Hal Greer Boulevard Multimodal Study

Final Report

Prepared for:
West Virginia Department of Transportation, Division of Highways
and
KYOVA Interstate Planning Commission

Prepared by:
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Executive Summary

This report summarizes a study of traffic and safety issues, along with potential pedestrian crossing treatments, for the section of Hal Greer Boulevard (WV 10) in Huntington between Medical Center Drive and 10th Avenue. The study section includes the Cabell Huntington Hospital and surrounding medical services. Several previous studies related to this issue have been conducted. This resulted in a 2015 request by the KYOVA Interstate Planning Commission to the West Virginia Department of Transportation, Division of Highways ("WVDOH") to construct a split pedestrian crossover treatment (SPXO) known as a Danish Crossing. That treatment would be constructed between Columbia Avenue and 13th Avenue, just north of the hospital. The response from the WVDOH stated that a design study must be undertaken before the project could proceed. The design study would include the SPXO treatment but also would examine additional alternatives. This multimodal study of Hal Greer Boulevard constitutes that effort.

Existing conditions were evaluated and the impacts of the new signal constructed at Hal Greer Boulevard and Boulevard Avenue were quantified. Field reviews were performed and low-cost, easily implemented improvements were recommended.

At Columbia and 13th avenues, four alternative pedestrian crossing treatments were identified and evaluated:

1. Danish Offset Pedestrian Crossing
2. Pedestrian Hybrid Beacon
3. Conventional Traffic Signal with Crosswalks and Pedestrian Signals
4. Raised Median

None of the alternatives is projected to seriously degrade auto performance further when compared with the base condition. Those involving signals – the Danish Crossing, Pedestrian Hybrid Beacon (PHB), and conventional traffic signal – do provide some additional disruption to traffic flow, but the disruption can be mitigated by coordinating those signals with the others along the corridor. For the conventional signal (Alternative #3), a signal warrant analysis was conducted and only minor warrants were satisfied. The biggest benefit of the alternatives involving new signals is that there are more "protected" opportunities to cross Hal Greer Boulevard. For those alternatives (1, 2, and 4) where left turns would be displaced, because side street volumes are low, it was determined that impacts would not be significant.

Beyond the low-cost improvements that were identified from the field reviews, any of the alternatives examined would be expected to improve pedestrian safety with a minimal additional disruption to traffic flow. Other factors such as cost, warrants for installation, prohibiting or limiting statutes, and stakeholder desires are expected to play a role in the final decision.

Later in 2017, a study will be undertaken to develop a corridor master plan for all of Hal Greer Boulevard, from Interstate 64 to 3rd Avenue. This will include the section that was the subject of this pedestrian safety study. Decisions made for the master plan should be made in consideration of the analysis and findings of this multimodal study. Similarly, decisions made related to this project should consider that the issue will be revisited at a more encompassing level in the near future.

1.0 INTRODUCTION

Stantec Consulting Services Inc. was retained by the West Virginia Department of Transportation, Division of Highways ("WVDOH") to perform a study of traffic and safety issues, along with potential pedestrian crossing treatments, for the section of Hal Greer Boulevard (WV 10) in Huntington between Medical Center Drive and 10th Avenue. The study section includes the Cabell Huntington Hospital and surrounding medical services. A map of the study area is shown in **Figure 1**.

Hal Greer Boulevard (WV 10) is a four-lane divided street connecting Interstate 64 with downtown Huntington and the Marshall University campus. It is functionally classified as an Urban Principal Arterial. Average daily traffic volumes along Hal Greer Boulevard are approximately 20,000 near the hospital.

1.1 HISTORY

Several studies related to this issue have been conducted. In December 2013, Kimley-Horn and Associates culminated a study of pedestrian corridor enhancements for the Cabell Huntington Hospital. Recommendations included a landscaped median that would convert the Columbia Avenue and 13th Avenue intersections with Hal Greer Boulevard to T-intersections. A Danish Offset intersection also was included in the letter that documented types of pedestrian safety enhancements.

In 2013 and 2014, under an agreement with the KYOVA Interstate Planning Commission, the Rahall Appalachian Transportation Institute collected pedestrian counts along Hal Greer Boulevard in the vicinity of the hospital. A technical memorandum summarizing the results, dated June 6, 2014, was submitted to KYOVA. The study quantified pedestrian crossing volumes within four segments along the corridor. Segments 1 (north end) and 4 (south end, at Medical Center Drive) contained marked pedestrian crosswalks; at the time of this study, the middle segments did not contain any marked pedestrian crossings.

A follow-up Road Safety Audit (RSA) of Hal Greer Boulevard from the hospital entrance to 8th Avenue was conducted by the WVDOH and a report was produced in December 2014. The RSA identified a number of positive features in the corridor, as well as opportunities to improve safety. One recommendation, construction of a traffic signal at Hal Greer Boulevard and Boulevard Avenue, was implemented in 2016. The intersection includes crosswalks and pedestrian signals.

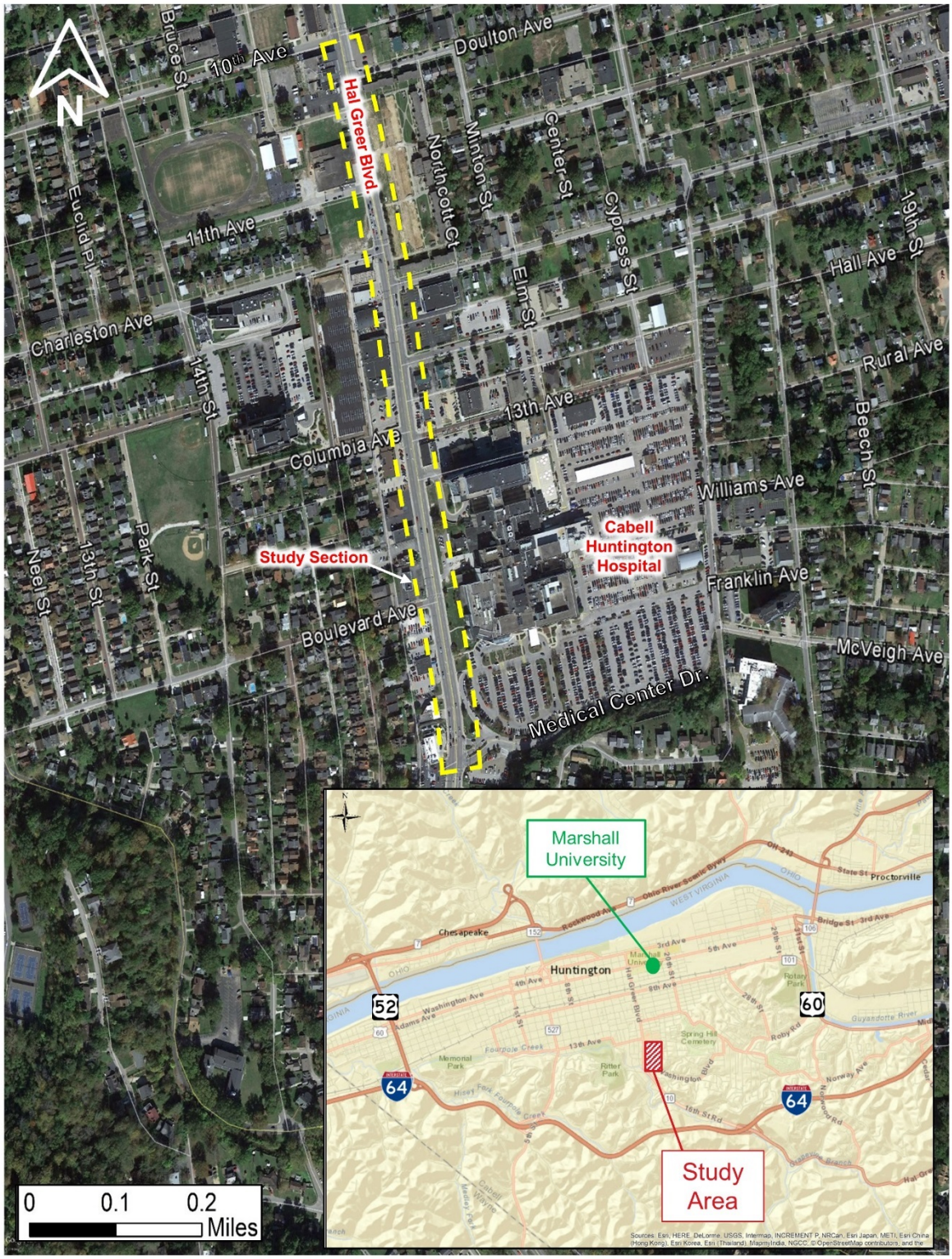


Figure 1. Study Section of Hal Greer Boulevard/16th Street

In 2015, the Rahall Appalachian Transportation Institute conducted the Hal Greer Boulevard Pedestrian Safety Study for KYOVA. The study focused on the section of Hal Greer Boulevard near Columbia Avenue and 13th Avenue. The results were documented in a letter-type report dated June 4, 2015. The study concluded that pedestrians will cross Hal Greer Boulevard where it is most convenient; around Columbia Avenue and 13th Avenue, they are most likely to cross mid-block instead of walk 500 feet north or south to the nearest signalized intersection. The study recommended providing a median pedestrian refuge at this location and, because of the offset between Columbia Avenue and 13th Avenue, a split pedestrian crossover treatment (SPXO) should be installed. The SPXO treatment is also referred to as a Danish Crossing.

A June 4, 2015 letter from KYOVA to WVDOH summarized the pedestrian safety study and requested the installation of the SPXO or Danish Crossing treatment. A reply letter from the WVDOH to KYOVA, dated July 21, 2015, stated that a design study must be undertaken before the project can proceed. The design study would include the SPXO treatment but also would include additional alternatives. This report is the product of that subsequent design study.

1.2 STUDY OBJECTIVES

Study objectives were:

- Perform a safety review of the corridor to identify issues that contribute to crashes, including those that involve pedestrians;
- Assess existing traffic conditions along the corridor;
- Identify and evaluate alternative pedestrian crossing treatments on Hal Greer Boulevard near Columbia Avenue and 13th Avenue;
- Identify other feasible pedestrian improvements that could be made along the study section of the corridor; and
- Provide information for coordination with stakeholders and the public.

1.3 METHODOLOGY FRAMEWORK

Data from several sources were collected at the beginning of the study to support the technical analyses and to provide information. The data included previous studies/evaluations, peak hour intersection turning movement counts and pedestrian crossing counts (collected by the WVDOH), average travel speed data (from the National Performance Measure Research Data Set), traffic signal timing plans, and crash records. Two field reviews also were conducted to document existing corridor conditions and to identify potential low-cost intersection improvements that can enhance pedestrian safety.

An analysis of existing conditions was performed. This included an analysis of crash records to identify potential causative factors. A multimodal level of service analysis was conducted to provide a baseline for comparison when evaluating the impacts of potential alternative

pedestrian crossing treatments on both automobile and pedestrian transportation modes. This evaluation was conducted using the Multimodal Urban Streets method as documented in the 2010 Highway Capacity Manual. The existing conditions analysis was replicated using microscopic traffic simulation (using TransModeler simulation software) to provide additional system-wide performance measures.

These analytical tools also were used to evaluate and compare anticipated traffic conditions for alternative pedestrian crossing treatments that were identified as candidates.

2.0 BASE CONDITION

2.1 CRASH ANALYSIS

Crash records for the study section of Hal Greer Boulevard were obtained for the three-year period from January 1, 2013 through December 31, 2015. A total of 20 crashes were reported; two of those crashes involved pedestrians, with one of those pedestrian crashes resulting in a fatality. A graphical summary of crashes by type is shown in **Figure 2**. A summary of the crashes by severity is shown in **Figure 3**. A map showing locations of all crashes, including the two auto-pedestrian crashes, is shown in **Figure 4**.

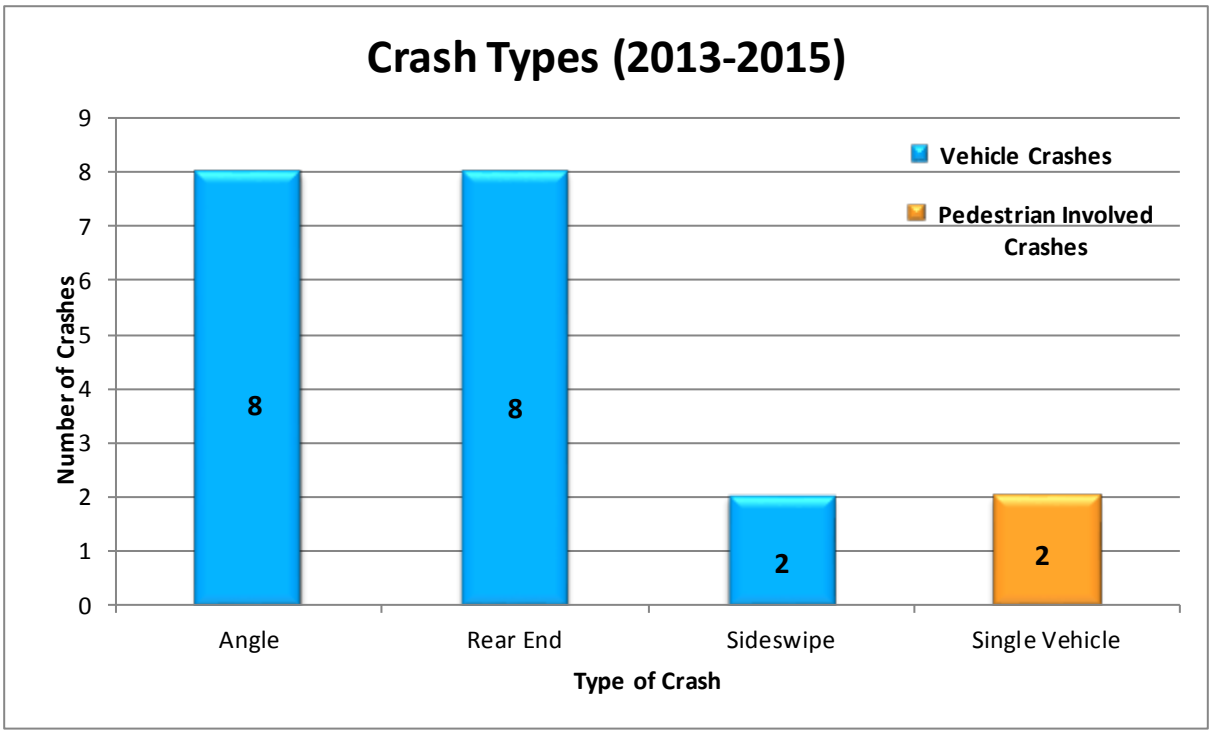


Figure 2. Summary of Crashes by Type

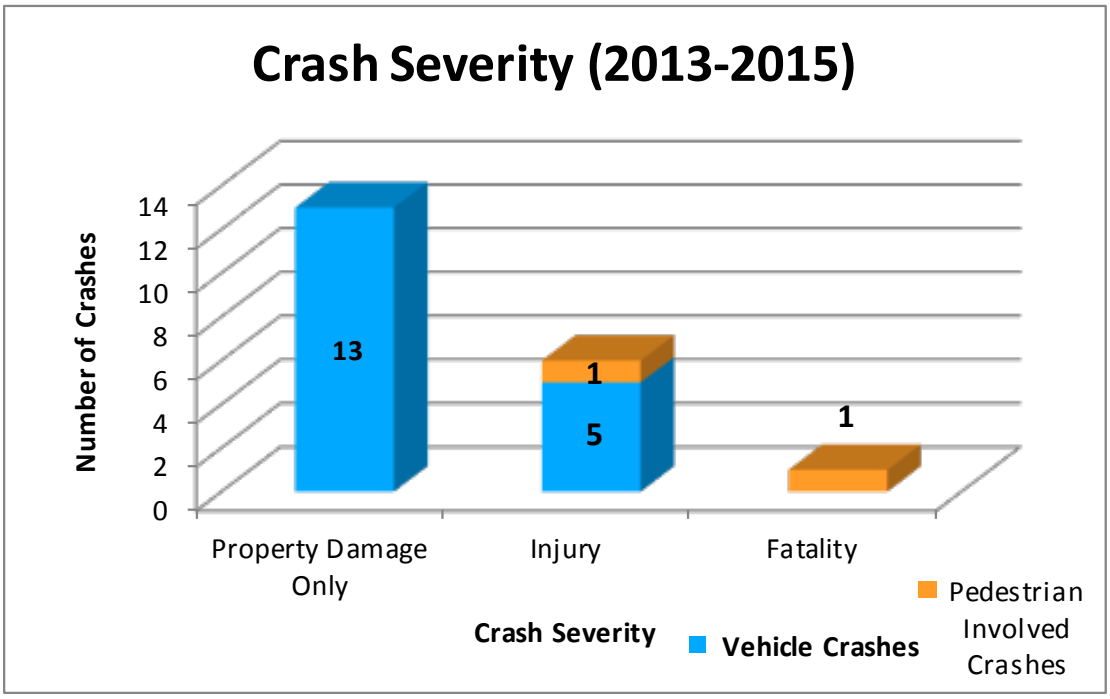


Figure 3. Summary of Crashes by Severity

Figure 4. Crash Locations

2.2 FIELD REVIEWS

Field reviews were conducted on two occasions. The purpose was two-fold: 1) identify deficiencies or factors that have a negative effect on pedestrian safety; and 2) identify short-term, low-cost improvements that can mitigate these negative impacts. Noted deficiencies from the field reviews include:

- Faded crosswalk delineation (**Figure 5**)
- Poles and features reducing available sidewalk width (**Figure 6**)
- Drop-offs at the back of sidewalks (**Figure 7**)
- Storm water inlets within the marked crosswalk (**Figure 8**)
- Five-lane urban section, in combination with relatively long signal spacing over some sections, that does not provide a pedestrian refuge in the center of the roadway (**Figure 9**).

Figure 5. Faded Crosswalk Delineation

Figure 6. Poles and Features Reducing Sidewalk Width

Figure 7. Drop-off's at the Backs of Sidewalks

Figure 8. Storm Water Inlets within Crosswalk

Figure 9. Lack of Pedestrian Refuge

Near the south end of the study section, at the intersection of Hal Greer Boulevard with Medical Center Drive and the entrance to McDonald's, there is no pedestrian crosswalk across the north leg of the intersection (**Figure 10**). The Cabell Huntington Hospital is located northeast of this intersection and there is a lot of pedestrian crossing activity between the hospital and the restaurant. The signal phasing at this location provides an exclusive pedestrian phase where all traffic is stopped and pedestrians may cross within the crosswalks, but the phase is long enough only to make one crossing per cycle. Thus, pedestrians traveling from the hospital to McDonald's must take three signal cycles to legally cross the street. This encourages illegal (and unsafe) pedestrian crossings at this location.

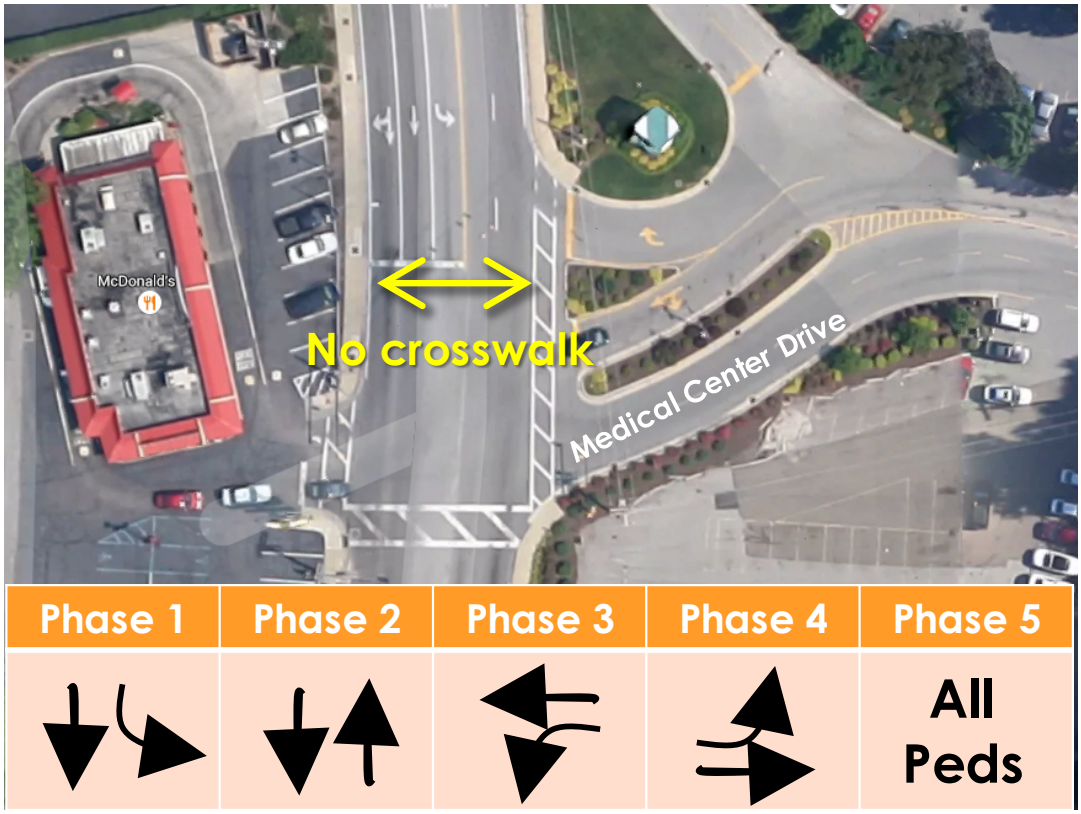


Figure 10. Exclusive Pedestrian Phase

2.3 TRAFFIC CONDITIONS

Two tools were used to evaluate the existing or base traffic conditions for Hal Greer Boulevard from 10th Avenue to Medical Center Drive. The Urban Streets method of the 2010 Highway Capacity Manual (HCM) was used to compute automobile performance measures (average travel speed, queue lengths, and level of service) and pedestrian level of service. Microscopic traffic simulation using TransModeler software was used to quantify system impacts along this same arterial section, including the impacts of pedestrian crossing activity on traffic flow (see Section 6).

Using the HCM methods, levels of service were computed for three modal elements of the Hal Greer Boulevard study section:

- Intersection Level of Service (LOS) is based on a volume-weighted average control delay (in seconds per vehicle) of all vehicles passing through the intersection during the analysis period.
- Arterial segment LOS is based on the average travel speed (each direction) as a percentage of the free-flow speed during the analysis period. Free-flow speed is defined as the average speed at which drivers will travel under low traffic volume conditions. The

more congested the street segment, the less likely drivers will be able to travel at the desired free-flow speed and the lower this metric (expressed as a percentage) will be.

- Pedestrian LOS as a function of average pedestrian space along sidewalks and at street corners, delay in crossing the street at signalized intersections, and difficulty in crossing the roadway mid-block.

The HCM Pedestrian LOS method provides a framework for evaluating the performance of an urban street facility in terms of its service to pedestrians. The method is applied separately to each side of the arterial. Factors that affect the computed LOS score include presence/absence of a sidewalk, total sidewalk width, presence or absence of a buffer (i.e. separation between pedestrians and the edge of the traffic lane, distance to the nearest signalized crossing, and legality of crossing mid-block (some communities prohibit mid-block crossings and actively enforce this prohibition). Additional factors affecting pedestrian LOS include proximity of buildings adjacent to the sidewalk, bus stops and street furniture, traffic (volume, composition, and speed), and presence of on-street parking (including the proportion occupied).

The Pedestrian LOS Score is correlated with an index; the association between LOS score and LOS is based upon traveler perception research. Travelers were asked to rate the quality of service associated with a specific trip along an urban street. Thus, the LOS score is similar to a customer satisfaction survey where consumers are asked to rate a product or experience according to "Very Satisfied", "Somewhat Satisfied," etc. The graphic in **Figure 11** illustrates the Pedestrian LOS Score and its stratification into Level of Service.

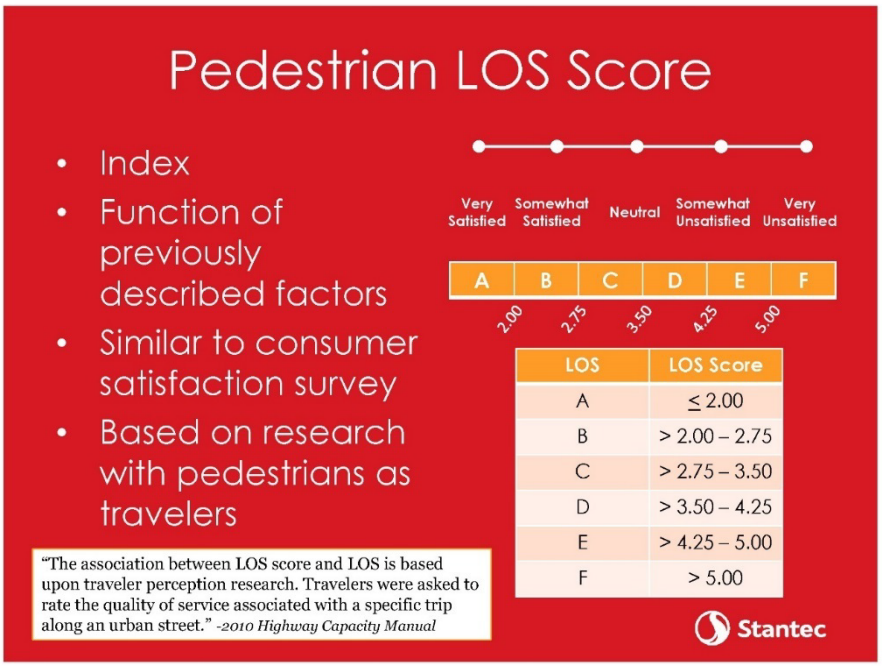


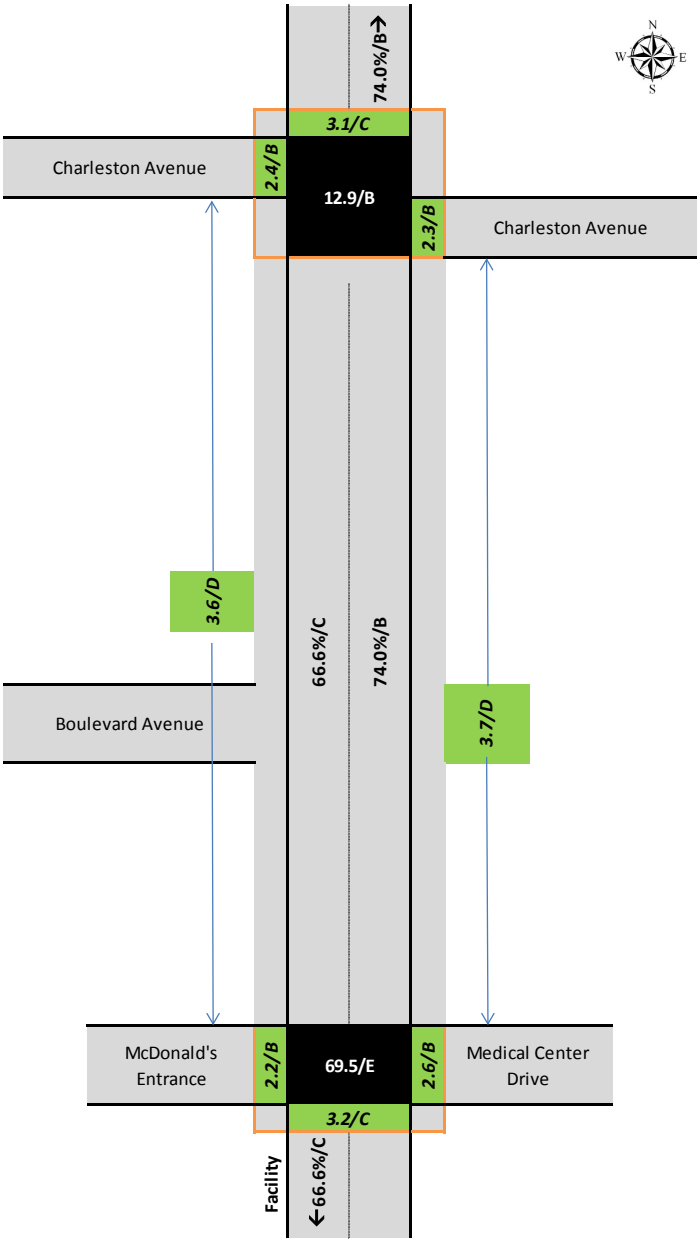
Figure 11. Pedestrian Level of Service Score

In March 2016, a new signal was installed and became operational at the intersection of Hal Greer Boulevard and Boulevard Avenue. The new installation, just south of the hospital main entrance, includes a pedestrian signal. This study was initiated in January 2016, prior to activation of the signal. Traffic conditions were evaluated before and after activation of the new signal to demonstrate the impact of the new traffic light on both auto and pedestrian level of service. The scenario before signal actuation is referred to as "Previous," while the "Base" scenario refers to the present condition with the signal being operational. It is the "Base" scenario against which future improvement alternatives were compared.

For all scenarios, based on data collected, traffic conditions were evaluated for representative weekday A.M. peak (occurring between 7:00 a.m. and 9:00 a.m.), mid-day peak (occurring between 11:30 a.m. and 1:30 p.m.), and P.M. peak (occurring between 4:00 p.m. and 6:00 p.m.) periods. The results are presented in a graphic format for which auto and pedestrian service measures and levels of service are shown. The arterial segment service measures and levels of service are shown for both northbound and southbound directions along Hal Greer Boulevard. Intersection control delay and level of service are volume-weighted averages for the overall intersection. Pedestrian LOS score and LOS are shown for delineated pedestrian crossings at intersections and for the mid-block segments along Hal Greer Boulevard.

For the Previous scenario, prior to construction of the new signal at Boulevard Avenue, results of the traffic analysis for the A.M., mid-day and P.M. peak periods are shown in **Figures 12 – 14**, respectively. Similarly, for the Base condition, which includes construction of the new signal at Boulevard Avenue, results of the traffic analysis for the A.M., mid-day and P.M. peak periods are shown in **Figures 15 – 17**, respectively.

Introduction of a new signal at Boulevard Avenue influences traffic flow along Hal Greer Boulevard, as this added "disruption" serves to reduce average travel speed and worsens vehicle levels of service. A big part of this disruption is due to the proximity of the Medical Center Drive intersection, about 500 feet to the south. Slowing down traffic does have a safety benefit, especially along this section that experiences a lot of pedestrian activity. The new signal also adds a protected pedestrian crossing of Hal Greer Boulevard; a crosswalk existed prior to the construction, but it was unsignalized.

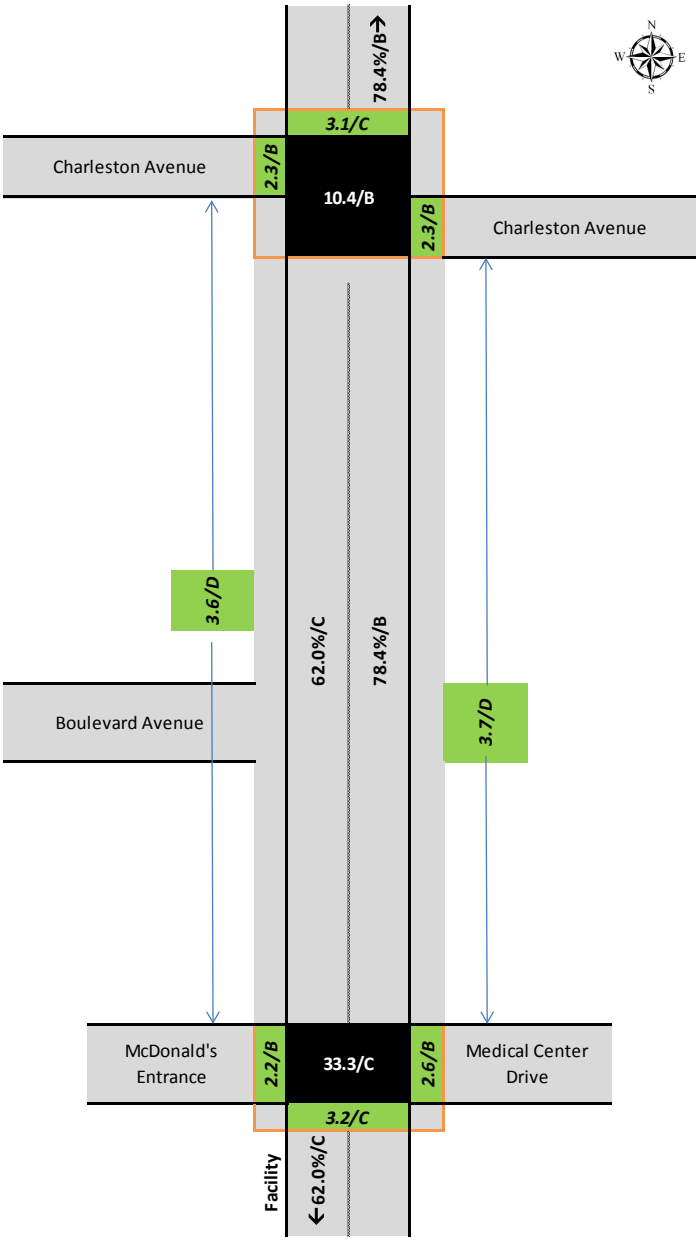


KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 12. Previous Conditions - A.M. Peak

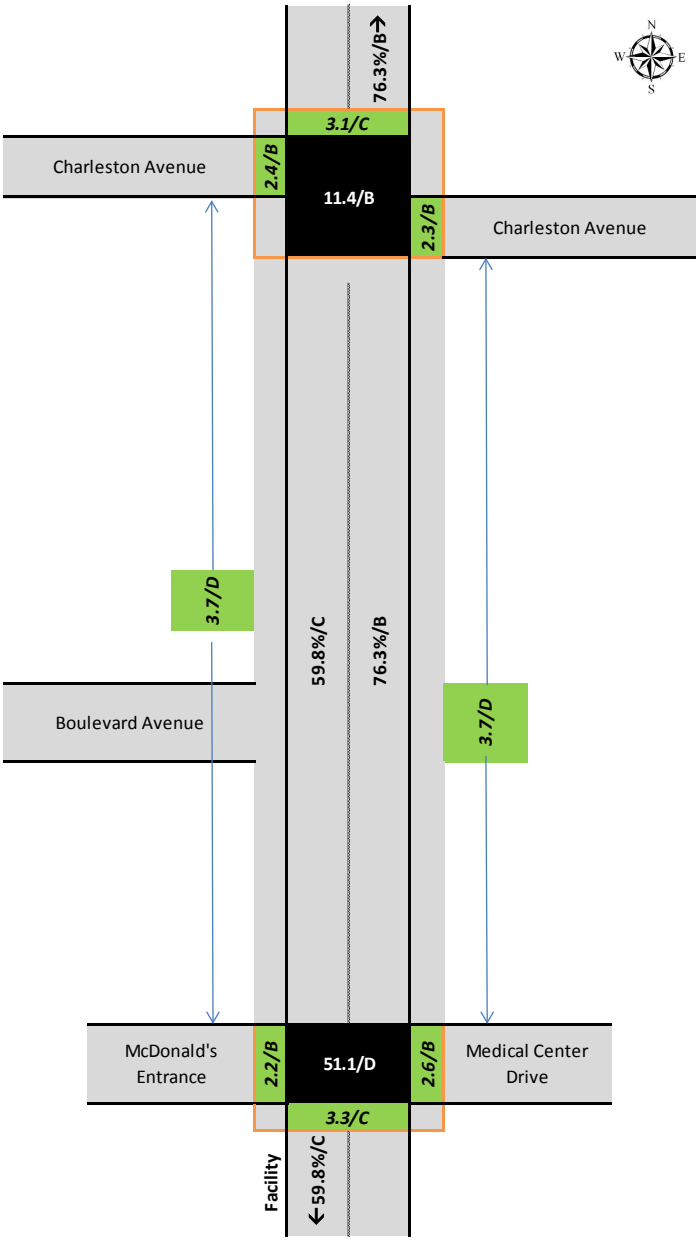


KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 13. Previous Conditions - Mid-Day Peak



KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 14. Previous Conditions - P.M. Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 15. Base Conditions - A.M. Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 16. Base Conditions - Mid-Day Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 17. Base Conditions - P.M. Peak

3.0 RECOMMENDED LOW-COST IMPROVEMENTS

Field reviews of the study corridor were conducted on January 5, 2016 and again on March 1, 2016. Objectives of the field reviews were to document site conditions and identify deficiencies for which short-term, relatively low-cost improvements could be identified.

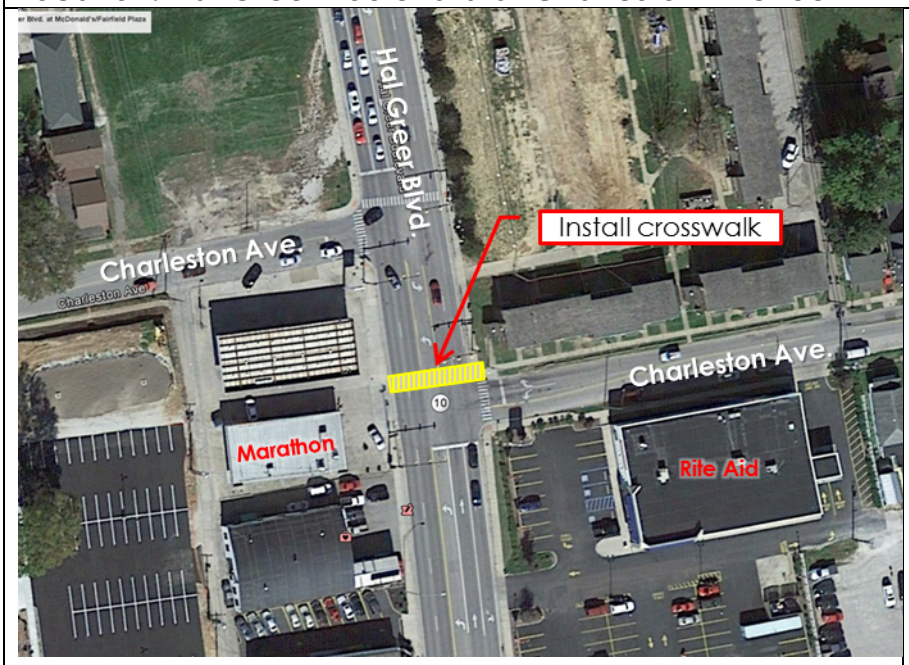
From the field review, two specific locations are noted where several deficiencies exist and where short-term improvement recommendations were made. Those two locations are:

- Hal Greer Boulevard at Charleston Avenue
- Hal Greer Boulevard at McDonald's entrance and Medical Center Drive

Existing deficiencies and low-cost, short-term improvement recommendations at Charleston Avenue are shown in **Figure 18**. Those for the intersection at McDonald's and Medical Center Drive are shown in **Figure 19**. Deficiencies not at these intersections (e.g. sidewalk drop-offs, storm sewer inlets in crosswalks, etc.) should be addressed as part of long-term master plan development efforts (to be discussed later in this report).

A multimodal LOS analysis was performed for the recommended low-cost improvements as a "package." The impacts those improvements for the weekday A.M. peak period are quantified and presented in **Figure 20**. For the mid-day and P.M. peak periods, those improvements are shown in **Figures 21** and **22**, respectively. Improved pedestrian safety would be the biggest benefit of the low-cost improvement, especially with respect relocation of crosswalks at McDonald's/Medical Center Drive and at Charleston Avenue. If signal timing was revised and pedestrian phases ran concurrently with parallel approach phases, delay at the McDonald's/Medical Center Drive intersection could be reduced significantly (improving LOS from D/E to B/C, depending on the time of day).

Location: Hal Greer Boulevard at Charleston Avenue



Issues

- Offset intersection that results in less efficient signal operation
- Crosswalk on north leg does not provide direct connection between activity generators (Marathon gas station/convenience store, Rite Aid Pharmacy, residential areas)
- No pedestrian crosswalk on south leg, which encourages crossings through the middle of this offset intersection

Opinion of Probable Cost for Design and Construction

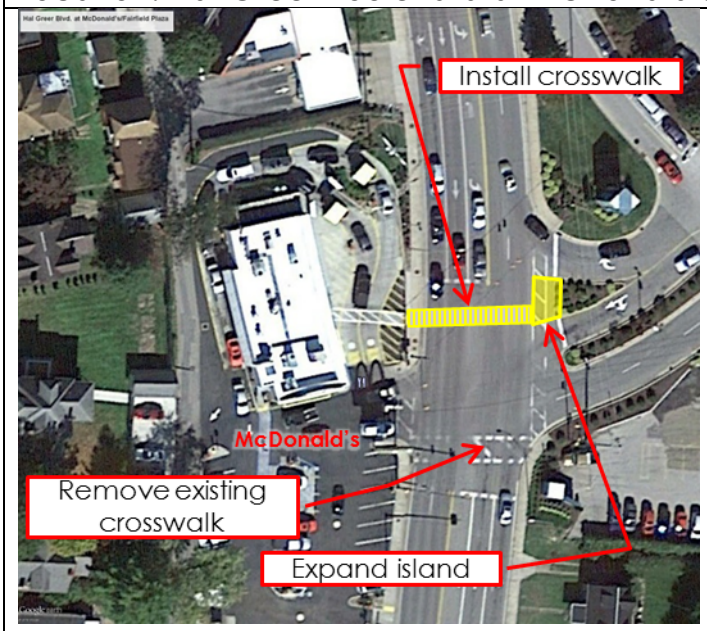
1. Crosswalk on South Leg = $4,000
2. Modify Signal Timing = $5,000 (Does Not Include Cost for Traffic Counts)
3. Total Cost = $9,000

Recommendations

- ☐ Install marked pedestrian crosswalk on south leg
- ☐ Modify signal timing to accommodate new crossing and corresponding pedestrian phases

Figure 18. Recommended Short-Term Improvements at Charleston Avenue

Location: Hal Greer Boulevard at McDonald's Entrance/Medical Center Drive



Issues

- Lack of compliance with Manual on Uniform Traffic Control Devices (MUTCD) requirements
  - Pedestrian pushbuttons not properly located
  - No pedestrian signal indications on west leg (McDonald's driveway)
  - No pedestrian WALK signal on east leg
- No marked crosswalk on north leg (closest to hospital) of intersection (pedestrians must cross 3 legs to get from hospital to McDonald's)
- Inefficient signal timing
  - Exclusive "scramble" phase where all pedestrian crossings occur at once
  - Pedestrians must wait through 3 full cycles to cross on pedestrian phases to get from hospital to McDonald's
- Right-Turn-on-Red (RTOR) conflicts with pedestrians on east leg

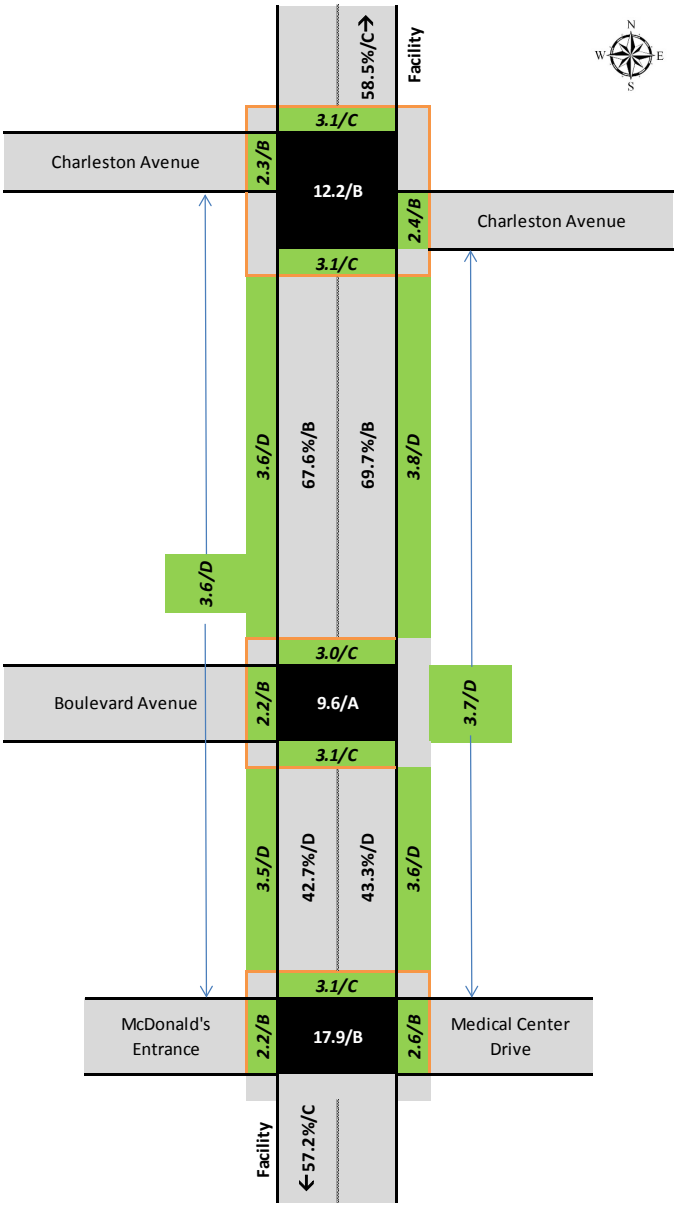
Opinion of Probable Cost for Design and Construction

1. Pedestrian Push Buttons and Countdown Pedestrian Signals on All Legs = $9,000
2. Crosswalk on North Leg = $4,000
3. Remove Crosswalk on South Leg = $2,000
4. Pedestrian Refuge Area on East Leg = $20,000
5. Modify Signal Timing = $5,000 (Does Not Include Cost for Traffic Counts)
6. Total = $40,000

Recommendations

- ☐ Add missing pedestrian signal and push buttons on west leg and replace existing pushbuttons in accordance with MUTCD requirements.
- ☐ Install marked pedestrian crosswalk on north leg
- ☐ Remove existing pedestrian crosswalk on south leg
- ☐ Expand island on east leg to include pedestrian refuge area
- ☐ Modify signal timing to eliminate pedestrian "scramble" phase and add pedestrian phases with corresponding traffic movement (serve the North-South crosswalks with North-South traffic and serve new crosswalk with East-West traffic)

Figure 19. Recommended Short-Term Improvements at Medical Center Drive

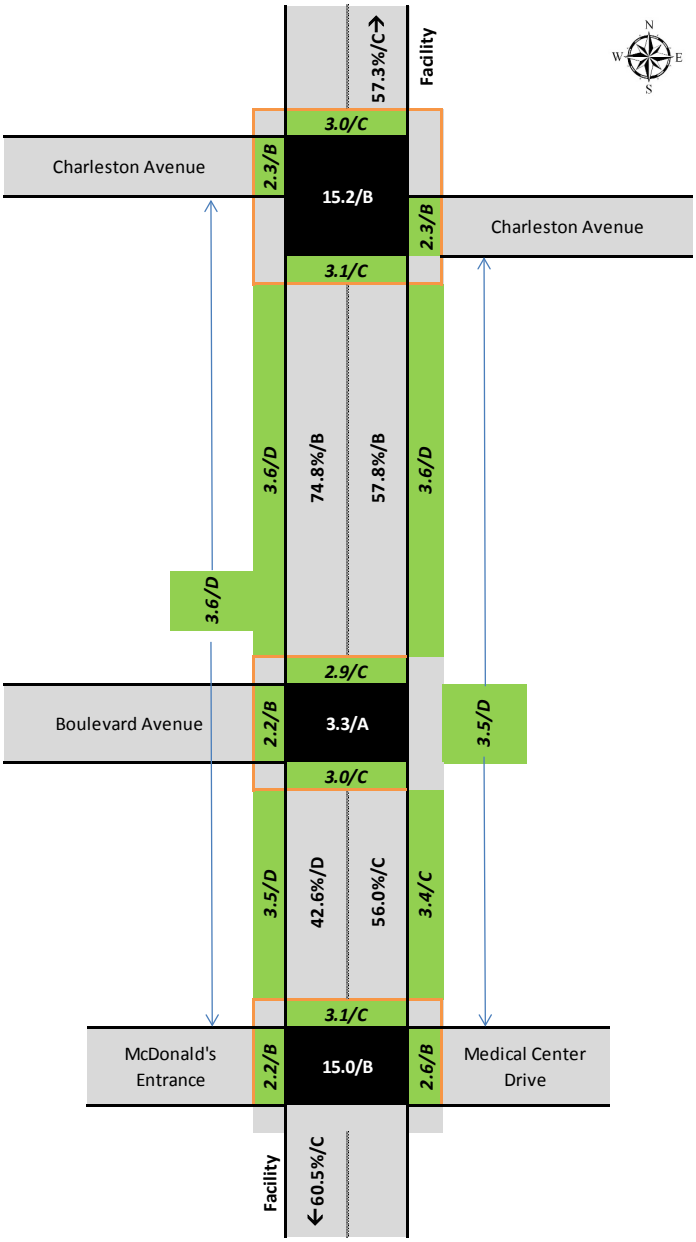


KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 20. Low-Cost Improvements – A.M. Peak



KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 21. Low-Cost Improvements – Mid-Day Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 22. Low-Cost Improvements – P.M. Peak

4.0 PEDESTRIAN CROSSING ALTERNATIVES

As stated on page 3 of this report, one of the objectives of this study was to examine alternatives for providing a new pedestrian crossing of Hal Greer Boulevard near Columbia Avenue and 13th Avenue, at the north end of the Cabell Huntington Hospital. There are frequent pedestrian crossings at this location, with no traffic control to accommodate them. Access from side streets is important at this location, especially as the access point to the Emergency Room is near these side streets.

Four candidate treatments were identified and are described below. Also discussed are the limitations to side street access associated with each treatment and an opinion of probable cost. A comparison of operational impacts is provided in the subsequent section.

4.1 DANISH CROSSING

The Danish Offset Pedestrian Crossing (also referred to as a split pedestrian crossover treatment or SPXO) has offset signals and crosswalks that allow pedestrians the opportunity to cross the halves of a divided street independently. The offset accommodates pedestrian storage in the median. Because the pedestrian signals operate independently from one another, they can be coordinated with signal timing for the arterial so that pedestrian calls are served only when gaps are available; the median storage area accommodates waiting pedestrians while auto platoons pass. Examples of a Danish Crossing, including a conceptual sketch of how it would be applied to Hal Greer Boulevard, are shown in **Figure 23**.

With this treatment, left turns to and from Columbia Avenue and 13th Avenue are blocked; these side streets provide right-in/right-out access only. Side streets parallel to Hal Greer Boulevard – namely Elm Street and 14th or 15th streets – must be used to relocate these left turning movements to other side streets. Also, the pedestrian actuation calls should be coordinated with northbound and southbound flow on Hal Greer Boulevard so that they do not retard progression of traffic platoons.

The opinion of probable cost for design and construction for a Danish Crossing at this location is $175,000.

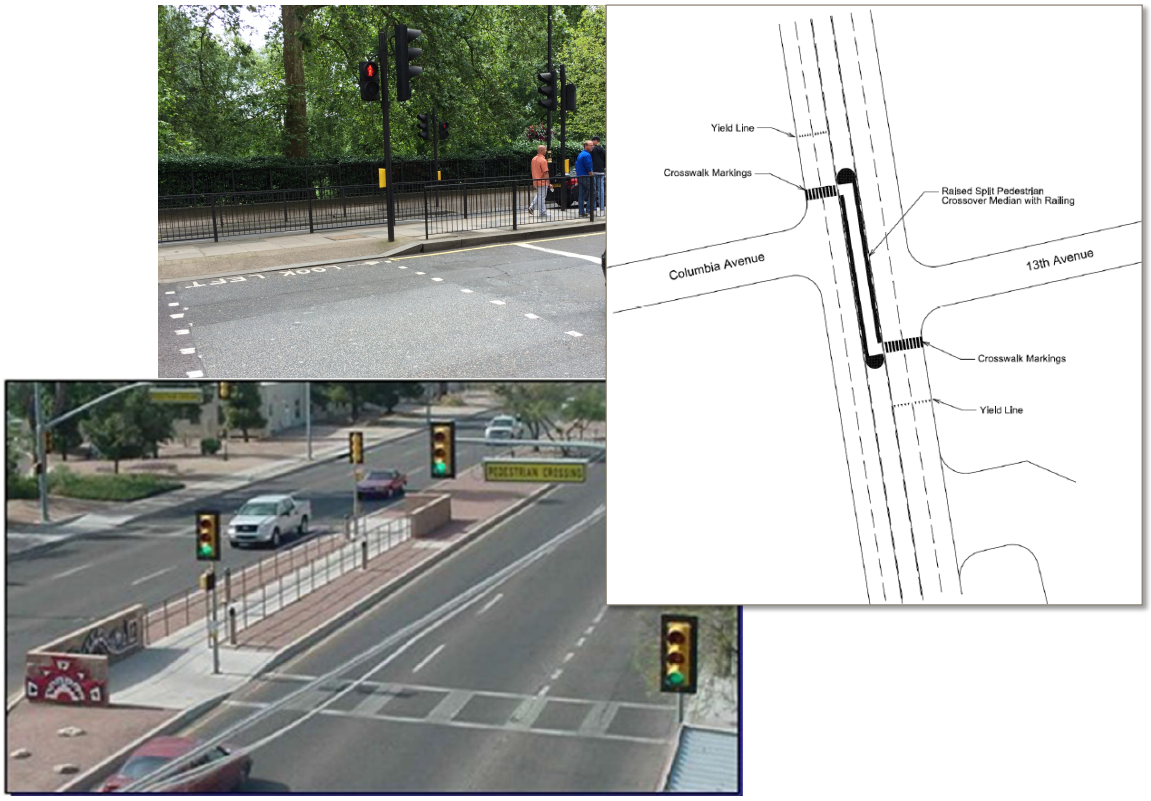


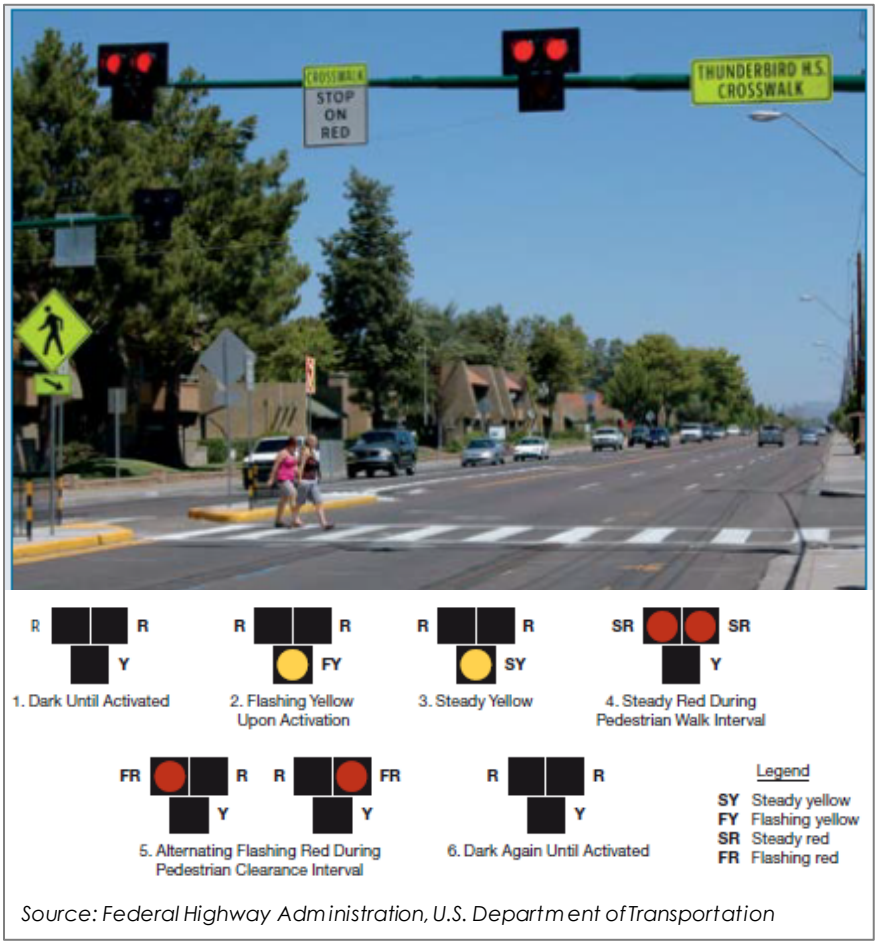
Figure 23. Danish Offset Pedestrian Crossing

4.2 PEDESTRIAN HYBRID BEACON

Another option examined was a Pedestrian Hybrid Beacon (PHB). This includes the High intensity Activated crossWalK (HAWK) signal. The PHB is similar to a European signal (PELICAN) that was imported to the U.S. and adapted to increase motorists' awareness of pedestrian crossings at uncontrolled marked crosswalks. According to the Federal Highway Administration, PHBs are becoming increasingly popular with state and local transportation agencies to fill the gap between unprotected crosswalks and full traffic signals to serve pedestrians.

A PHB along Hal Greer Boulevard would be located somewhere in the vicinity of Columbia Avenue, 13th Avenue, and the access to the Emergency Room. If preferred, further study if this option is needed to identify the specific location of this treatment. Turning volumes into and out of the side streets is a factor. An example PHB and phasing scheme is shown in **Figure 24**.

The opinion of probable cost for design and construction for a PHB at this location is $100,000.



Source: Federal Highway Administration, U.S. Department of Transportation

Figure 24. Pedestrian Hybrid Beacon (PHB)

4.3 NEW SIGNAL AT COLUMBIA AVENUE/13TH AVENUE

This option involves construction of a conventional traffic signal at Columbia Avenue and 13th Avenue; though the side streets are offset, this would operate as one intersection, similar to the offset intersection with Charleston Avenue to the north. The intersection would include crosswalks and pedestrian signals, and should be coordinated with existing signals along Hal Greer Boulevard.

Multiple signal warrant studies at this location have been conducted in the past, including one performed as part of this study. Warrants for justifying traffic signal installation are set forth in the *Manual on Uniform Traffic Control Devices*. A summary output report from that analysis is provided in Appendix A. The analysis shows that no major warrants are satisfied, but two of the minor warrants (Warrant 6: Coordinated Signal System and Warrant 7: Crash Experience) are met.

The opinion of probable cost for design and construction for a signal at this location is $150,000.

4.4 RAISED MEDIAN

A final alternative that was identified was the construction of a raised median along Hal Greer Boulevard from just north of the Emergency Room entrance drive to just south of 12th Avenue (see **Figure 25**). A raised median is not a pedestrian crossing treatment; in this case, it can be considered as an alternative to a Danish Crossing, providing a pedestrian refuge and allowing for two-stage crossing of Hal Greer Boulevard. The limits of the median are constrained by the Emergency Room driveway and parking garage access to south, and 12th Avenue to north. As with the Danish Crossing, left turns to and from Columbia Avenue and 13th Avenue would be prohibited. The median should be constructed with a mountable curb to accommodate traversal by emergency vehicles, should the need arise.

The opinion of probable cost for design and construction and design for a signal at this location is $75,000.

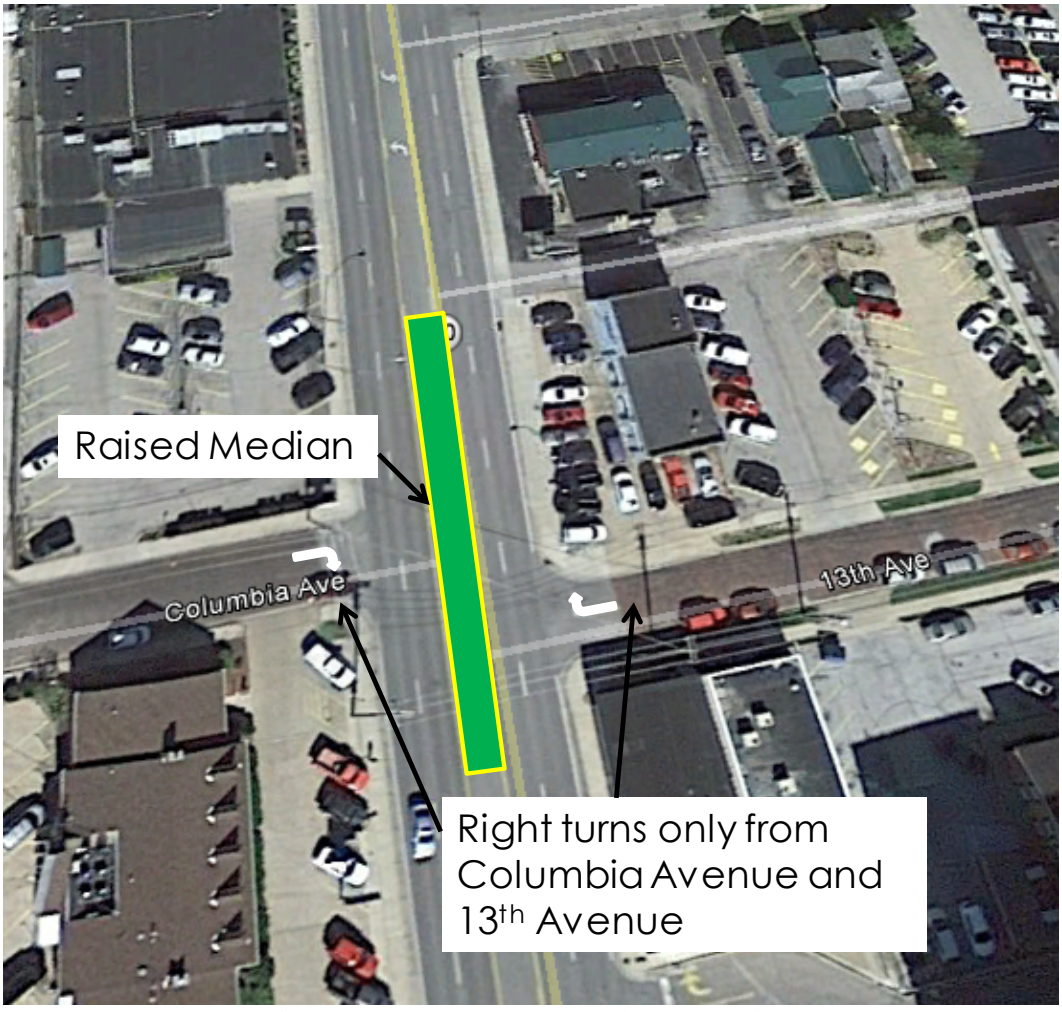


Figure 25. Conceptual Raised Median

5.0 MULTIMODAL COMPARISON OF ALTERNATIVES

Using the aforementioned methods in the 2010 Highway Capacity Manual, a multimodal comparison of the "build" alternatives is provided. Average weekday A.M. peak, mid-day and P.M. peak period intersection, arterial street segment, and pedestrian performance measures and levels of service for the Danish Crossing are provided in **Figures 26-28**, respectively. For a Pedestrian Hybrid Beacon (PHB), similar measures are shown in **Figures 29-31**.

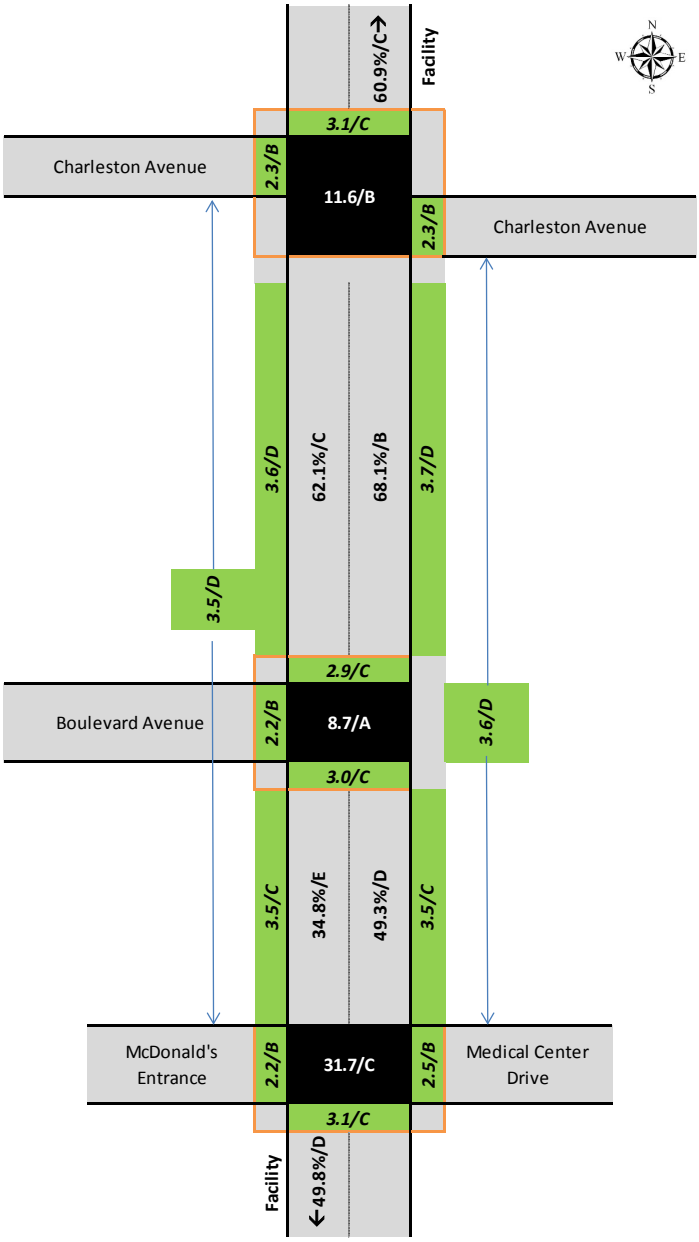
Associated A.M. peak, mid-day and P.M. peak period performance measures for a new signal at Columbia Avenue and 13th Avenue are shown in **Figures 32-34**, respectively. For the raised median, these metrics are shown in **Figures 35-37**.

Because the traffic signal at Boulevard Avenue has been installed and is operational, the "Previous Conditions" scenario should be considered for informational purposes only. In other words, comparison of pedestrian crossing alternatives with this scenario is not logical. Moving forward, the Base Condition, with the new signal at Boulevard Avenue, should be the basis for comparison among the various alternatives.

Introduction of the new signal at Boulevard Avenue does serve to slow down traffic, in part because of its proximity to the Medical Center Drive/McDonald's intersection, located about 500 feet to the south. While this additional signal does reduce travel speeds, given the adjacent land use and high pedestrian volumes, the argument can be made that slower speeds are more desirable from a safety perspective.

None of the alternatives is projected to seriously degrade auto performance further when compared with the base condition. Those involving signals – the Danish Crossing, Pedestrian Hybrid Beacon (PHB), and conventional traffic signal – do provide some additional disruption to traffic flow, but the disruption can be mitigated by coordinating those signals with the others along the corridor. The biggest benefit of those alternatives involving new signals is that there are more "protected" opportunities to cross Hal Greer Boulevard.

In urban areas with high pedestrian activity, it has been WVDOH practice to employ a pedestrian-only phase as part of signal operations. For this exclusive "ped" phase, all vehicular traffic is stopped while pedestrians are allowed to cross all approach legs concurrently. In terms of vehicular delay, signal operations are less efficient when this exclusive ped phase is used. The tradeoff is better pedestrian safety along with the increased delay. The downside to using an exclusive ped phase is it can take multiple cycles for pedestrians to cross an intersection diagonally (e.g. from the northeast corner to the southwest corner), as the ped phase duration usually allows only one leg to be crossed per cycle. At the McDonald's/Medical Center Drive intersection with Hal Greer Boulevard, for pedestrians walking between the hospital and the restaurant, it requires three full signal cycles for pedestrians to make this journey legally (i.e. crossing only during the ped phase).



KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 26. Danish Crossing – A.M. Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 27. Danish Crossing – Mid-Day Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

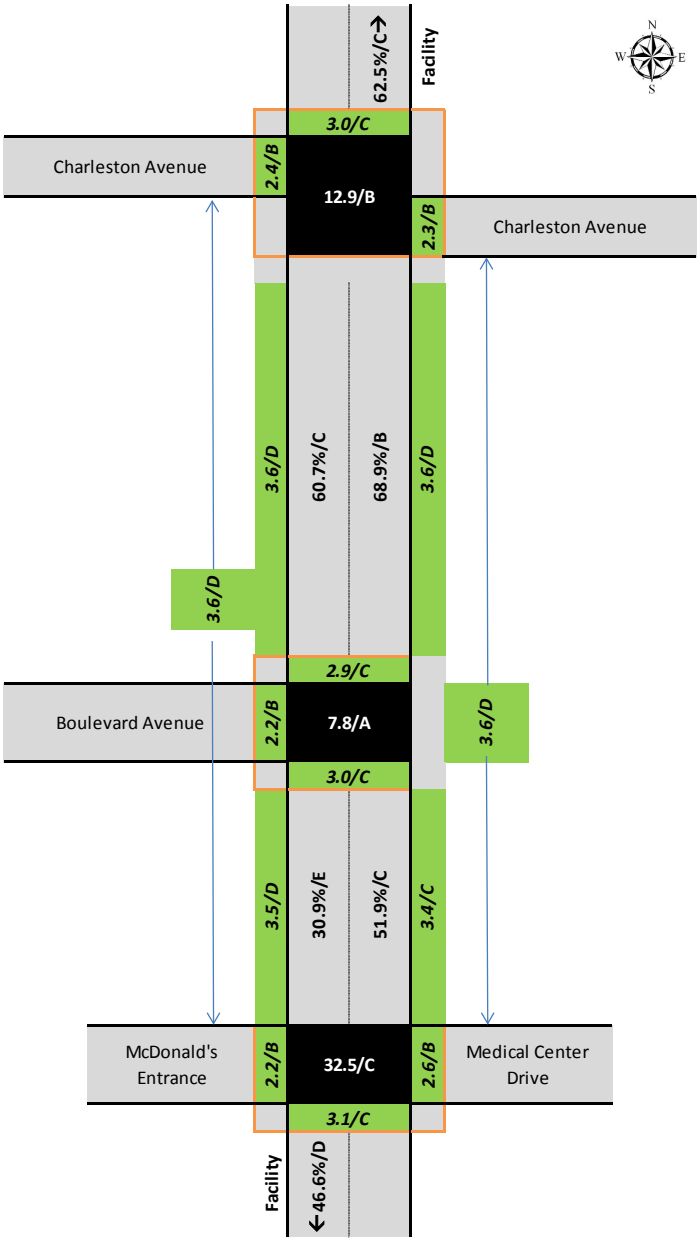
Figure 28. Danish Crossing – P.M. Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 29. Pedestrian Hybrid Beacon – A.M. Peak



KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

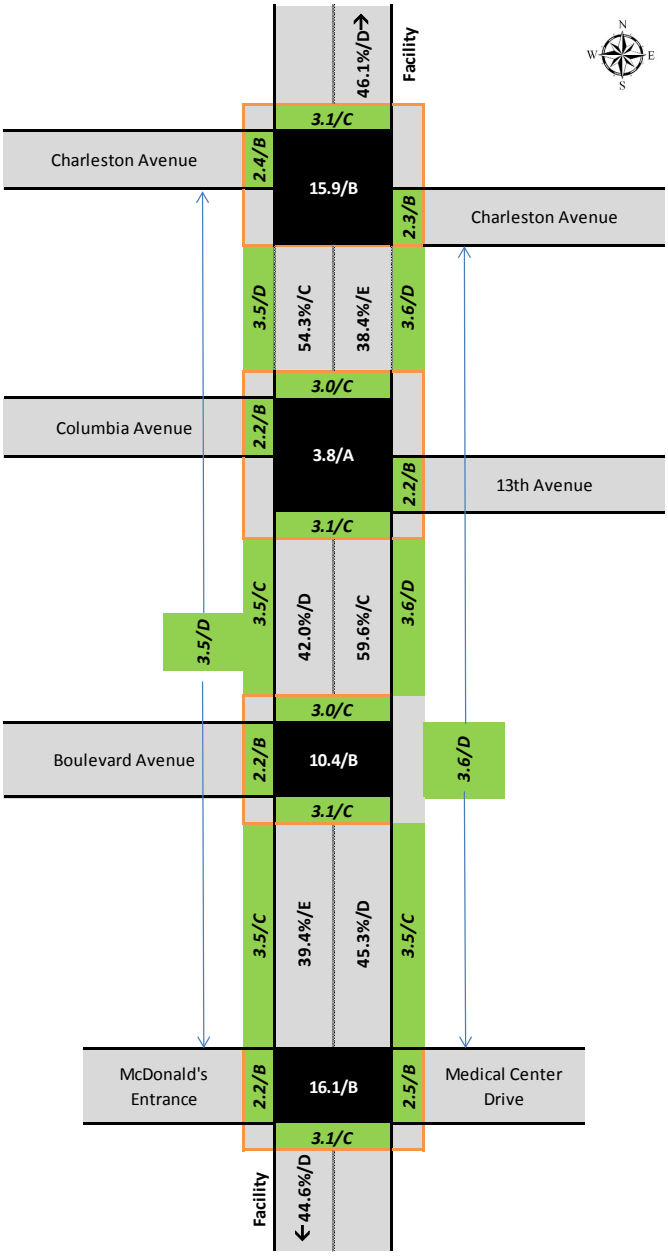
Figure 30. Pedestrian Hybrid Beacon – Mid-Day Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 31. Pedestrian Hybrid Beacon – P.M. Peak

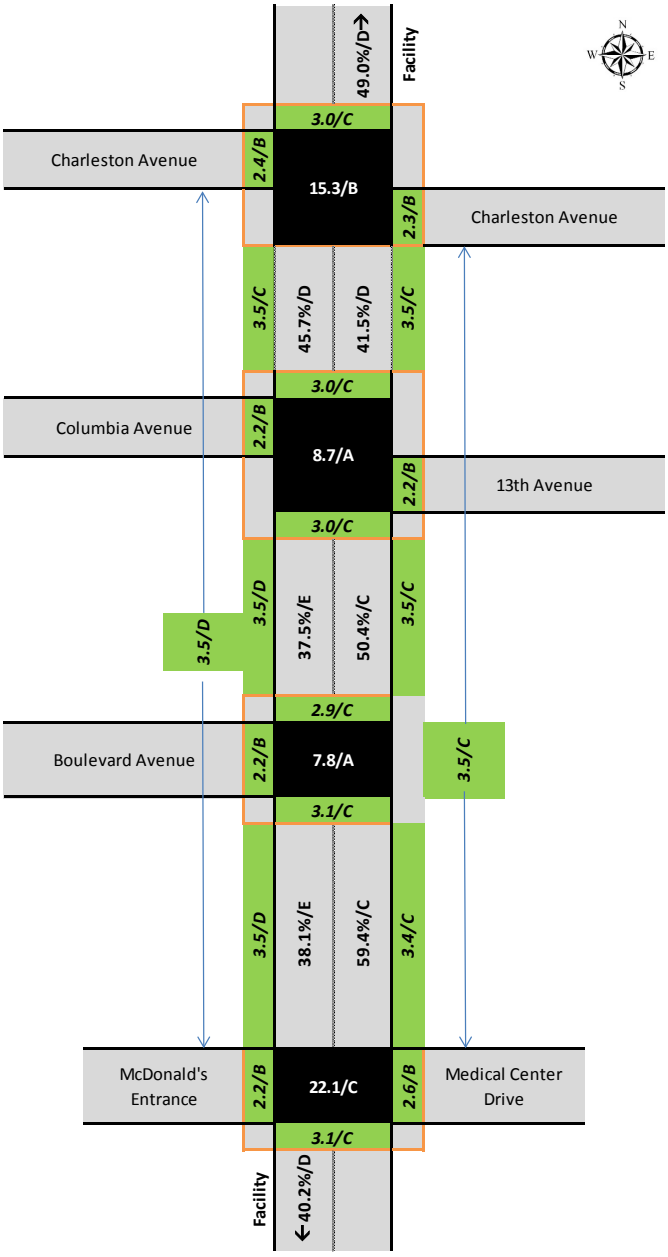


KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 32. New Signal Installation – A.M. Peak

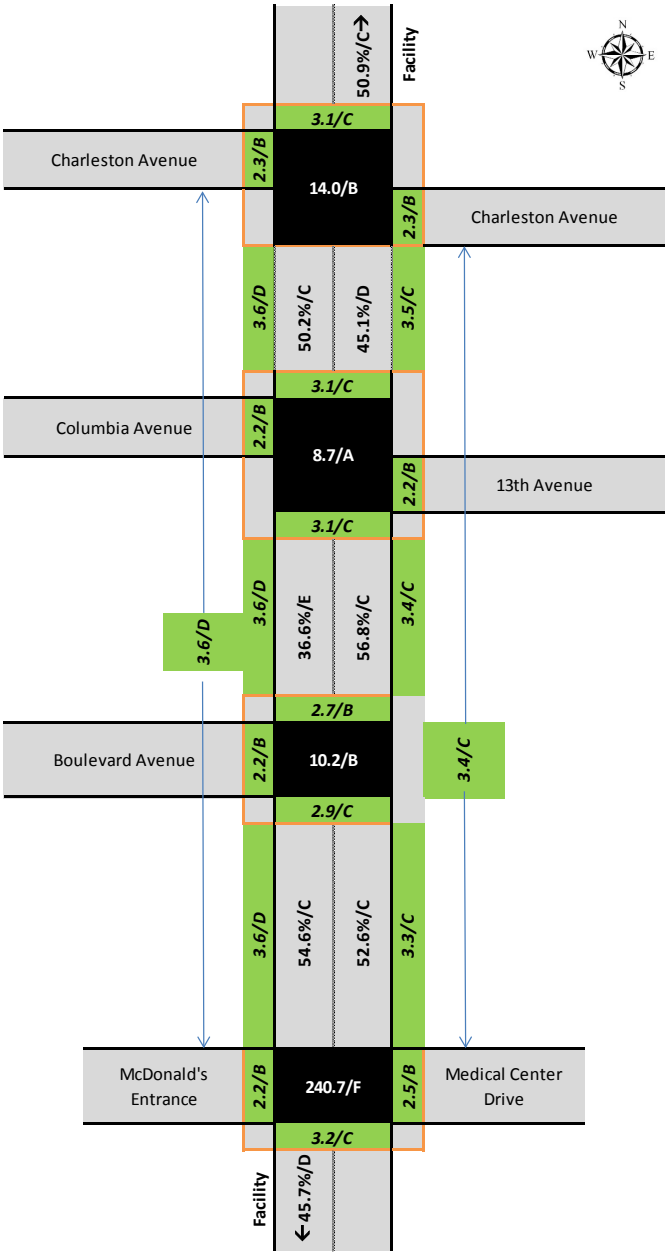


KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 33. New Signal Installation – Mid-Day Peak



KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 34. New Signal Installation – P.M. Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 35. Raised Median – A.M. Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 36. Raised Median – Mid-Day Peak

KEY

26.0/C	Intersection Delay (sec/veh)/Level of Service
2.6/B	Pedestrian LOS Score/Level of Service
49.2%/E	Arterial Pct. Base FFS/Level of Service

Level of Service, LOS	Intersection Control Delay (sec/veh)	*Ped. LOS Score*	Arterial Pct. of Base FFS
A	≤ 10	≤ 2.00	> 85
B	> 10 - 20	> 2.00 - 2.75	> 67 - 85
C	> 20 - 35	> 2.75 - 3.50	> 50 - 67
D	> 35 - 55	> 3.50 - 4.25	> 40 - 50
E	> 55 - 80	> 4.25 - 5.00	> 30 - 40
F	> 80	> 5.00	≤ 30

Figure 37. Raised Median – P.M. Peak

For the alternative introducing a new traffic signal at Columbia Avenue and 13th Avenue, an exclusive pedestrian phase was not assumed; pedestrian crossings were incorporated in the more traditional method, concurrently parallel with the auto phases and with the minimum green times being set to accommodate pedestrian walk times.

6.0 SIMULATION MODEL RESULTS

The study section of Hal Greer Boulevard, including the alternative pedestrian crossing treatments, also was evaluated using microscopic traffic simulation software (TransModeler). Using the same traffic volume and pedestrian count inputs, ten simulation runs were performed for each time period for each scenario, averages were calculated, and the results were compiled.

The simulation software is multimodal in that it does simulate the impacts from other travel modes on auto traffic flow, but it does not produce measures of effectiveness for those other modes (e.g. pedestrian LOS). It is auto-centric. The software does produce system-wide auto performance measures that allow for a comparison of alternatives at the overall level; i.e. for the study section of Hal Greer Boulevard as a whole. For those alternatives eliminating left turns (Danish Crossing and Raised Median), the simulation model diverted this traffic to adjacent streets for access to Hal Greer Boulevard.

Reported system-wide measures of effectiveness include vehicle-miles traveled (VMT), vehicle-hours of travel (VHT), average delay (in vehicle-hours), and average travel speed. A system-wide VMT comparison among alternatives is provided in **Figure 38**. System-wide VHT and average delay comparisons are provided in **Figures 39** and **40**, respectively. A comparison of overall average travel speeds among alternatives is provided in **Figure 41**.

The simulation results illustrate that the P.M. peak period represents the heaviest travel demand and the greatest differences in performance measures among the alternatives. At face value, it appears that the Low Cost improvements offer the greatest benefit to traffic operations. This apparent benefit must be qualified. The Low Cost improvements assume conventional pedestrian phasing at signalized intersections, concurrent with parallel traffic movements. The existing study section signalized intersections employ an exclusive pedestrian phase, which increases delay at these locations. The Low Cost improvements alternative optimizes signal timing to minimize delay while accommodating the pedestrian crossings.

Additional facility-based performance measure summaries are included in **Appendix B**. These include intersection delay and LOS, average travel times, and 95th-percentile queue lengths.

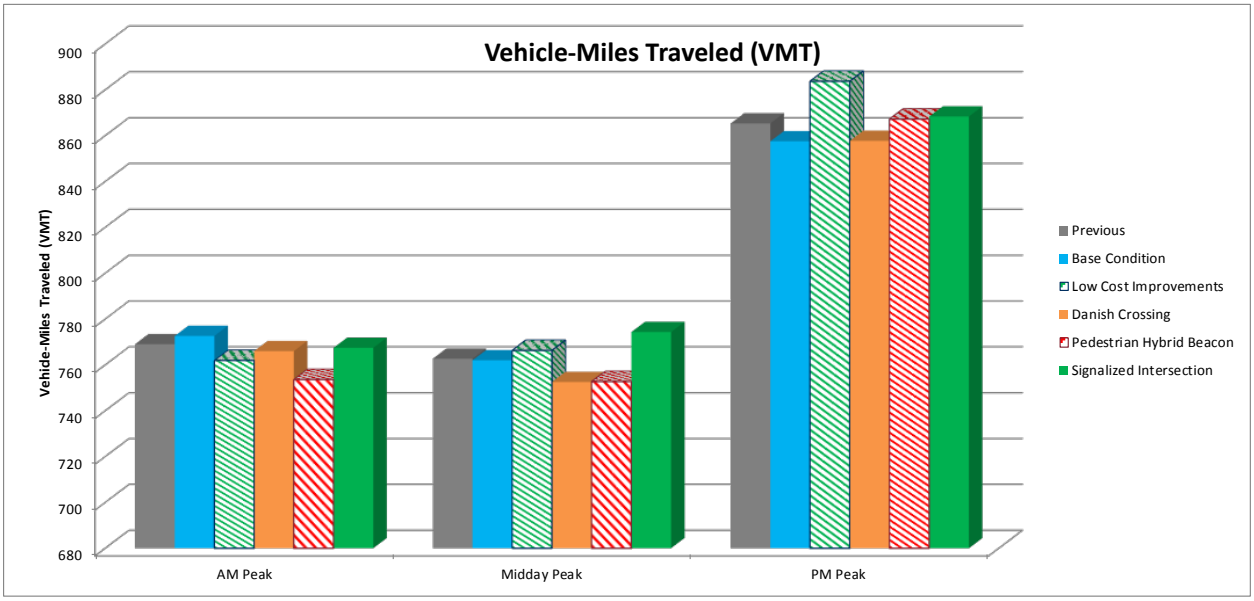


Figure 38. System-wide Vehicle-Miles Traveled (VMT) Comparison

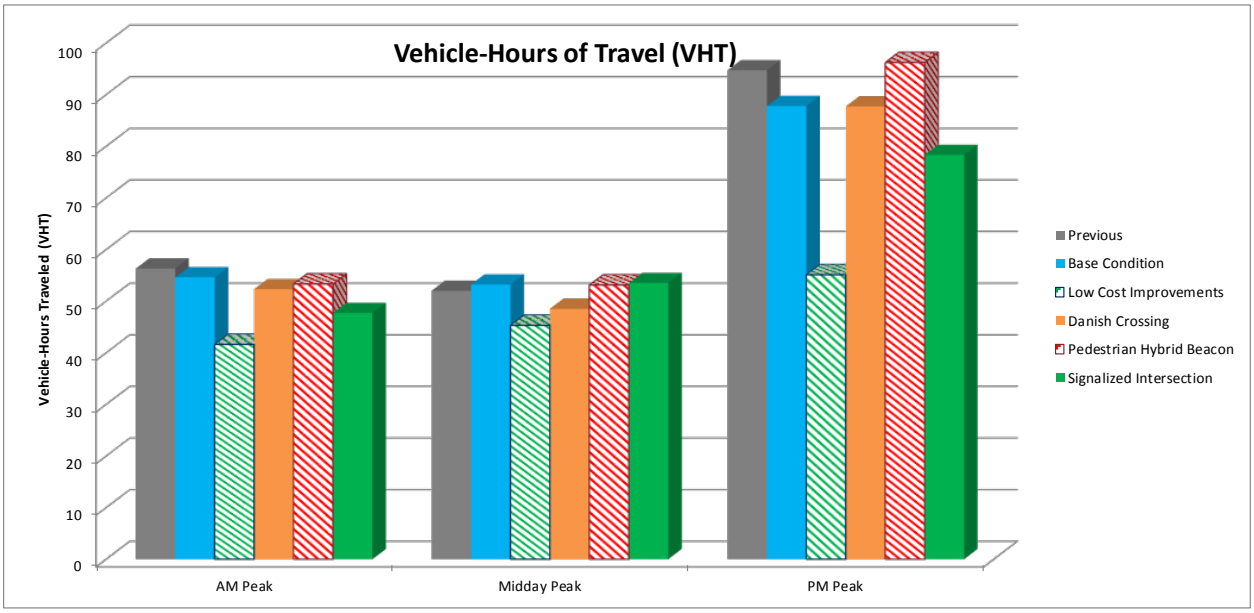


Figure 39. System-wide Vehicle-Hours of Travel (VHT) Comparison

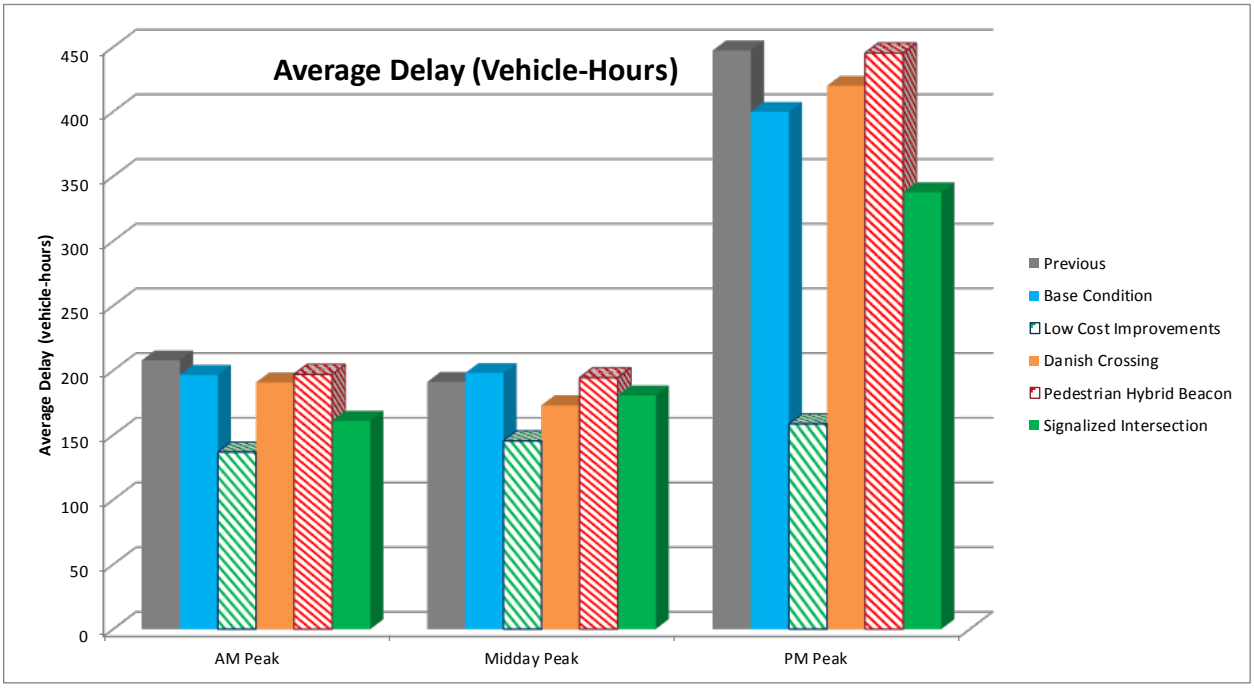


Figure 40. System-wide Average Delay Comparison

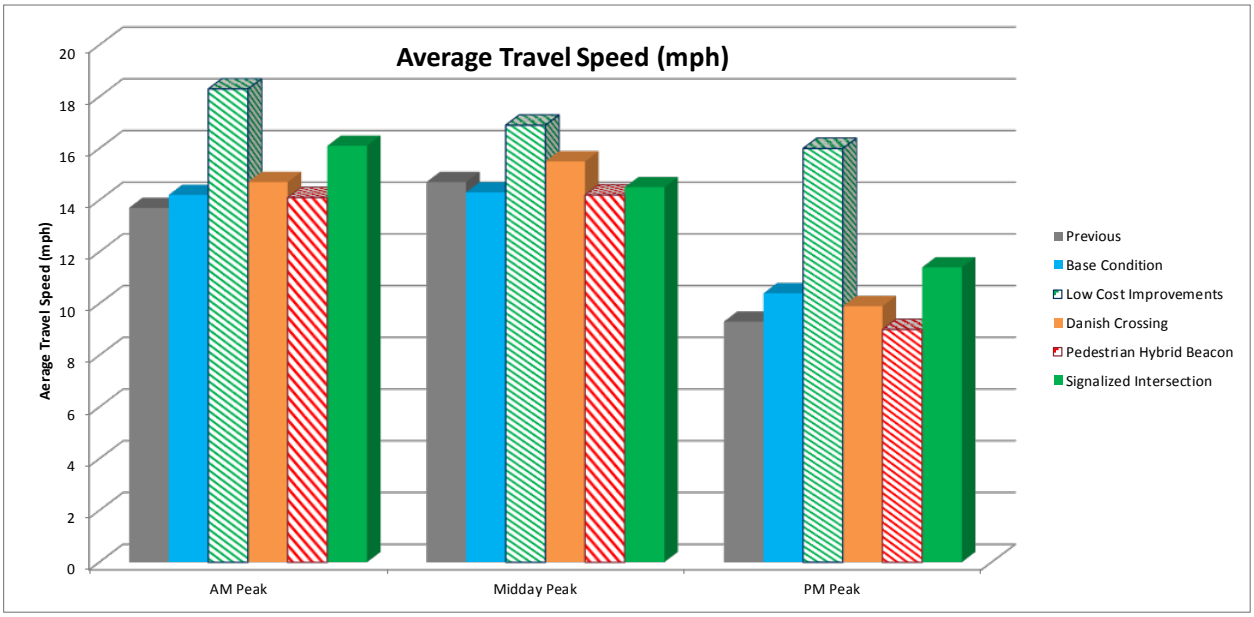


Figure 41. System-wide Average Travel Speed Comparison

7.0 EVALUATION AND COMPARISON SUMMARY

The Low-Cost Improvements offer short-term, easily implementable, relatively low-cost actions that should provide immediate benefits. One recommendation, to optimize signal timing plans, involves eliminating the exclusive pedestrian phases that currently exist at Charleston Avenue, Boulevard Avenue, and McDonald's/Medical Center Drive. It is the practice of WVDOH to incorporate exclusive pedestrian phases in urban areas where there is high pedestrian activity. Given the character of Hal Greer Boulevard, which serves as a key multimodal corridor connecting downtown with Interstate 64, this can be seen as a dilemma; the exclusive pedestrian phases are intended to enhance safety, but that also increase delay and congestion. In most major metropolitan areas, pedestrian phases at signalized intersections are run concurrently with parallel approach phases. If it is the desire of WVDOH to stay with this practice for Hal Greer Boulevard, then the operational benefits associated with the Low-Cost Improvements could not be fully achieved.

Two of the improvements – the Danish Crossing and the Pedestrian Hybrid Beacon – constitute mid-block pedestrian signals. According to the Manual on Uniform Traffic Control Devices, "A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants … or at a location that meets traffic signal warrants … but a decision is made to not install a traffic control signal." The MUTCD does not contain warrants for a Danish Crossing. For either alternative to be considered further, it is important that West Virginia statutes be consulted to ensure such type of treatment is allowed.

A new conventional traffic signal at Columbia Avenue and 13th Avenue was the only alternative where the evaluation methods used were sensitive enough to discern any significant, quantifiable impact. This is not to say that the other alternatives had no impact; rather, the tools available simply were not able to detect any noticeable differences. As mentioned previously, a warrant analysis indicated that only minor warrants justifying the signal were met; the major, traffic volume-based warrants were not. When modeled as a signalized intersection, it was demonstrated that disruption to traffic flow along Hal Greer Boulevard would be minimal.

For those alternatives eliminating left turns (Danish Crossing and Raised Median), it was assumed that traffic movements to and from Hal Greer Boulevard would divert to adjacent streets and that no traffic would relocate to another corridor. The traffic analyses of these alternatives incorporated this assumed diversion.

In summary, beyond the low-cost improvements that were identified from the field reviews, any of the alternatives examined would be expected to improve pedestrian safety with a minimal additional disruption to traffic flow. Other factors such as cost, warrants for installation, prohibiting or limiting statutes, and stakeholder desires are expected to play a role in the final decision.

Later in 2017, a study will be undertaken to develop a corridor master plan for all of Hal Greer Boulevard, from Interstate 64 to 3rd Avenue. This will include the section that was the subject of this pedestrian safety study. Decisions made for the master plan study should be made in consideration of the analysis and findings of this multimodal study. Similarly, decisions made related to this project should consider that the issue will be revisited at a more encompassing level in the near future.

8.0 PUBLIC INPUT

Stakeholder support for improvements to pedestrian safety was documented at the beginning of this report. A public meeting was held on October 4, 2016 to gather public input concerning possible improvements to Hal Greer Boulevard in the vicinity of Columbia Avenue and 13th Avenue. Comments were received on three general alternatives: #1 No Build (this is the same as the Base Scenario for this study, where the signal at Boulevard Avenue has been installed already), #2 Danish Crossing, and #3 Traffic Signalization. The raised median alternative evaluated in this study was not presented at the meeting.

A total of 27 comments were received and a summary of those responses is contained in a letter from WVDOH to the City of Huntington, presented in **Appendix C**. Preferences from the survey were widespread – the majority were in favor of doing nothing, but there was also support for the Danish Crossing and for a pedestrian overpass. Also in this appendix is a letter from the City to WVDOH stating its support for the Danish Crossing alternative.

APPENDICES

Appendix A SIGNAL WARRANT ANALYSIS FOR HAL GREER BOULEVARD AT COLUMBIA AVENUE/13TH AVENUE

Warrants Summary

Information

Analyst	AW		
Agency/Co	Stantec	Intersection	Hal Greer Blvd & Columbia/13th
Date Performed	9/29/2016		
Project ID		Jurisdiction	
East/West Street	Columbia Avenue/13th Street	Units	U.S. Customary
		Time Period Analyzed	
	Hal Greer and	North/South Street	Hal Greer Blvd
File Name	Columbia_13th Signal Warrant_TwelveHours.xhy	Major Street	North-South

Project Description

General				Roadway Network	
Major Street Speed (mph)	35	☐	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	500	☑	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	6	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	0	1	0	0	1	0	1	2	0	1	2	0
Lane usage		LTR			LTR		L	TR		L	TR	
Vehicle Volume Averages (vph)	12	3	41	20	1	22	42	553	25	20	574	13
Peds (ped/h) / Gaps (gaps/h)	--	14 / 0	--	--	16 / 0	--	--	4 / 0	--	--	8 / 0	--
Delay (s/veh) / (veh-hr)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 (80%) Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☐
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 3: Peak Hour	☐
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 4: Pedestrian Volume	☐
4 A. Four Hour Volumes --or--	☐
4 B. One-Hour Volumes	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☑
6. Degree of Platooning (Predominant direction or both directions)	☑
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐

7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☑
7 C. (80%) Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐
Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐
Warrant 9: Grade Crossing	☐
9 A. Grade Crossing within 140 ft --and--	☐
9 B. Peak-Hour Vehicular Volumes	☐

HCS 2010™ Version 6.65 Generated: 9/30/2016 7:55 AM

Appendix B ADDITIONAL SIMULATION MODEL PERFORMANCE MEASURES

A.M. Peak Average Control Delay and Level-of-Service

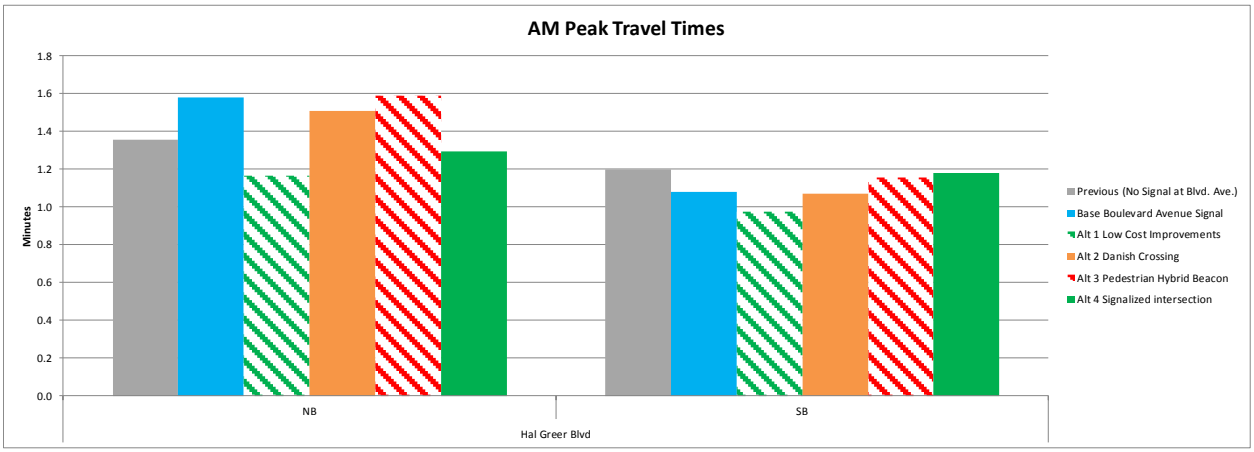
Intersection	Previous		Base Condition		Low Cost Improvements		Danish Crossing		Pedestrian Hybrid Beacon		Signalized Intersection	
	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS
Hal Greer Blvd at:												
Charleston Avenue (north)	8	A	9	A	8	A	9	A	8	A	8	A
Charleston Avenue (south)	10	B	15	B	10	B	12	B	11	B	9	A
Boulevard Avenue			8	A	4	A	7	A	8	A	8	A
Medical Center Drive	42	D	29	C	11	B	29	C	28	C	17	B

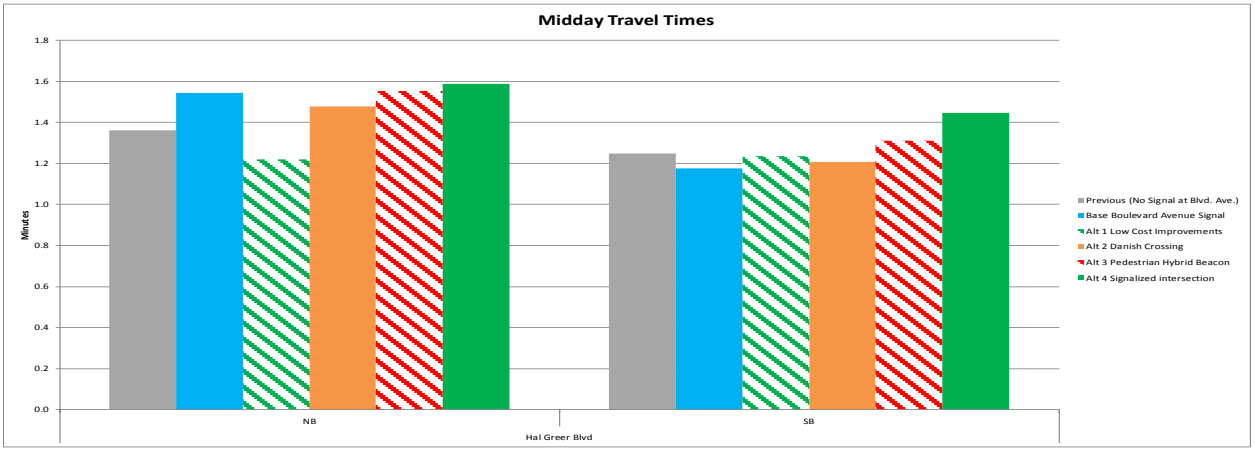
Midday Peak Average Control Delay and Level-of-Service

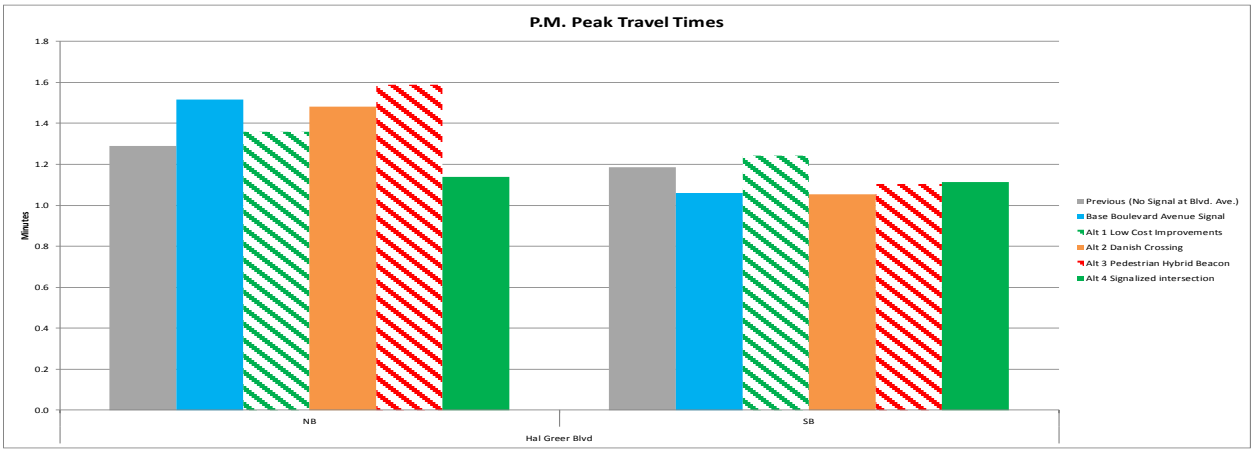
Intersection	Previous		Base Condition		Low Cost Improvements		Danish Crossing		Pedestrian Hybrid Beacon		Signalized Intersection	
	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS
Hal Greer Blvd at:												
Charleston Avenue (north)	11	B	11	B	12	B	11	B	11	B	10	B
Charleston Avenue (south)	10	B	13	B	10	B	11	B	10	B	12	B
Boulevard Avenue			7	A	6	A	6	A	8	A	10	B
Medical Center Drive	32	C	24	C	11	B	22	C	23	C	17	B

P.M. Peak Average Control Delay and Level-of-Service

Intersection	Previous		Base Condition		Low Cost Improvements		Danish Crossing		Pedestrian Hybrid Beacon		Signalized Intersection	
	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS	Avg. Delay	LOS
Hal Greer Blvd at:												
Charleston Avenue (north)	11	B	11	B	12	B	11	B	11	B	11	B
Charleston Avenue (south)	9	A	13	B	12	B	10	B	11	B	7	A
Boulevard Avenue			7	A	9	A	6	A	7	A	5	A
Medical Center Drive	40	D	21	C	12	B	23	C	22	C	15	B


AM Peak Travel Times
Minutes
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
NB
SB
Hal Greer Blvd
Previous (No Signal at Blvd. Ave.)
Base Boulevard Avenue Signal
Alt 1 Low Cost Improvements
Alt 2 Danish Crossing
Alt 3 Pedestrian Hybrid Beacon
Alt 4 Signalized intersection


Midday Travel Times
Minutes
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
NB
SB
Hal Greer Blvd
Previous (No Signal at Blvd. Ave.)
Base Boulevard Avenue Signal
Alt 1 Low Cost Improvements
Alt 2 Danish Crossing
Alt 3 Pedestrian Hybrid Beacon
Alt 4 Signalized intersection


P.M. Peak Travel Times
Minutes
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
NB
SB
Hal Greer Blvd
Previous (No Signal at Blvd. Ave.)
Base Boulevard Avenue Signal
Alt 1 Low Cost Improvements
Alt 2 Danish Crossing
Alt 3 Pedestrian Hybrid Beacon
Alt 4 Signalized intersection

A.M. Peak 95th Percentile Queue Length

Intersection	Previous		Base		Low Cost Improvements		Danish Crossing		Pedestrian Hybrid Beacon		Signalized Intersection	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
Hal Greer at:												
Charleston Avenue (north)	52	129	58	128	50	124	77	135	47	122	49	118
Charleston Avenue (south)	209	37	204	38	150	46	206	33	189	48	148	42
Boulevard Avenue			157	79	84	83	130	78	125	111	155	130
Medical Center Drive	300	363	295	166	163	25	304	145	279	144	183	128

Midday Peak 95th Percentile Queue Length

Intersection	Previous		Base		Low Cost Improvements		Danish Crossing		Pedestrian Hybrid Beacon		Signalized Intersection	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
Hal Greer at:												
Charleston Avenue (north)	52	139	53	149	49	143	70	146	54	137	46	135
Charleston Avenue (south)	168	24	189	31	141	31	188	33	166	29	192	27
Boulevard Avenue			83	103	85	125	98	75	105	149	175	178
Medical Center Drive	168	194	197	103	123	25	236	95	196	112	128	201

P.M. Peak 95th Percentile Queue Length

Intersection	Previous		Base		Low Cost Improvements		Danish Crossing		Pedestrian Hybrid Beacon		Signalized Intersection	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
Hal Greer at:												
Charleston Avenue (north)	52	157	52	155	50	160	62	160	53	159	45	161
Charleston Avenue (south)	185	29	203	42	177	33	198	25	169	34	139	34
Boulevard Avenue			78	143	88	241	75	142	79	175	88	127
Medical Center Drive	192	236	178	86	141	22	182	82	189	82	115	108

Appendix C PUBLIC INPUT

WEST VIRGINIA DEPARTMENT OF TRANSPORTATION

Division of Highways

1900 Kanawha Boulevard East • Building Five • Room 110
Charleston, West Virginia 25305-0430 • (304) 558-3505

Earl Ray Tomblin
Governor

Paul A. Mattox, Jr., P. E.
Secretary of Transportation/
Commissioner of Highways

January 9, 2017

The Honorable Steve Williams
Mayor
City of Huntington
Post Office Box 1659
Huntington, West Virginia 25717

Dear Mayor Williams:

The West Virginia Division of Highways (WVDOH), in partnership with the City of Huntington (City) and the KYOVA Interstate Planning Commission (KYOVA), conducted a public meeting on October 4, 2016 to gather public input concerning possible improvements to Hal Greer Boulevard in the vicinity of Columbia and 13th Avenues. The three general alternatives considered were: Alternative #1 (No-Build), Alternative #2 (Danish Crossing), and Alternative #3 (Traffic Signalization). We received your letter during the preparation of the project alternatives (see attached letter dated September 30, 2016) indicating the City's support and preference for Alternative #2. We are following up with the City on the comments received as a result of the public meeting.

Public comments were taken through November 8, 2016. The WVDOH received a total of 27 public comments regarding the initiative, with a breakdown as follows:

- Nine (9) responses in favor of Alternative #1 (No-Build),
- Six (6) responses (including yours) in favor of Alternative #2 (Danish Crossing),
- One (1) response in favor of Alternative #3 (Traffic Signalization), and
- Eleven (11) responses received were in favor of a different course of action or non-committal to any alternative.

With regards to the 11 responses that favored something other than the three (3) primary alternatives presented at the public workshop, eight (8) responses advocated the construction of a pedestrian bridge and three (3) responses were non-committal to any specific action. The selection of any of the three (3) alternatives would not negate a decision to construct a pedestrian bridge in the future.

E.E.O./AFFIRMATIVE ACTION EMPLOYER

In light of the responses received during the public involvement process and the City's interest in the project, we want to make the City aware of the comments received and afford your office the opportunity to either reconfirm your support for the construction of a Danish Pedestrian Crossing or let the Agency know if your office desires to revise its position. The WVDOH is currently in the early stages of project development and thus, we are following up with the City as part of the project environmental review process.

The project is anticipated to now progress from a planning phase to the National Environmental Protection Act phase. The input received from the public meeting and the City will be further utilized as the project progresses through the environmental review process. Upon receipt of your letter, a review of potential funding sources for the environmental review and potential project development, including the possibility of completing an application to KYOVA for funding, will be completed.

We look forward to hearing from you in this matter. Should you have any questions, please contact Mr. Robert C. Watson, P. E., Regional Planning Engineer with our Planning Division, at (304) 558-9623 or by email at Robert.C.Watson@wv.gov.

Very truly yours,

C. Elwood Penn, IV, P. E.
Acting Director, Planning Division

CEP:WI

Attachment

cc: KYOVA

Mayor Steve Williams
City of Huntington

March 10, 2017

C. Elwood Penn, IV, P.E.
Acting Director, Planning Division
WV Department of Transportation
Division of Highways
1900 Kanawha Boulevard East
Building Five, Room 110
Charleston, WV 25305-0430

Dear Mr. Penn,

In response to your letter dated January 9, 2017 regarding the public input concerning the possible improvements to Hal Greer Boulevard in the vicinity of Columbia and 13th Avenues, the City of Huntington still supports Alternative #2 (Danish Crossing).

I look forward to hearing from you regarding the next steps in this process.

Sincerely,

Steve Williams
Mayor, City of Huntington, WV

SW/ab

– I can't thank you enough for all you have done to help us with this!

cityofhuntington.com
Mayor Steve Williams @huntingtonmayor
P.O. Box 1659 | Huntington, WV 25717 | p 304.696.5540 | f 304.696.4493