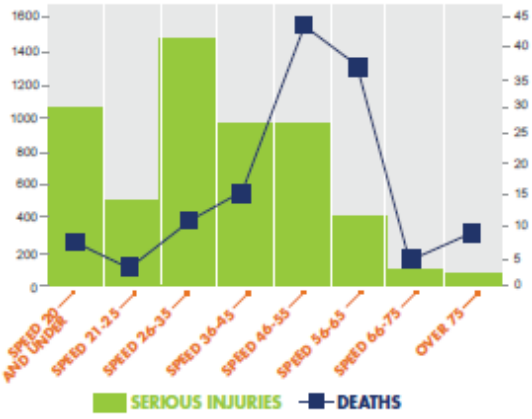
The majority of rear end crashes occurred under dry conditions. About 20 percent occurred under wet or snow conditions when the pavement is slick, requiring extra stopping distance to avoid a crash.

REAR END RELATED DEATHS AND SERIOUS INJURIES BY ROAD CONDITION



Rear end serious injuries tend to occur at the mid-range speeds, most likely near intersections as opposed to highways. However, fatalities spike at higher speeds, due to high speed rural roads or freeways where traffic may have stopped due to congestion.

REAR END RELATED DEATHS AND SERIOUS INJURIES BY AT FAULT DRIVER SPEED



Note: all data from 2008-2012, except Overview section

2.0 Intersection of Lee Street and Washington Boulevard

2.1 Existing Conditions

The Lee Street and Washington Boulevard intersection is signalized with 4 approaches on level terrain. The signal operation on the Lee Street approach is actuated with an 8 second delay. Lee Street a two lane local road that extends from the north to south. Washington Boulevard is classified as a minor arterial that runs from the east to west. It has two travel lanes in each direction. Turning movements are permitted, but not designated. There are numerous mid-block access points for commercial and residential traffic along Washington Boulevard. The speed limit on Washington Boulevard is 35 MPH, while the speed limit on the minor approach is 25 MPH.

The four corners of this intersection are comprised of commercial property. On the northern corners are a McDonald's Restaurant to the east and an unoccupied building (previously 1st Bank) the west. To the southwest is State Farm Insurance and to the southeast is a CVS Pharmacy.

Geographically, this intersection is approximately 430' to the south of Lee Street and 3rd Street and approximately 530' north of the Lee Street and Ridge Street intersection. Both intersections are unsignalized. Along Washington Boulevard and approximately 1060' to the east is Stone Road and Washington Boulevard, which is signalized. Approximately 1060' to the west is the intersection of 4th Street and Washington Boulevard, which is unsignalized.

There are sidewalks, sidewalk aprons, and crosswalks on all four corners of this intersection. However, continuous sidewalk is only available along Washington Boulevard. It is in poor condition and in need of repair on both the northern and southern sides of the road. All of the pedestrian facilities need evaluated for ADA concerns.

A diagram of this intersection can be found in Figure 2-1.

Belpre Traffic Safety and Operations Study 2018

Lee Street and Washingtonn Boulevard

FIGURE 2-1

2.2 Crash Information and Summary

During the study period, there were 36 crashes resulting in 13 injuries at the Lee Street and Washington Boulevard intersection. Of these crashes, 18 were attributed to the driveway access points adjacent to the intersection. The majority of these and the most severe crash type were angled crashes at the Kroger entrance to the east of the intersection. Angled crashes (36%), rear-end crashes (28%), and left turn crashes (19%) were the three most frequent types during the study period.

A collision diagram documenting the crashes at this intersection can be found in Figure 2-2. Charts and graphs of the crash data at this intersection can be found in Appendix A. Pictures can be found in Appendix B. A traffic movement summary can be found in Appendix C.

HCS was utilized to determine the LOS of this intersection, which operates at LOS A in the AM with an intersection delay of 6.2 sec/vehicle. HSC LOS output for this intersection can be found in Appendix D.

FIGURE 2-2

Belpre Traffic Safety and Operations Study 2018

Lee Street and Washington Boulevard

Legend

- Bicycle
- Pedestrian
- Animal
- Injury
- Fatality
- Fixed Object
- Parked Vehicle
- Left Turn
- Through
- Backing
- Angled
- Rear End
- Head On
- Sideswipe, Passing
- Sideswipe, Meeting

N

MM-YY Time Light-Weather-Pavement Add'l

Time: A=AM, P=PM

Light: L=Day/Artificial, D=Dark, M=Dusk/Dawn

Weather: C=Clear/Cloudy, R=Rain, S=Snow/Ice, O=Other

Pavement: D=Dry, W=Wet, S=Snow/Ice, O=Other

Add'l: S=Speed, T=Teen/Youth, A=Alcohol, D=Drugs

2.3 Comments and Probable Cause

Geometric modifications are needed to improve truck access to and from the minor approaches from Lee Street. These modifications can be made in conjunction with roadway resurfacing. During a field view, it was noted that water was ponding in the trough area of the asphalt in each lane of Washington Boulevard caused by surface ware. Resurfacing would also improve drainage around the intersection.

There are numerous access points along Washington Boulevard on both sides of this minor arterial. Sporadic driver behavior in response to turning vehicles is a contributing factor in the crash history at this intersection and along Washington Boulevard in general. Drivers will swerve around a vehicle waiting for a left turn gap or slowing to make a right hand turn. This generates several conflicts. Vehicles switching lanes to avoid the delay of a turning vehicle can sideswipe an unsuspecting vehicle traveling in the adjacent travel lane. An additional conflict can be created when a motorist behind a vehicle toggling travel lanes is suddenly aware of a stopped vehicle in the path of motion when the sight distance is opened up by the vehicle switching lanes. In concert with high speeds, this instance can have severe repercussions in a rear end crash.

Pedestrian crossing at this intersection is provided, but not signalized or integrated into the signal timing plan. Accommodations to improve and enhance pedestrian crossing and visibility at the intersection would improve safety.

2.4 Summary of Countermeasures

Prior to the finalization of this Study, the City of Belpre announced that ODOT safety funds were programmed to replace the signal. The project includes complete signal replacement, the addition of signal backplates, and pedestrian improvements to include curb ramps, push buttons, and pedheads.

WWW supports ODOT's recommendations and adds the following countermeasures for consideration in future projects to address the conflicts and safety concerns discovered as a result of historical crash data and field research activities.

In the short term, the pavement markings on Lee Street are extremely faded and should be repainted. To address the geometric deficiencies of this intersection, the intersection of Lee Street and Washington Boulevard should be resurfaced. The resurfacing project will properly channelize stormwater drainage away from the intersection and improve curve radii on all corners of the intersection.

Turning movements from Washington Boulevard need to be appropriately facilitated to improve safety. Not just at this intersection, but to the east and west of Lee Street along Washington Boulevard. Rear end crashes can be reduced with the addition of left turn lanes and left turn signal heads at the intersection of Lee Street and Washington Boulevard. A left turn lane at this intersection alone will not provide access to the surrounding commercial development. Commercial access roads would be ideal, but costly due to the limited availability of right-of-way along Washington Boulevard. Therefore, a two way left turn lane (TWLTL) or exclusive left turn turning bays should be considered as an alternative. A TWLTL or left turn turning bays should be constructed along Washington Boulevard from 4th Street to Stone Road. The TWLTL shall be modified at the intersection approaches of Lee Street and Stone Road to provide exclusive left turn lanes with the appropriate queue based storage lengths. An example of this concept has been provided in Figure 2-3.

While the countermeasure shown in Figure 2-3 addresses the portion of Washington Boulevard from Fourth Street to Stone Street, further corridor and capacity analysis should be conducted to ascertain the need to maintain four through lanes on the Washington Boulevard corridor. As per comment from ODOT, modifying the corridor to include two through lanes with a TWLTL should maintain the LOS given the existing ADT, would reduce pavement maintenance costs, and would allot space for dedicated bicycle facilities on Washington Boulevard. WWW supports this recommendation and

the potential for a corridor wide improvement that will enhance safety, mobility, connectivity, and economic development.

There were six crashes related to drivers 18 or younger that could be addressed by the school in driver education classes or in concert with law enforcement visitation/educational time.

2.4.1 ADA, Pedestrian, and Bicycle Countermeasures

The existing sidewalks, crosswalks, signal heads, pushbuttons, and sidewalk aprons should be re-evaluated to address and ADA deficiencies and include improvements in the future on Washington Boulevard. Future conditions may facilitate the designation of a bicycle lane within this space.

Figure 2-3: Diagram of the Long Term Countermeasures at the Lee Street and Washington Boulevard Intersection (TWLTL)

3.0 Intersection of Farson Street and SR7

3.1 Existing Conditions

The intersection of Farson Street and SR7 is a four legged, signalized intersection. Farson Street is a two lane major collector and has a speed limit of 35 MPH. SR7 is a four lane principal arterial and freight corridor with a speed limit of 50 MPH. EB SR7 is two lanes with a separate and offset left turn lane with protected/permitted signal phasing and an exclusive right turn lane. WB SR7 is two lanes with an offset left turn lane that also has protected signal phasing. NB Farson Street has an exclusive left turn lane and a through right. SB Farson Street is one lane in and one out. The signals are equipped with backplates and overhead lighting is provided on all four corners of the intersection. Turns are prohibited on red for all the approaches.

The intersection has a Speedway gas station on the southeast corner, a church on the northwest corner, and the Marietta Memorial Belpre Campus facility on the southwest corner, and Belpre Medical Center which is on the northeast corner. Access points to the church, medical center, and hospital campus are not immediately associated with the intersection, but the Speedway has two access points within 200’ of the intersection.

A diagram of this intersection can be found in Figure 3-1.

Belpre Traffic Safety and Operations Study 2018

FARSON STREET AND SR 7

FIGURE 3-1

3.2 Crash Information and Summary

The crash history at this intersection shows a total of 17 crashes and seven injuries between 2014 and 2016. Angle type crashes were the most frequent type (27%) followed by rear end crashes (22%). There were an equal number of left turn, sideswipe, and animal related strikes. Each comprising about 11% of the crash history.

A collision diagram documenting the crashes at this intersection can be found in Figure 3-2. It should be noted that two of the crashes at this intersection could not be included in the collision diagram due to incomplete information. Charts and graphs of the crash data at this intersection can be found in Appendix A. Pictures can be found in Appendix B. Traffic movement summaries can be found in Appendix C.

HCS was utilized to determine the LOS of this intersection during the AM peak, which operates at LOS B with delays of 10.5 sec/vehicle. The northbound and southbound approaches operate at LOS C and D, respectively. The eastbound and westbound approaches operate at LOS A. HSC LOS output for this intersection can be found in Appendix D.

FIGURE 3-2

BelpreTraffic Safety and Operations Study 2018

Farson Street and SR7

Legend

- Bicycle
- Pedestrian
- Animal
- Injury
- Fatality
- Fixed Object
- Parked Vehicle
- Left Turn
- Through
- Backing
- Angled
- Rear End
- Head On
- Sideswipe, Passing
- Sideswipe, Meeting

N

MM-YY Time Light-Weather-Pavement Add'l

Time: A=AM, P=PM

Light: L=Day/Artificial, D=Dark, M=Dusk/Dawn

Weather: C=Clear/Cloudy, R=Rain, S=Snow/Ice, O=Other

Pavement: D=Dry, W=Wet, S=Snow/Ice, O=Other

Add'l: S=Speed, T=Teen/Youth, A=Alcohol, D=Drugs

3.3 Comments and Probable Cause

There were several complex crashes at this intersection during the study period. Upon review of the individual crashes, WWW noted that the overhead lighting may need examined for operations and maintenance, because there were inconsistencies noted that may have contributed to the crashes. This includes the two deer strike related crashes.

3.4 Summary of Countermeasures

Prior to the finalization of this Study, the City of Belpre announced that ODOT safety funds were slated for signal enhancements that include additional signal heads, replacing the controller, improvements to the existing advanced warning signage, and improvements to the vehicle detection system for left turns from SR7 whereby the existing loop system will be replaced with a Wavetronix radar system. WWW supports ODOT's recommendations and adds that consideration should be given to advanced warning signage for deer crossing and examining/correcting any overhead lighting issues.

4.0 Intersection of Stone Road and Washington Boulevard

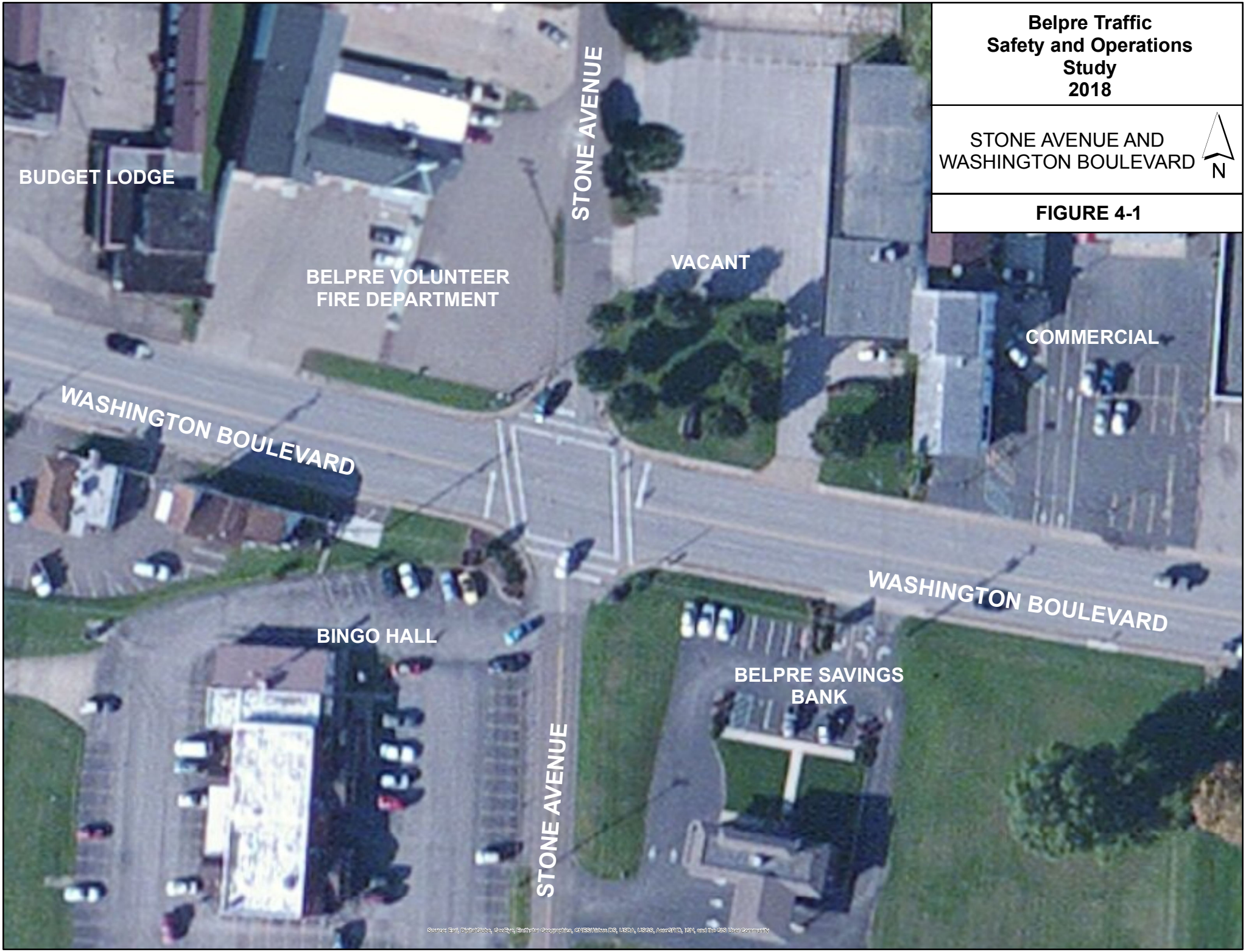
4.1 Existing Conditions

The intersection of Stone Road and Washington Boulevard is a four legged, signalized intersection surrounded by commercial development. Stone Road is a two lane facility that runs north-south and is classified as a major collector. It serves as a primary access point for Belpre Elementary School, which is to the north of the intersection. Stone Road also serves as access to residential development beyond the intersection. The signal operation on the Stone Road approach is actuated with an extended delay (>30 seconds) as noted during a field survey. Washington Boulevard is classified as a minor arterial that runs from the east to west. It has two travel lanes in each direction. There are numerous mid-block access points for commercial and residential traffic along Washington Boulevard. The speed limit on Washington Boulevard is 35 MPH, while the speed limit on the minor approach is 25 MPH.

Geographically, this intersection is approximately 1300’ to the east of Lee Street, 400’ north of Ridge Street, 680’ south of School Drive, and 820’ to the west of Locust Street. With the exception of Lee Street, the intersections are stop controlled.

There are sidewalks, sidewalk aprons, and crosswalks on all four corners of this intersection. However, continuous sidewalk is only available along Washington Boulevard. It is in poor condition and in need of repair on both the northern and southern sides of the road.

A diagram of this intersection can be found in Figure 4-1.



Belpre Traffic Safety and Operations Study 2018

STONE AVENUE AND WASHINGTON BOULEVARD

N

FIGURE 4-1

4.2 Crash Information and Summary

The crash history at this intersection shows a total of 9 crashes and 4 injuries as a result of crashes between 2014 and 2016. Rear end crashes were the most prevalent at 67%, but the most severe were angled (22%) and left turn related (11%) crashes.

A collision diagram documenting the crashes at this intersection can be found in Figure 4-2. Charts and graphs of the crash data at this intersection can be found in Appendix A. Pictures can be found in Appendix B. Traffic movement summaries can be found in Appendix C.

HCS was utilized to determine the LOS of this intersection during the AM peak, which operates at LOS C with delays of 23.9 sec/vehicle. The northbound and southbound approaches operate at LOS A. The eastbound and westbound approaches operate at LOS C. HSC LOS output for this intersection can be found in Appendix D.

FIGURE 4-2

Belpre Traffic Safety and Operations Study 2018

Stone Road and Washington Boulevard

Legend

N

- Bicycle
- Pedestrian
- Animal
- Injury
- Fatality
- Fixed Object
- Parked Vehicle
- Left Turn
- Through
- Backing
- Angled
- Rear End
- Head On
- Sideswipe, Passing
- Sideswipe, Meeting

MM-YY Time Light-Weather-Pavement Add'l

Time: A=AM, P=PM

Light: L=Day/Artificial, D=Dark, M=Dusk/Dawn

Weather: C=Clear/Cloudy, R=Rain, S=Snow/Ice, O=Other

Pavement: D=Dry, W=Wet, S=Snow/Ice, O=Other

Add'l: S=Speed, T=Teen/Youth, A=Alcohol, D=Drugs

4.3 Comments and Probable Cause

There are numerous access points along Washington Boulevard on both sides of this minor arterial. In combination with the existing four lane configuration, drivers were observed weaving between lanes to avoid stopping for a vehicle making a left turn. This increases the chances that a rear end collision will result from a vehicle traveling behind a driver making such a maneuver, who may be unaware of the stopped vehicle ahead. It also increases the chance of sideswipe type crashes for the driver switching lanes during this maneuver. This scenario is a contributing factor in the crash history along Washington Boulevard in general.

During field observations several vehicles were noted running the red light from the minor approaches on Stone Road. This was in part due to the extended wait time for the signal to actuate for the vehicles once they reached the light, which was over 60 seconds by field estimation. Speeding through the intersection was also noted, but not verified by any detection methods.

Pedestrian crossing at this intersection is provided, but not signalized or integrated into the signal timing plan. Accommodations to improve and enhance pedestrian crossing and visibility at the intersection would improve safety.

4.4 Summary of Countermeasures

WWW recommends new pavement marking for Stone Road and along Washington Boulevard, replacing the overhead signals with LED type lighting and signal backplates, and optimizing signal operations. Signal optimization should include new timing for pedestrian crossing and equipping the intersection with pedestrian signal heads.

As discussed in Section 2.4 and illustrated in Figure 2-3, Washington Boulevard lane configurations could be modified to include a TWLTL, which would result in signal and turning lane modifications at this intersection.

4.4.1 ADA, Pedestrian, and Bicycle Countermeasures

The existing sidewalks, crosswalks, signal heads, pushbuttons, and sidewalk aprons should be re-evaluated to address and ADA deficiencies and include improvements in the future on Washington Boulevard. Future conditions may facilitate the designation of a bicycle lane within this space.

5.0 Intersection of Clement Avenue and SR 7

5.1 Existing Conditions

The intersection of Clement Avenue and SR 7 is unsignalized with four legs and is surrounded by residential and commercial development. Clement Avenue has two lanes and is stop controlled. At the intersection, SR 7 is four lanes with right and left turn lanes on the eastbound (northbound) and westbound (southbound) approaches. The left turn lanes are aligned with pavement markings to delineate lane separation between mainstream and turning traffic. There is a converted shopping plaza that has become apartments and a residential/commercial glass company on the northeast corner of the intersection and a car dealership on the southwest corner. The southern portion of the intersection serves a mix of residential and light commercial development. The speed limit on SR 7 is 50 MPH. The speed limit on Clement Avenue is 25 MPH.

Clement Avenue is approximately 2000’ to the west of the SR 7 ramps. It is approximately 3000’ to the east of Braun Road. The Village Plaza, which is to the north of SR 7, is approximately 440’ from the intersection while Hocking Road is just 280’ to the south. Both of these intersections are stop controlled on the minor approaches. There are no pedestrian facilities at this intersection, but there is bicycling activity on SR 7.

A diagram of this intersection can be found in Figure 5-1.

Belpre Traffic Safety and Operations Study 2018

CLEMENT AVENUE AND SR 7

FIGURE 5-1

5.2 Crash Information and Summary

The crash history at this intersection shows a total of nine incidents and five injuries as a result of crashes between 2014 and 2016. There were primarily angle (33%) and sideswipe-passing (22%) type crashes. One crash was animal related and two were related to impaired driving (drugs indicated). The angle crashes were complex and occurred in the mixing zone for turning movements in the center of the intersection. Most crashes were attributed to the fault of the drivers exiting Clement Avenue from the south.

A collision diagram documenting the crashes at this intersection can be found in Figure 5-2. Charts and graphs of the crash data at this intersection can be found in Appendix A. Pictures can be found in Appendix B. Traffic movement summaries can be found in Appendix C.

HCS was utilized to determine the LOS of this intersection during the AM peak, which operates at LOS B in the northbound direction and LOS C in the southbound direction. Northbound approach delay lasts for 14.6 sec/vehicle while southbound delays are 16.6 sec/vehicle. HSC LOS output for this intersection can be found in Appendix D.

FIGURE 5-2

Belpre Traffic Safety and Operations Study 2018

Clement Avenue and SR7

Legend

- Bicycle
- Pedestrian
- Animal
- Injury
- Fatality
- Fixed Object
- Parked Vehicle
- Left Turn
- Through
- Backing
- Angled
- Rear End
- Head On
- Sideswipe, Passing
- Sideswipe, Meeting

N

MM-YY Time Light-Weather-Pavement Add'l

Time: A=AM, P=PM

Light: L=Day/Artificial, D=Dark, M=Dusk/Dawn

Weather: C=Clear/Cloudy, R=Rain, S=Snow/Ice, O=Other

Pavement: D=Dry, W=Wet, S=Snow/Ice, O=Other

Add'l: S=Speed, T=Teen/Youth, A=Alcohol, D=Drugs

5.3 Comments and Probable Cause

This intersection was improved in 2006. Improvements included the addition of right turn lanes to both approaches offsetting the existing left turn lanes. During field observations, it was noted that the center of the intersection was housing vehicles queuing for turning movements. At times, there were multiple cars in the center box at a time. This could explain two of the angle type crashes shown in the collision diagram. Improvements should incorporate enhancements to assist drivers in judging gap spacing at unsignalized intersections.

5.4 Summary of Countermeasures

Improvements should consider advanced warning options such as signage and advanced warning lights for intersection awareness. Automated real-time systems could be implemented to inform drivers of the suitability of available gaps for making turning and crossing maneuvers. Future improvements to the intersection could include widening the footprint of the intersection and pavement markings to better delineate the safe area for queuing vehicles in the center of the intersection.

6.0 Intersection Fourth Street and Main Street

6.1 Existing Conditions

The intersection of Fourth Street and Main Street is a two-way stop controlled intersection with four approaches. Main Street (SR32) is a north-south principal arterial with a speed limit of 35 MPH. At the intersection, Main Street has two northbound lanes and a single lane southbound. Fourth Street is a two lane, east-west local road with a speed limit of 25 MPH and is stop controlled at the intersection. Trucks are prohibited on Fourth Street. The intersection has pedestrian accommodations on all four corners and marked crosswalk. Overhead lighting is provided on Main Street, but only one light is situated over the intersection.

The area surrounding the intersection is residential. However, the intersection corners have commercial development. Hawkins Family Dentistry is on the northeast corner, Riverview FCU is on the northwest corner, Chase Bank is on the sourthwest corner, and the southeast corner is currently an abandoned lot.

Fourth Street and Main Street is approximately 525 feet north of the Third Street and Main Street intersection, which is stop controlled for the minor approaches. The intersection of Fifth Street and Main Street is approximately 460 feet north of the intersection and is also stop controlled on the minor approaches. Three hundred and eighty feet to the east of Fourth Street and Main Street is Florence Street and Fourth Street. This is a four-way stop controlled intersection. Walnut Street and Fourth Street is 400 feet to the west of the intersection. It is two-way stop controlled for the Fourth Street approaches.

A diagram of this intersection can be found in Figure 6-1.

Belpre Traffic Safety and Operations Study 2018

FOURTH STREET AND MAIN STREET

FIGURE 6-1

6.2 Crash Information and Summary

There were nine crashes at the intersection of Fourth Street and Main Street that resulted in a single injury between 2014 and 2016. The crash types were sideswipe-passing (44%), angle (33%), and rear-end (22%) incidents. It should be noted that one crash was attributed to the southern access point of the bank, which is adjacent to the intersection.

A collision diagram documenting the crashes at this intersection can be found in Figure 6-2. Charts and graphs of the crash data at this intersection can be found in Appendix A. Pictures can be found in Appendix B. Traffic movement summaries can be found in Appendix C.

HCS was utilized to determine the LOS of this intersection during the AM peak, which operates at LOS A with an intersection delay of 9.5 sec/vehicle in the westbound direction and 9.9 sec/vehicle in the eastbound direction. HSC LOS output for this intersection can be found in Appendix D.

FIGURE 6-2

Belpre Traffic Safety and Operations Study 2018

Fourth Street and Main Street

Legend

- Bicycle
- Pedestrian
- Animal
- Injury
- Fatality
- Fixed Object
- Parked Vehicle
- Left Turn
- Through
- Backing
- Angled
- Rear End
- Head On
- Sideswipe, Passing
- Sideswipe, Meeting

N

MM-YY Time Light-Weather-Pavement Add'l

Time: A=AM, P=PM

Light: L=Day/Artificial, D=Dark, M=Dusk/Dawn

Weather: C=Clear/Cloudy, R=Rain, S=Snow/Ice, O=Other

Pavement: D=Dry, W=Wet, S=Snow/Ice, O=Other

Add'l: S=Speed, T=Teen/Youth, A=Alcohol, D=Drugs

6.3 Comments and Probable Cause

Speeding and the lane configuration at this intersection could be the most credible cause of crashes at this location. Vehicles toggling between to avoid stopping for left turns in the northbound direction on Main Street are likely to sideswipe an oncoming vehicle making the through movement.

6.4 Summary of Countermeasures

Prior to the completion of this Study, ODOT developed a project that would modify the lane configuration on Main Street to a two-lane facility with a TWLTL from Eighth Street beyond Third Street. Pedestrian crossings are being maintained as part of this project. WWW concurs with this modification as it is consistent with the goals and objectives in the Long Range Transportation Plan Update 2040.