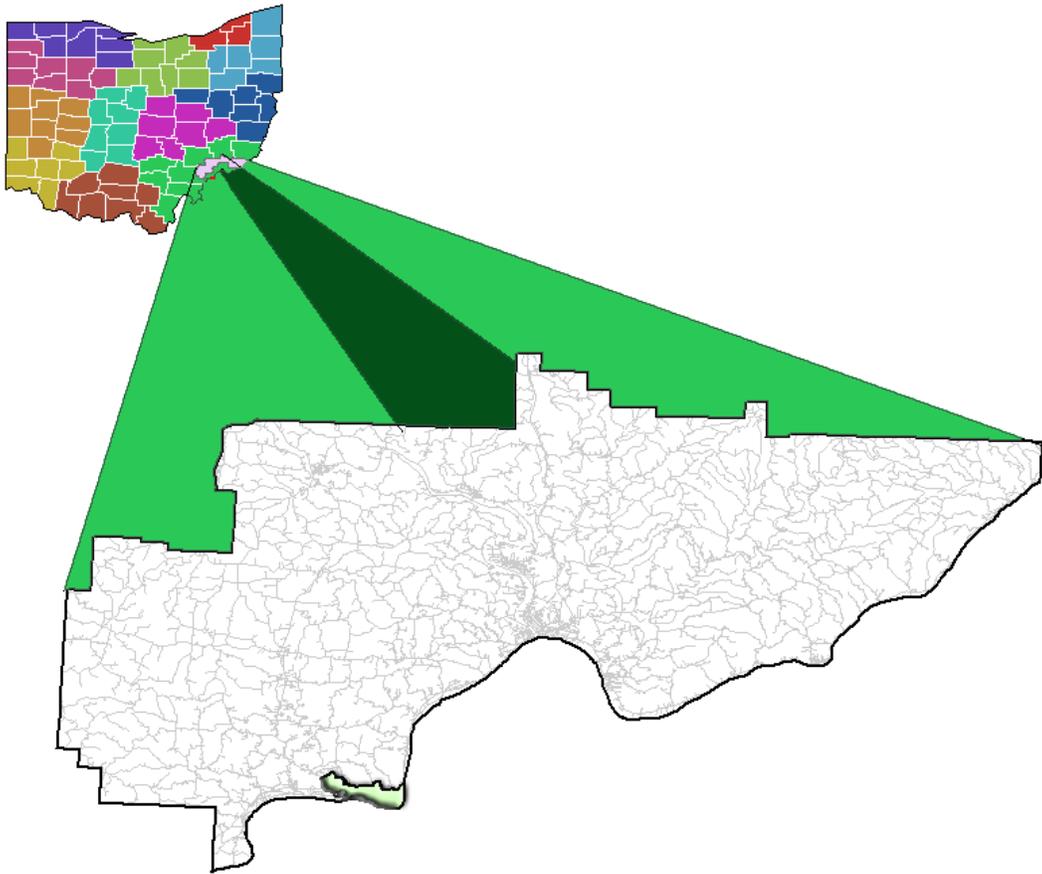


# Traffic Safety and Operations Study for the City of Belpre 2012



*WOOD • WASHINGTON • WIRT  
INTERSTATE PLANNING COMMISSION  
An affiliate agency of the  
MID-OHIO VALLEY REGIONAL COUNCIL  
Parkersburg, West Virginia*



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## 1.0 Introduction

### 1.1 Purpose and Need

The Intermodal Surface Transportation Efficiency Act (ISTEA) and the subsequent Transportation Equity Act for the 21<sup>st</sup> Century (TEA-21) identified the need to preserve existing transportation systems to achieve maximum efficiency from existing facilities. These two bills are endowed by the legislation of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), which secured funding to maintain and grow the transportation infrastructure. In accordance with the goals of the aforementioned legislation, the Wood • Washington • Wirt Interstate Planning Commission (WWW) has conducted this Traffic Operations and Safety Study (Study) for the City of Belpre, Ohio. 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, and 2008, this Study identifies high accident locations and supplements recommendations to improve performance, operational efficiency, and safety based on data from 2008-2010. Information was gathered from various sources including the Ohio Department of Transportation (ODOT), the Ohio Department of Public Safety, previous Studies, the Comprehensive Long Range Multimodal Transportation Plan Update 2007 (WWW, 2007), ITE's Transportation Planning Handbook, FHWA's Objectives and Strategies for Improving Safety at Unsignalized and Signalized Intersections, [www.trafficcalming.org](http://www.trafficcalming.org), as well as field observations conducted by WWW staff.

### 1.2 Project Background

Crash records for Washington County from 2008 to 2010 were downloaded from the Ohio Department of Public Safety website. This crash data was refined for clarity and sifted to determine which intersections within the City experienced ten or greater

accidents 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 Accidents |
|--|------------------|
| Memorial Bridge, SR 7, and Main Street                           | 50               |
| Parkersburg-Belpre Bridge, Main Street, and Washington Boulevard | 31               |
| SR 7 and Farson Street   | 24               |
| SR 7 and Clement Avenue  | 15               |
| Washington Boulevard and Lee Street                              | 13               |
| Washington Boulevard and Stone Road                              | 10               |
| SR 7 and Braun Road  | 10               |

The number of injuries, accident severity, and severity index were tabulated for each of the intersection on the long list and ranked according to each category (see Section 1.3). The overall rank of each intersection was then established. From this, the top five ranked intersections were selected to create the short list of intersections (short list). The short list 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. As a result, the following intersections were removed from the short list:

| Intersection   | Project Number | Description  |
|--|----------------|--|
| SR 7 and Farson Street<br>and<br>SR 7 and Braun Road | PID 82799      | Belpre –Construct two left turn lanes at the intersections of SR 7 with Braun Road and Farson Street. Add left turn signal heads at both locations. Project was moved from FY2011 to FY2012. |

These intersections were replaced by lower ranking intersections on the short list. The resultant list became the final list of intersections (final list). The final list of intersections can be found on the following page 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 |      | Severity Index |      | Accident Rate |      | TOTALS | Overall Rank | Previous Rank |
|--|---------------------|------|--------------------|------|----------------|------|---------------|------|--------|--------------|---------------|
|  | Value               | Rank | Value              | Rank | Value          | Rank | Value         | Rank |        |              |               |
| Memorial Bridge, SR 7, and Main Street                           | 50                  | 1    | 28                 | 1    | 0.560          | 1    | 0.795         | 1    | 4      | 1            | 1             |
| Parkersburg-Belpre Bridge, Main Street, and Washington Boulevard | 31                  | 2    | 11                 | 2    | 0.355          | 3    | 0.501         | 2    | 9      | 2            | 2             |
| SR 7 and Clement Avenue  | 15                  | 3    | 7                  | 3    | 0.467          | 2    | 0.250         | 5    | 13     | 3            | Long List     |
| Lee Street and Washington Boulevard                              | 13                  | 4    | 2                  | 5    | 0.154          | 5    | 0.372         | 3    | 17     | 4            | Long List     |
| Stone Road and Washington Boulevard                              | 10                  | 5    | 3                  | 4    | 0.300          | 4    | 0.306         | 4    | 17     | 4            | 4             |

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

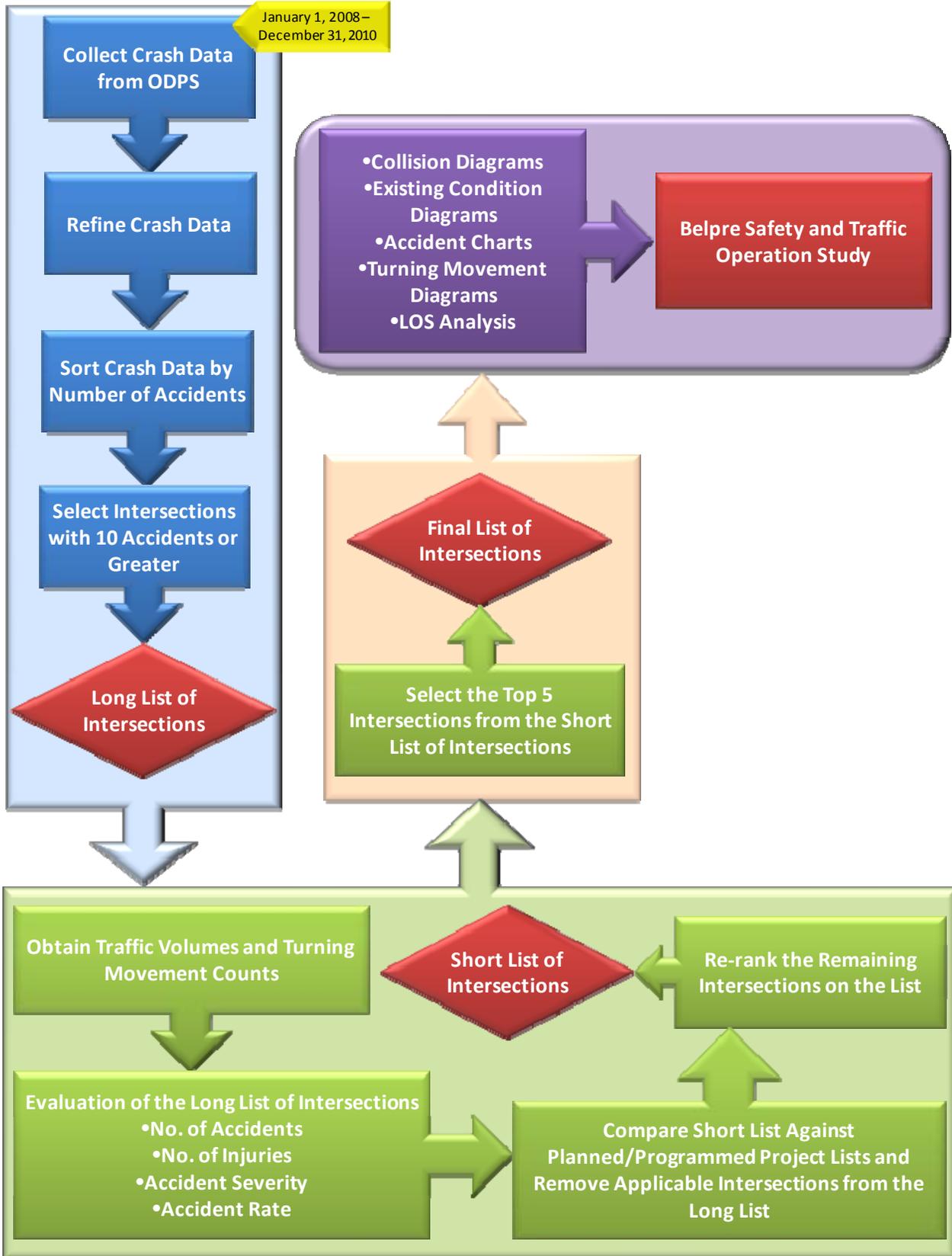


Figure 1-2: Location Map of the Final List of Intersections



- ① Memorial Bridge, SR 7, and Main Street
- ② Parkersburg-Belpre Bridge, Main Street, and Washington Boulevard
- ③ SR 7 and Clement Avenue
- ④ Lee Street and Washington Boulevard
- ⑤ Stone Road and Washington Boulevard

### **1.3 Evaluation Criteria**

Crash records, ADT volumes, turning movement counts, straight line diagrams, severity indices, accident 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 Public Safety was utilized to generate crash diagrams for the final list of intersections. During the process of developing the collision diagrams for each intersection, discrepancies in crash 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. ODOT recommended utilizing the ADT values calculated for 2011 as the ADT for 2009, due to the lack of growth along the Washington Boulevard corridor. Accident rates are discussed in Section 1.3.2.

ADT counts were utilized to calculate accident 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 Accident Rate

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

$$\text{Accident rate} = [(T)(10^6)] \div [(ADT)(n)(365)]$$

- where,
- T = the total number of accidents 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.

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

### 1.3.4 Severity Index

Accident severity is a contrast of the number of injuries at an intersection and the total number of accidents 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 accidents, number of injuries, accident 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 accidents 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. Overall, signalized intersections need improved signal and intersection visibility. Access management strategies should be employed throughout the City to enhance safety, capacity, and efficiency. Traffic

calming techniques should also be applied whenever possible to improve these components as well.

According to the ITE Journal, “traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users.” Some of these techniques are understated and alter a driver’s perception of safe travel speed by reducing the apparent size of the travel lane. WWW examined the application of these techniques for the Lee Street and Washington Boulevard intersection. At this location, widening the width of the centerline and lane delineator pavement markings would alter driver perception and modify driver behavior by reducing the perceived width of the travel lane, slowing speeds. Additionally, the stop bars on Lee Street and Washington Boulevard should also be widened.

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 4<sup>th</sup> Street. There are approximately 130 access points from 4<sup>th</sup> 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.

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. As noted previously, the intersection of Lee Street and Washington Boulevard is ranked #4 on the final list of intersections relative to this safety Study. It is individually discussed in more detail in Section 5.0 of this report. Countermeasures will be discussed in the following Sections of this report to address these concerns.

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. The intent of this report was not to survey all deficiencies for ADA compliance purposes at each intersection in the Study. However, WWW did observe handicap access issues during field surveys and has incorporated those observations and needs in this Study.

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

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.

## 2.0 Intersection of the Memorial Bridge, SR 7, and Main Street

### 2.1 Existing Conditions

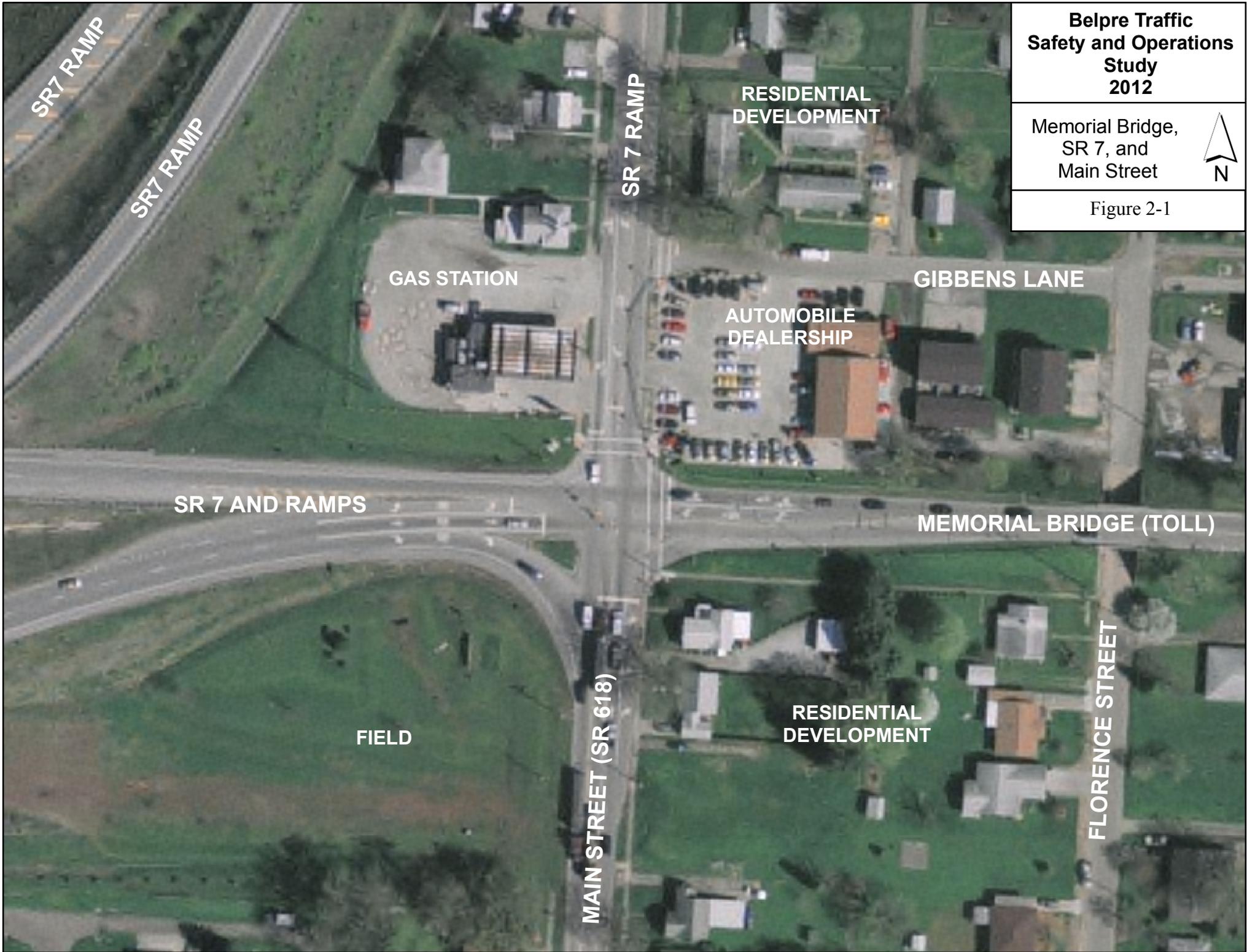
The Memorial Bridge is a tolled connection from Parkersburg, WV to Belpre, Ohio. On the Ohio side, the Memorial Bridge meets with SR 7 and Main Street at a signalized, four-legged intersection.

The current configuration is bordered by commercial and private development. There is a gas station on the northwest corner, an auto sales building and parking lot on the northeast corner, a private residence is located on the southeast corner, and there is an open field on the southwest corner.

There are numerous access points for businesses and residences along both sides of Main Street to the south of the intersection. 8<sup>th</sup> Street is unsignalized and intersects with Main Street approximately 1060' from the subject intersection. The Memorial Bridge is a toll facility with a collection site approximately 4200' from Main Street on the Parkersburg side of the bridge. Clement Avenue is unsignalized and approximately 2600' from Main Street along SR 7. Approximately 500' past the intersection to the north are the SR 7 on and off-ramps. On the northern leg of this approach are driveways for residences located on the east side of SR 7.

Pedestrian sidewalks are provided along the east side of Main Street and the east side of SR 7. A sidewalk is also provided on the southern side of the intersection that connects with the pedestrian facility on the Memorial Bridge. There are crosswalks on the northern and eastern legs of the intersection. The crosswalks, sidewalk aprons, pedestrian signal heads (pedheads), and pushbuttons at this intersection are all in excellent condition. The sidewalks, however, are in need of repair and design updates to meet current ADA standards.

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



**Belpre Traffic  
Safety and Operations  
Study  
2012**

Memorial Bridge,  
SR 7, and  
Main Street



Figure 2-1

## *2.2 Accident Information and Summary*

From 2008 to 2010, there were 50 accidents resulting in 28 injuries at the Memorial Bridge intersection. Most accidents were the result of rear end type collisions (78%). Of that 78%, 62% were related to the SR 7 ramps to the west of the intersection. There were between 2% and 8% of various other types of crashes during the study period. They included a head-on, a few left turns, a couple fixed objects, a sideswipe, and a couple other type crashes. Rear end crashes were also prevalent in the previous Study (2008). However, the distribution was not the same by location.

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. Traffic movement summaries can be found in Appendix C.

HCS was utilized to determine the LOS of this intersection, which operates at LOS C in the AM with an intersection delay of 27.8 sec/vehicle. Eastbound approach delay is operating at LOS D. Westbound and southbound approaches are operating at LOS C, while the NB approach LOS is B. HSC LOS output for this intersection can be found in Appendix D.

## *2.3 Comments and Probable Cause*

The shift between accident locations from 2008 to 2010 is intriguing, because it depicts an overall hitch with signal awareness and/or visibility. Speeds may be a contributor even though it is not documented as a factor in the crash records. Both the intersection approaches from the Memorial Bridge and SR 7 ramps are on a declining asphalt surface. It is also interesting that the crash records indicate weather conditions were considered normal twice as often as they were considered poor, but the road conditions were documented as poor more often than they were normal.

The previous Study documented potential safety concerns related to Traffic Control Device (TCD) visibility, speeding, traffic signal timing, slippery surfaces, restricted sight distances, and intersection geometry. The same is true for the findings of this study.

#### ***2.4 Summary of Countermeasures***

To address the aforementioned safety concerns, the following countermeasures should be considered for this intersection. Improved warning signs should be provided on the SR 7 off ramp approach and the SR 7 approach. Improvements can include flashing lights and radar speed signs to reduce speeds on SR 7. Speeds from the Memorial Bridge approach could be curbed by increasing the width of pavement markings. This traffic calming measure creates the perception that the lane widths are smaller, thus reducing speeds.

The signal timing should be optimized to provide adequate green and amber phases for each approach. The SR 7 approach should have signage to reinforce the location of the stop bar. The pavement should be grooved to improve traction during inclement weather or an anti-slip surface should be applied. WVV recommends a skid study be conducted at this intersection to see if any techniques could be applied to improve traction.

##### **2.4.1 ADA, Pedestrian, and Bicycle Countermeasures**

The local bicycle groups sponsor weekly and monthly rides in the region that utilize the Memorial Bridge to access SR 7. Share the road signage could be applied to the bridge, to the SR 7 ramps, and to the northern leg of Main Street.

As mentioned in Section 2.1, the sidewalks around this intersection are in need of repair. Future improvements at this location should incorporate sidewalk enhancements.

# BelpreTraffic Safety and Operations Study 2012

Memorial Bridge

## Legend

- 
-  ---> Bicycle
  -  ---> Pedestrian
  -  ---> Animal
  -  Injury
  -  Fatality
  -  (X) Number of Injuries/Fatalities (When greater than one).
  -  Fixed Object
  -  Parked Vehicle
  -  Right Turn
  -  Left Turn
  -  Through
  -  Rear-to-Rear
  -  Backing
  -  Angled
  -  Rear End
  -  Head On
  -  Sideswipe, Same Direction
  -  Sideswipe, Opposite Direction
  - 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



Figure 2-2

### **3.0 Intersection of Parkersburg-Belpre Bridge, Main Street, and Washington Boulevard**

#### ***3.1 Existing Conditions***

The intersection of Main Street, Parkersburg-Belpre Bridge, and Washington Boulevard is a 4-legged signalized intersection on uneven terrain. The signal encompasses movements from the Bridge, northern Main Street, and Washington Boulevard approaches. There are two overhead signs on southbound Main Street that inform drivers of movement restrictions. One dictates that right turns are prohibited during the red phase from 6am to 6pm. The other advises left turns to yield on green. The southern leg of Main Street is designated as one-way in and is not included in signal operations. The Bridge grade is uphill from the level approaches of Main Street and Washington Boulevard at the intersection.

The Parkersburg-Belpre Bridge is classified as a principal arterial. It has two westbound approach lanes for exclusive access to Washington Boulevard and Main Street and two receiving lanes. Main Street is classified as a principal arterial to the north and a local road to the south of the intersection. It also has exclusive left and right turn lanes with one receiving lane leading northbound. Washington Boulevard is classified as a minor arterial and carries traffic from the west. It has an exclusive left turn lane and one lane for through/right turn movements and two receiving lanes.

Overhead signage is provided on the Parkersburg-Belpre Bridge and aids in proper separation of traffic to and at the signal. However, in conjunction with pole mounted signage and advertisements on the northern side of the bridge approach, signage is intrusive and obstructs the sight distance at this approach.

The intersection of 3<sup>rd</sup> Street and Main Street is unsignalized and approximately 530' to the north of Washington Boulevard. The intersection of the Parkersburg-Belpre Bridge (5<sup>th</sup> Street) and Ann Street is situated on the east side of the bridge approximately 2640' from Main Street. This intersection is signalized; however, Bridge traffic is not included

in signal operations. To the west is the intersection of Washington Boulevard and Walnut Street. It is unsignalized with stop control on the minor approaches of Walnut Street.

The immediate vicinity of the subject intersection consists of a Rite Aid Pharmacy (on the southwest corner), the Wal-Bon's Commissary (on the northeast corner), and a BP Gas Station (on the northwest corner). There are additional commercial operations along Washington Boulevard and Main Street. Beyond the first block of these roads are residential neighborhoods. The speed limit on all approaches of this intersection is 25 MPH.

There are sidewalks and sidewalk aprons on both sides of Main Street and Washington Boulevard. There is also a sidewalk on the southern side of the Bridge. There are crosswalks and crosswalk aprons across the southern leg of Main Street and across Washington Boulevard. The Washington Boulevard crosswalk is marked behind the stop bar for eastbound traffic. The crosswalks are extremely worn and need repair. Pedheads and pushbuttons are not present at this intersection. All of the pedestrian facilities need evaluated for ADA concerns.

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

**Belpre Traffic  
Safety and Operations  
Study  
2012**

Parkersburg-Belpre  
Bridge, Main Street,  
and Washington Boulevard



Figure 3-1



### 3.2 Accident Information and Summary

There were 31 accidents resulting in 11 injuries at the Parkersburg-Belpre Bridge intersection with Main Street and Washington Boulevard. Most accidents (55%) were rear end related type crashes. Other crash types included left turn (23%), other (16%), and sideswipe (6%). It should be noted four of the “other” type crashes involved fixed objects, but the fixed object was not an obstruction or a potential hazard that caused the accident.

Sixty percent of the crashes at this intersection were attributed to the Parkersburg-Belpre Bridge approach lanes. More serious crash types involved the left turn onto Washington Boulevard from the bridge, but there were also a large number of rear end crashes on the approach. Compared to the previous Study, there was nearly a 50% decline in the number of crashes at this intersection. This is likely due to the completion of the US 50 corridor, which detracts traffic from the Parkersburg-Belpre Bridge. The types and distribution of accidents is relatively the same with the exception of conflicts on the Main Street approach. In the 2012 study period, there was only a single crash attributed to the fault of the driver on the Main Street approach. Speed and alcohol were other factors recorded for seven of the total crashes at this intersection.

A collision diagram documenting the crashes at this intersection can be found in Figure 3-2. 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, which operates at LOS C in the AM with delay of 26.3 sec/vehicle. HCS analysis shows LOS C and B for the EB and WB directions of Washington Boulevard and the Parkersburg-Belpre Bridge, respectively. Southbound Main Street shows a LOS D with 44 sec/vehicle delays. HCS LOS output for this intersection can be found in Appendix D.

# BelpreTraffic Safety and Operations Study 2012

Parkersburg-Belpre Bridge

## Legend

-  ---> Bicycle
  -  ---> Pedestrian
  -  ---> Animal
  -  Injury
  -  Fatality
  -  (X) Number of Injuries/Fatalities (When greater than one).
  -  Fixed Object
  -  Parked Vehicle
  -  Right Turn
  -  Left Turn
  -  Through
  -  Rear-to-Rear
  -  Backing
  -  Angled
  -  Rear End
  -  Head On
  -  Sideswipe, Same Direction
  -  Sideswipe, Opposite Direction
- 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



Figure 3-2

### 3.3 *Comments and Probable Cause*

Field observations and crash histories at this intersection exposed safety issues relative to sight distance, speed, driver behavior, pedestrian and bicycle access, and pavement conditions during inclement weather.

The geometry of this intersection is peculiar and requires special attention to navigate. Numerous overhead and pole mounted signs on the Parkersburg-Belpre Bridge and along the grassy space on the north end of the approach detract from signal visibility and intersection awareness. These signs are both commercial and traffic control related. To the west, signage and vegetation on the corner of the BP Gas station interferes with the sight distance of motorists making a right turn from Main Street to westbound Washington Boulevard.

Drivers can become overwhelmed or distracted by excessive signage and be desensitized to the awareness required to negotiate movements at this intersection. Therefore, commercial signage should be removed and prohibited from this intersection. The placement of existing traffic control signage should be examined to determine ancillary placement or removal. Vegetation should be removed or properly maintained to preclude the probability of accidents due to sight distance.

In addition to signage and vegetation, sight distance is impacted by vehicular obstruction at the approaches. This is especially true when large vehicles, including commercial and delivery trucks are involved. Vehicles in the left turn bay on Washington Boulevard block the sight distance of vehicles making the through movement onto the Parkersburg-Belpre Bridge. During field observations, several conflicts were noted between through movements onto the Bridge from Washington Boulevard and left turn movements onto the Bridge from Main Street. While these two movements are channelized by pavement markings, vehicles from Washington Street had a propensity to move directly into the left travel lane beyond the demarcation of the hatched channelization area.

Relative to driver behavior, accelerated speeds beyond the posted speed limit were noted during field observations. This was accompanied by a failure to stop at the stop bar (if at all) for vehicles traveling eastbound from Washington Boulevard to the bridge. Motorists are permitted to turn right on red at this location, which translates to steady traffic flow for this movement. However, the numerous conflicts described above have resulted.

Conflicts were also noted between westbound left turn movements from the Bridge onto Washington Boulevard and through movements from Main Street to the Bridge. Drivers on the bridge that fail to yield to Main Street traffic during the permitted turn phase of the signal create the potential for left turn and angled crashes at the intersection.

Additionally, the crash history during the study period identified incidents of speed and alcohol related accidents at this intersection that could be remediated with targeted police enforcement.

### ***3.4 Summary of Countermeasures***

Updated and improved pavement markings will aid in the proper channelization of traffic through the intersection. This includes widening the existing stop bars on each approach. Surface mount delineator posts will be added to the channelization island for the corner of the Parkersburg-Belpre Bridge and Washington Boulevard.

To deter eastbound Washington Boulevard traffic from crossing to the left lane and into Main Street flows, surface mount delineator posts will be added to the centerline of the bridge for a distance of 50'. Signage will also be added to direct traffic from Washington Boulevard to utilize the right lane until permissible access is available. Additional pavement markings will be added to channelize Main Street traffic to the left lane of the Bridge.

The area to the north of the Bridge abutment (the intersection of Main Street and the Bridge) is congested with traffic control signage and commercial signage. To improve sight distance, signage in this area will be removed or relocated. Commercial signage

should be prohibited from this area in the future. Initially, this measure will likely require enforcement by the City. Sight distance is also impacted by the landscaping in front of the BP gas station. The City should coordinate with the owners to develop a maintenance plan that removes or shrinks obtrusive vegetation.

Drainage issues will be addressed by re-surfacing the pavement at this location within 200' of the intersection.

The following countermeasures are recommended:

- Optimize signal timing.
- Install signal backplates.
- Refresh all pavement markings at this intersection, including the crosswalk pavement markings.
- Widen the pavement marking for the stop bars on each approach.
- Add channelizing pavement markers for the left turn from Main Street to the Parkersburg-Belpre Bridge to direct traffic through the intersection and highlight awareness of this movement for other approaches.
- Add surface mount delineator posts to the boundary of the channelizing island at the intersection of Washington Boulevard and the Parkersburg-Belpre Bridge.
- Add surface mount delineator posts for a distance of 50' along the centerline of the eastbound Bridge decking.
- Change the centerline pavement marking on the eastbound Bridge deck from dashed to solid in conjunction with the previous countermeasure.
- Add signage prior to the eastbound approach of Washington Boulevard to instruct drivers “Right Turn Must Stay in Right Lane thru Intersection” (MUTCD W-145B).
- Coordinate with the owners of BP to develop a maintenance plan for vegetation on the corner of the intersection.
- Address obtrusive signage on the northern corner of the Bridge near Main and the bridge abutment.
  - Prohibit commercial signage and remove.
  - Remove the “Belpre Business Route” sign.

- Relocate “Fasten Safety Belts State Law” sign.
- Relocate local attraction sign.
- Resurface roadway to improve drainage. The resurfacing project shall ensure proper stormwater drainage to the existing stormwater drains in the vicinity of the intersection.
- Review the existing Traffic Operations Maintenance Plan for the City of Belpre to ensure that snow/ice removal at this location is addressed properly.
- Work with local law enforcement to incorporate a targeted campaign to reduce speeding and DUI crashes at this intersection and others within the City.

#### **3.4.1 ADA, Pedestrian, and Bicycle Countermeasures**

Field observations noted numerous pedestrians and bicycles traversing this intersection to and from all directions. WWW documented the need for education, enforcement, and engineering strategies to bestow improved safety and access to this intersection for pedestrians and bicyclists. Especially since Washington Boulevard has been designated share the road by the City. Specifically, WWW recommends the following:

- Add signage to the eastbound approach of Washington Boulevard to highlight the location of the crosswalk (MUTCD W-81). Add signage instructing drivers to “Yield to Pedestrians” (MUTCD W-145B).
- Add signage to the westbound travel lane of Washington Boulevard to highlight the location of the crosswalk (MUTCD W-81). Add signage instructing drivers to “Yield to Pedestrians” (MUTCD W-145B).
- Add sidewalk aprons, crosswalk, and signage to Main Street. It should be situated behind the stop bar in similar format to the Washington Boulevard crosswalk.
- Add signage to the northbound travel lane of Main Street to highlight the location of the crosswalk (MUTCD W-81). Add signage instructing drivers to “Yield to Pedestrians” (MUTCD W-145B).
- Add signage to the southbound approach of Main Street to highlight the location of the crosswalk (MUTCD W-81). Add signage instructing drivers to “Yield to Pedestrians” (MUTCD W-145B).

- Install pedheads and pushbuttons.
- Evaluate all pedestrian facilities to determine where ADA facility improvements can be applied.

## 4.0 Intersection of Clement Avenue and SR 7

### 4.1 Existing Conditions

The intersection of Clement Avenue and SR 7 is unsignalized with four legs and is surrounded by mixed 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 shopping plaza 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 55 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 shopping center 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 4-1.

**Belpre Traffic  
Safety and Operations  
Study  
2012**

SR 7 and  
Clement Avenue



Figure 4-1



#### *4.2 Accident Information and Summary*

The accident history at this intersection shows a total of 15 accidents and 7 injuries as a result of crashes between 2008 and 2010. There were 6 angled type crashes, three sideswipe crashes, three fixed object crashes, two accidents classified as other, and a single right turn crash. One crash involved speed and another involved a deer strike. The collision diagram shows a cluster of accidents at the northern leg of Clement Avenue. These accidents have resulted in injury and overall, tend to be the most severe type of crash.

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 B in the northbound direction and LOS C in the southbound direction. Northbound approach delay lasts for 12.5 sec/vehicle while southbound delays are 15.4 sec/vehicle. Eastbound and westbound LOS for the two way stop controlled intersection was LOS A and B, respectively. HSC LOS output for this intersection can be found in Appendix D.

# BelpreTraffic Safety and Operations Study 2012

OH SR 7 and  
Clement Avenue

## Legend

-  ---> Bicycle
-  ---> Pedestrian
-  ---> Animal
-  Injury
-  Fatality
-  (X) Number of Injuries/Fatalities (When greater than one).
-  Fixed Object
-  Parked Vehicle
-  Right Turn
-  Left Turn
-  Through
-  Rear-to-Rear
-  Backing
-  Angled
-  Rear End
-  Head On
-  Sideswipe, Same Direction
-  Sideswipe, Opposite Direction
- 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

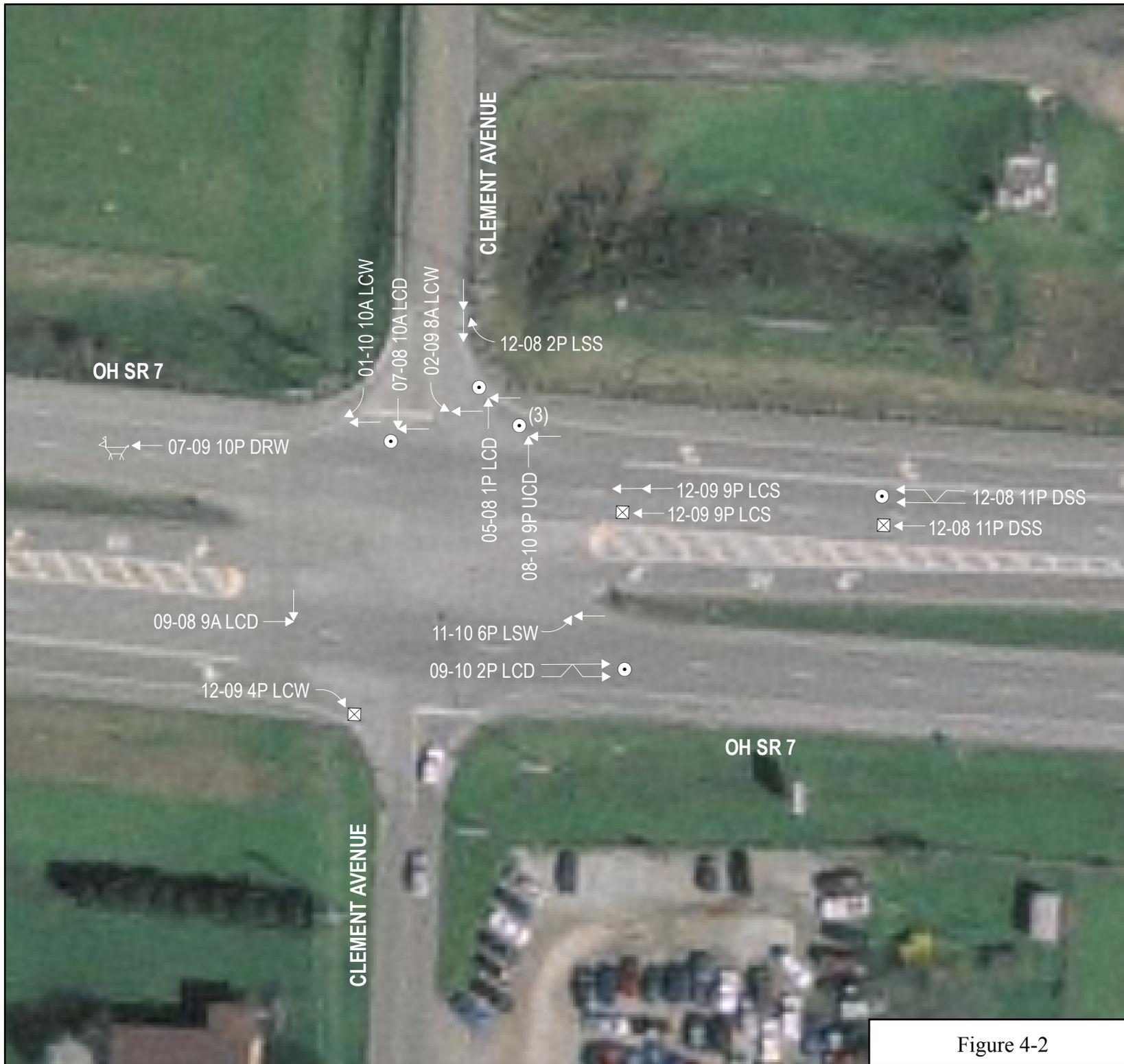


Figure 4-2

#### *4.3 Comments and Probable Cause*

This intersection was improved in 2006. Improvements included the addition of right turn lanes to both approaches and enhancements to the existing left turn lanes. Subsequent to these changes, the intersection continues to experience accidents. An examination of the crash data, graphs, and charts indicates that inclement weather and adverse road conditions were evident during a majority of the accidents. It also depicts that accidents are clustered around the northern leg of the intersection and fault is typically attributed to the fault of the driver on SR 7. Countermeasures to improve this intersection should take adverse weather and pavement conditions into account. Improvements should also incorporate enhancements to assist drivers in judging gap sizes at unsignalized intersections.

#### *4.4 Summary of Countermeasures*

Given the recent improvements to the intersection and the impact that adverse weather and pavement conditions have had on its crash history, WWW recommends that the maintenance plan be examined to determine whether or not snow removal/treatment plans meet the needs of the intersection. Advanced warning options could include signage, lights, and rumble strips on the northern leg of Clement Avenue. Automated real-time systems are also available to inform drivers of the suitability of available gaps for making turning and crossing maneuvers.

Pavement treatments to improve traction could also be applied to reduce crash frequency. As per a conversation with ODOT District 10, WWW recommends that a skid study be conducted at this intersection to see if any techniques could be applied to improve traction.

## 5.0 Intersection of Lee Street and Washington Boulevard

### 5.1 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 old 1<sup>st</sup> Bank building to 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 3<sup>rd</sup> 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 4<sup>th</sup> 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 5-1.

**Belpre Traffic  
Safety and Operations  
Study  
2012**

Washington Boulevard  
and  
Lee Street



Figure 5-1



1ST BANK  
(CLOSED)

LEE STREET

MCDONALD'S  
RESTAURANT

KROGER  
GAS STATION

WASHINGTON BOULEVARD (SR 618)

US POST  
OFFICE

STATE FARM  
INSURANCE

WASHINGTON BOULEVARD (SR 618)

CVS PHARMACY

LEE STREET

COMMERCIAL  
ESTABLISHMENT

## 5.2 Accident Information and Summary

During the study period, there were 10 accidents resulting in three injuries at the Lee Street and Washington Boulevard intersection. This is significantly less than the previous Study results, but on par with the declining accident trend evident from those results. As with the previous study, the majority of accidents were rear end type collisions (30%). The remaining crashes were left turns, sideswipes, backing, and an angled crash. The westbound approach from Washington Boulevard was the site of the majority of crashes at this intersection. The same was true for the previous Study.

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, which operates at LOS A in the AM with an intersection delay of 9.6 sec/vehicle. All approaches operate at LOS A with delays between 8.4 and 9.7 sec/vehicle. HSC LOS output for this intersection can be found in Appendix D.

# BelpreTraffic Safety and Operations Study 2012

Washington Boulevard  
and Lee Street

## Legend

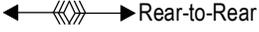
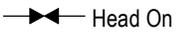
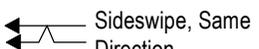
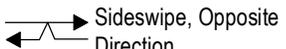
-  ---> Bicycle
-  ---> Pedestrian
-  ---> Animal
-  Injury
-  Fatality
-  (X) Number of Injuries/Fatalities (When greater than one).
-  Fixed Object
-  Parked Vehicle
-  Right Turn
-  Left Turn
-  Through
-  Rear-to-Rear
-  Backing
-  Angled
-  Rear End
-  Head On
-  Sideswipe, Same Direction
-  Sideswipe, Opposite Direction
- 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



Figure 5-2

### 5.3 *Comments and Probable Cause*

It was noted during field investigations that the pavement markings for vehicular and pedestrian traffic were worn and need refreshed on the major and minor approaches. Geometric modifications are needed to improve truck access to and from the minor approaches of Lee Street. These modifications can be made in conjunction with roadway resurfacing to improve drainage.

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. Several countermeasures will be discussed in the following Section of this report to address these concerns.

### 5.4 *Summary of Countermeasures*

The following countermeasures should be considered to address the conflicts and safety concerns discovered as a result of historical accident data and field research activities.

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 accidents 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 4<sup>th</sup> 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 5-3.

#### **5.4.1 ADA, Pedestrian, and Bicycle Countermeasures**

At the time of project development, the existing sidewalks, crosswalks, signal heads, pushbuttons, and sidewalk aprons should be re-evaluated to address and ADA deficiencies and include improvements in the final design. The existing pedestrian facilities shall be re-built with the application of any improvements to this intersection or corridor. If shoulder space is available on this section of road, shoulders should be provided and striped. Future conditions may facilitate the designation of a bicycle lane within this space.

Figure 5-3: Diagram of the Long Term Countermeasures at the Lee Street and Washington Boulevard Intersection (TWLTL)



## 6.0 Intersection of Stone Road and Washington Boulevard

### 6.1 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. 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. Stone Road is classified as a local road that extends from the north to south. The signal operation on the Stone Road approach is actuated with an 8 second delay. 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.

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.

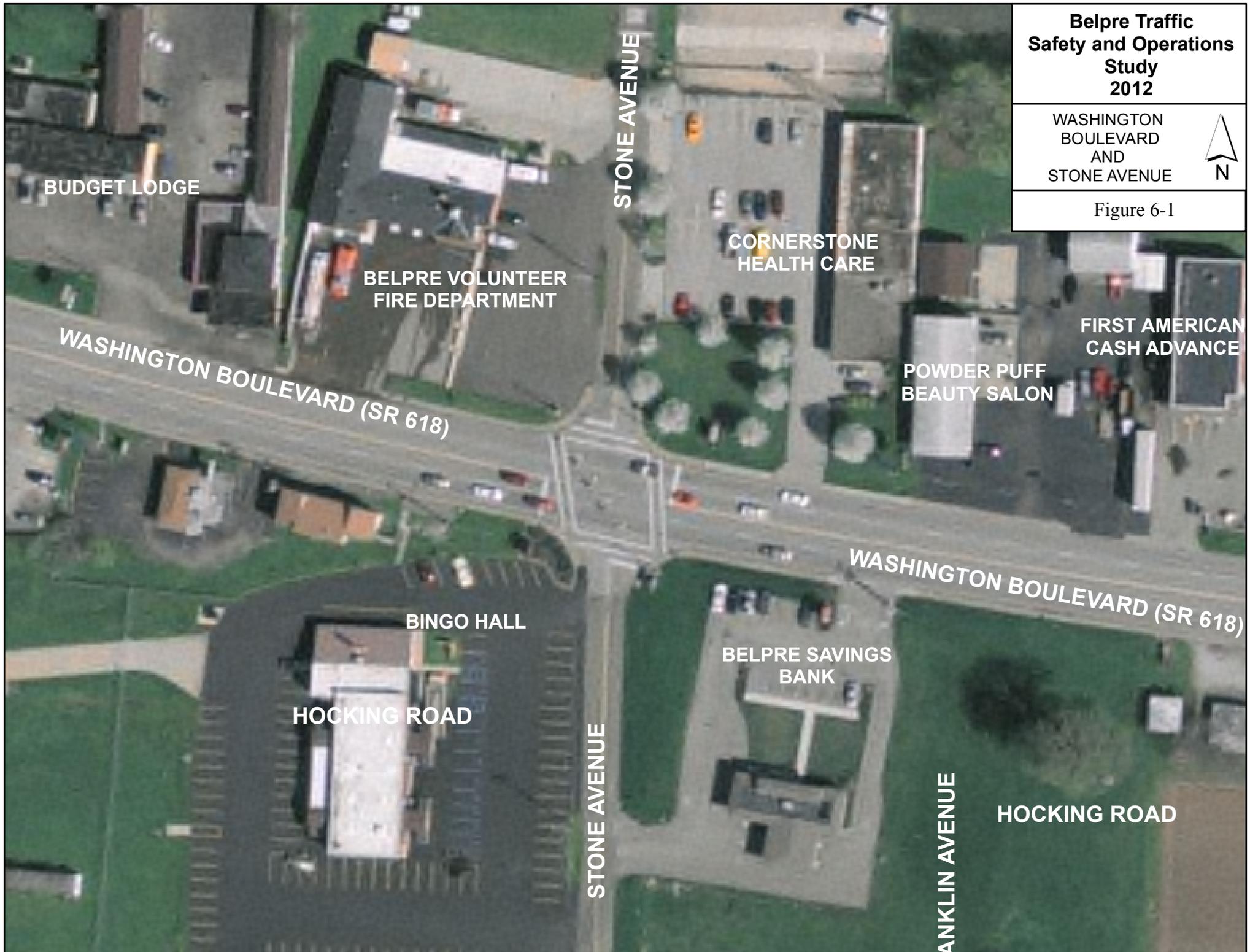
A diagram of this intersection can be found in Figure 6-1.

**Belpre Traffic  
Safety and Operations  
Study  
2012**

WASHINGTON  
BOULEVARD  
AND  
STONE AVENUE



Figure 6-1



BUDGET LODGE

BELPRE VOLUNTEER  
FIRE DEPARTMENT

CORNERSTONE  
HEALTH CARE

FIRST AMERICAN  
CASH ADVANCE

POWDER PUFF  
BEAUTY SALON

WASHINGTON BOULEVARD (SR 618)

WASHINGTON BOULEVARD (SR 618)

BINGO HALL

BELPRE SAVINGS  
BANK

HOCKING ROAD

HOCKING ROAD

STONE AVENUE

STONE AVENUE

ANKLIN AVENUE

## 6.2 Accident Information and Summary

The accident history at this intersection shows a total of 13 accidents and 2 injuries as a result of crashes between 2008 and 2010. Eleven of those accidents were rear-end type crashes, mostly on the westbound approach and mostly on Washington Boulevard. Additionally, there were two angle type crashes. Both angled crashes were attributed to the fault of the driver on Washington Boulevard.

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 B with delays of 10.1 sec/vehicle. The northbound, southbound and westbound approaches all operate at LOS A. The eastbound approach shows LOS B in the AM. This is expected given the traffic flows are heaviest in the eastbound direction in the AM. HSC LOS output for this intersection can be found in Appendix D.

# BelpreTraffic Safety and Operations Study 2012

Washington Boulevard  
and Stone Road

## Legend

-  ---> Bicycle
-  ---> Pedestrian
-  ---> Animal
-  Injury
-  Fatality
-  (X) Number of Injuries/Fatalities (When greater than one).
-  Fixed Object
-  Parked Vehicle
-  Right Turn
-  Left Turn
-  Through
-  Rear-to-Rear
-  Backing
-  Angled
-  Rear End
-  Head On
-  Sideswipe, Same Direction
-  Sideswipe, Opposite Direction
- 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



Figure 6-2

### **6.3 Comments and Probable Cause**

As is the case at the Lee Street and Washington Boulevard intersection, there are numerous access points along Washington Boulevard on both sides of the arterial. Driver behaviors match those of the subsequent intersection as well. Sporadic driver behavior in response to turning vehicles is a contributing factor in the crash history at this intersection. Several countermeasures will be discussed in the following Section of this report to address these concerns, which are in concert with the countermeasures discussed for the Lee Street and Washington Boulevard intersection.

### **6.4 Summary of Countermeasures**

The following countermeasures should be considered to address the conflicts and safety concerns discovered as a result of historical accident data and field research activities.

Turning movements from Washington Boulevard need to be appropriately facilitated to improve safety. Not just at this intersection, but to the west of Stone Road along Washington Boulevard. 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 4<sup>th</sup> Street to Stone Road. The TWLTL shall be modified at the intersection approach of Stone Road to provide exclusive left turn lanes with the appropriate queue based storage lengths. An example of this concept was provided in Figure 5-3 in Section 5.4 of this report.

#### **6.4.1 ADA, Pedestrian, and Bicycle Countermeasures**

The existing pedestrian facilities shall be re-built with the application of any improvements to this intersection or corridor. If shoulder space is available on this section of road, shoulders should be provided and striped. Future conditions may facilitate the designation of a bicycle lane within this space.