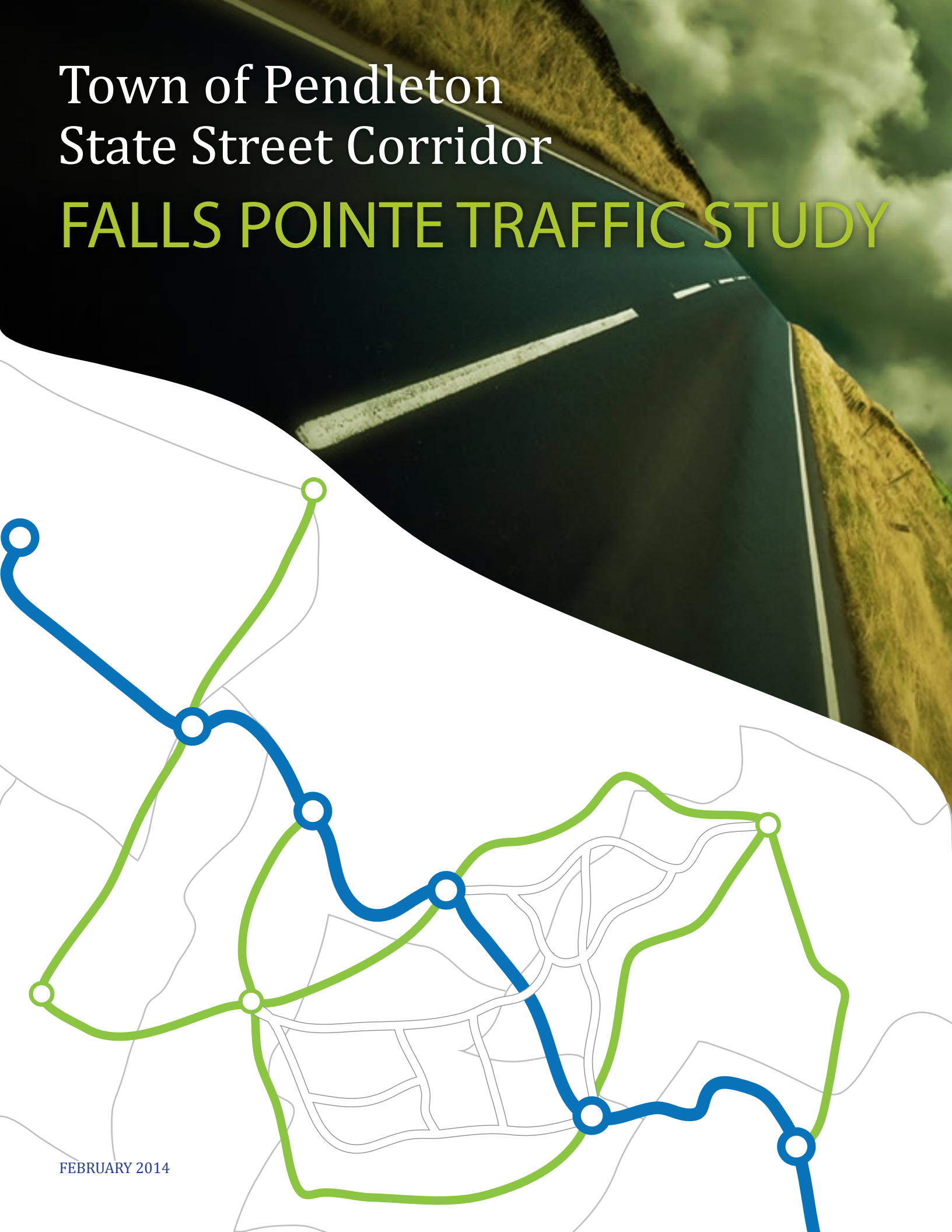


# Town of Pendleton State Street Corridor

## FALLS POINTE TRAFFIC STUDY



FEBRUARY 2014

This report was prepared by:



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This report was prepared for:



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# INTRODUCTION

Pendleton, Indiana is a town located in southwest Madison County, Indiana. As of the 2010 U.S. Census, Pendleton had a population 4,253 persons. Pendleton is strategically located at the nexus of several major state highways. Notably, Pendleton is situated along two major growth corridors in the MCCOG Metropolitan Planning Area: Interstate 69 and Indiana State Route 67.

State Street is currently functionally classified as a minor arterial, representing the 2nd highest arterial designation in the Federal Highway Administrations classification standards. While this makes the road more important when it comes to federal funding prioritization when compared to functionally classified collectors (local streets are not eligible for federal aid), it does not receive as much priority as roads which are classified as Principal Arterials or part of the National Highway System (NHS).

Nonetheless, State Street is important because it connects people and places. The State Street Corridor connects the western edge of Pendleton with the eastern edge of Pendleton. State Street connects Interstate 69 with State Route 67 via Downtown Pendleton. The facility serves as the road that carries the most east-west volume, and thus is of significant importance for the Town of Pendleton. The importance of this corridor will increasingly become more important for mobility and accessibility as this part of the metropolitan region grows and expands.

The State Street Corridor is owned by two entities: The State of Indiana (via the Indiana Department of Transportation) and the Town of Pendleton. West of Interstate 69 and east of Indiana State Route 67, State Street is part of Indiana State Route 38. Between Interstate 69 and Indiana State Route 67, the corridor is owned by the Town of Pendleton. This brings with it several considerations when planning for growth and change along the corridor, notably the need to coordinate and cooperate with the State of Indiana to ensure that the corridor is in line with the future vision of what Pendleton will become. The Madison County Council of Governments is an important resource for coordination between the Town of Pendleton and the Indiana Department of Transportation, and should be utilized to take advantage of long-range planning resources and future federal funding opportunities. MCCOG is the federally designated authority for metropolitan transportation planning authorized in the most recent highway bill, Moving Ahead for Progress in the 21st Century (MAP-21).

The State Street corridor has some unique characteristics, and has begun to experience increased traffic volumes making it necessary to consider upgrading this facility from rural highway standards to urban arterial standards. Of immediate concern is the perception of traffic congestion occurring near Exit 219 where State Street and Interstate 69 meet. This location is significant because it contains the Falls Pointe Business Park, which is horizontally mixed-use with retail, light industrial, and multi-family housing. The area is characterized by a high volume of truck traffic and intersections which are too closely spaced together, which will have significant traffic impacts in the future if not corrected now. At the request of the Town of Pendleton, the Madison County Council of Governments Transportation Planning Department initiated a traffic study of the current conditions and likely future scenarios. The Madison County Council of Governments gave a summary of their findings to the Pendleton Town Council on January 2nd, 2014.

# CURRENT PATTERNS AND TRENDS

## Traffic Volume Focus Areas



This study has a primary focus on the traffic patterns that currently exist in the Falls Pointe Business Park. These are grouped into 5 Focus Areas, which represent areas of significant interest for future transportation planning considerations.

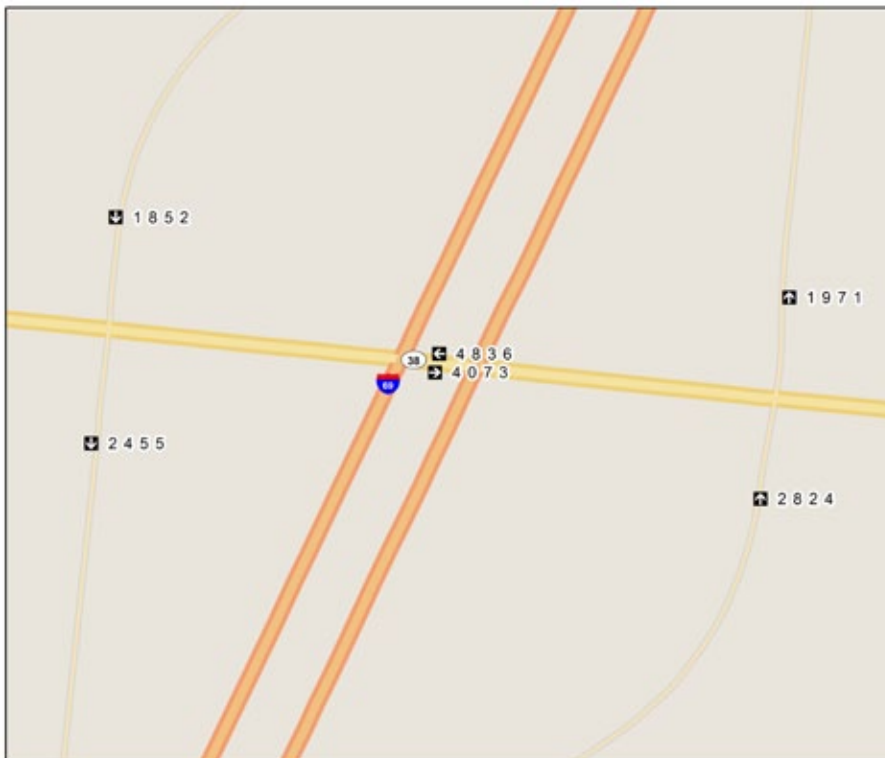
The 5 focus areas are (presented in clockwise fashion):

Focus Area #1: Exit 219 Interchange, Focus Area #2: State Street. & Enterprise Drive, Focus Area #3: State Street & Heritage Way, Focus Area #4: Heritage Way and Focus Area #5: Enterprise Drive.

The Interstate 69 Exit 219 is the primary interchange for the Town of Pendleton, and is crucial to the economic success of not only the Falls Pointe Business Park, but also the entire Town of Pendleton. Maintaining efficient traffic operations through this gateway is important because this interchange connects Pendleton to not only the greater Indianapolis metropolitan area, but also to the national and international economy.

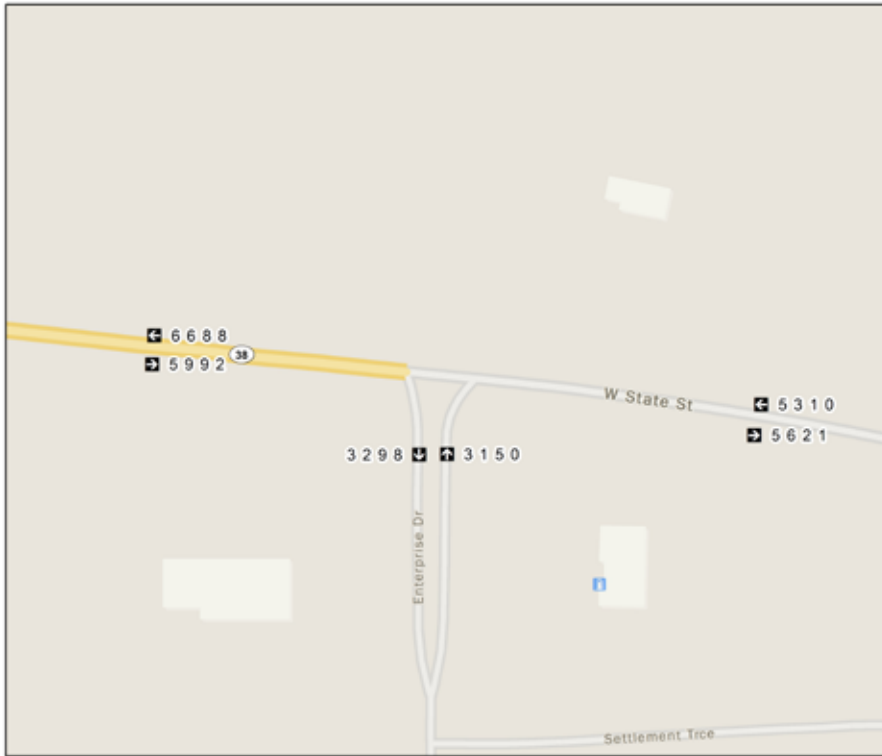
Present traffic conditions indicate that a majority of travel is toward the Indianapolis region (southwest), but with significant travel toward Anderson, IN (northeast). Current Annual Average Daily Traffic (AADT) on Indiana State Route 38 over Interstate 69 is 8,909 vehicles per day (VPD).

## Focus Area #1: Exit 219 Interchange Traffic Volumes



# CURRENT PATTERNS AND TRENDS

## Focus Area #2: State Street and Heritage Way

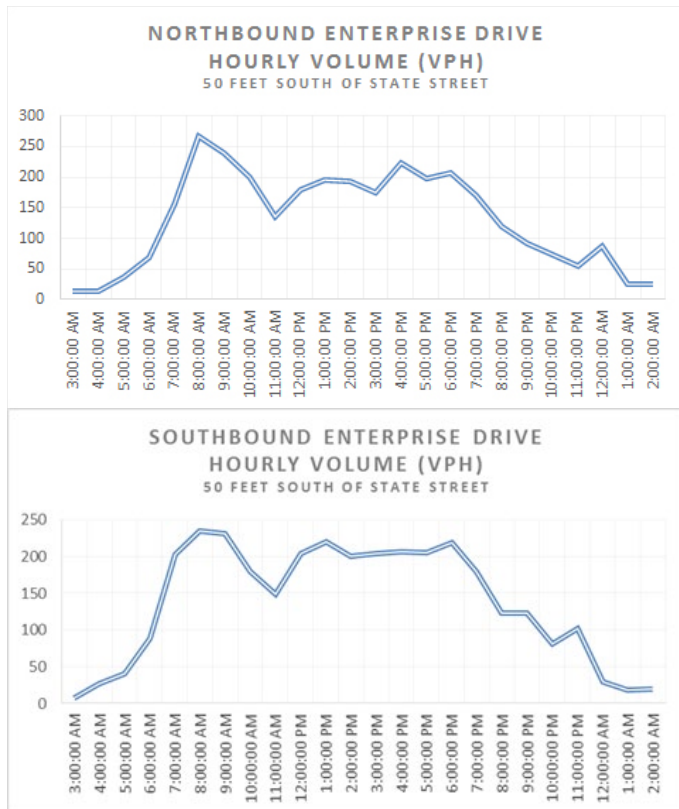


State Street east of Exit 219 currently has an AADT of 12,680 VPD. East of Enterprise Drive, State Streets traffic volume declines slightly to 10,931 VPD. Enterprise Drive, which currently serves as the major ingress and egress road to the Falls Pointe Business Park has a volume of 6,448 VPD.

Volumes on nearby interchanges are similar in nature, and will continue to grow as development increases along the Interstate 69 corridor.

Nearby interchange traffic volumes:

Exit 226: 25,249 VPD  
 Exit 222: 16,058 VPD  
**Exit 219: 12,680 VPD**  
 Exit 214: 10,347 VPD  
 Exit 210: 27,063 VPD



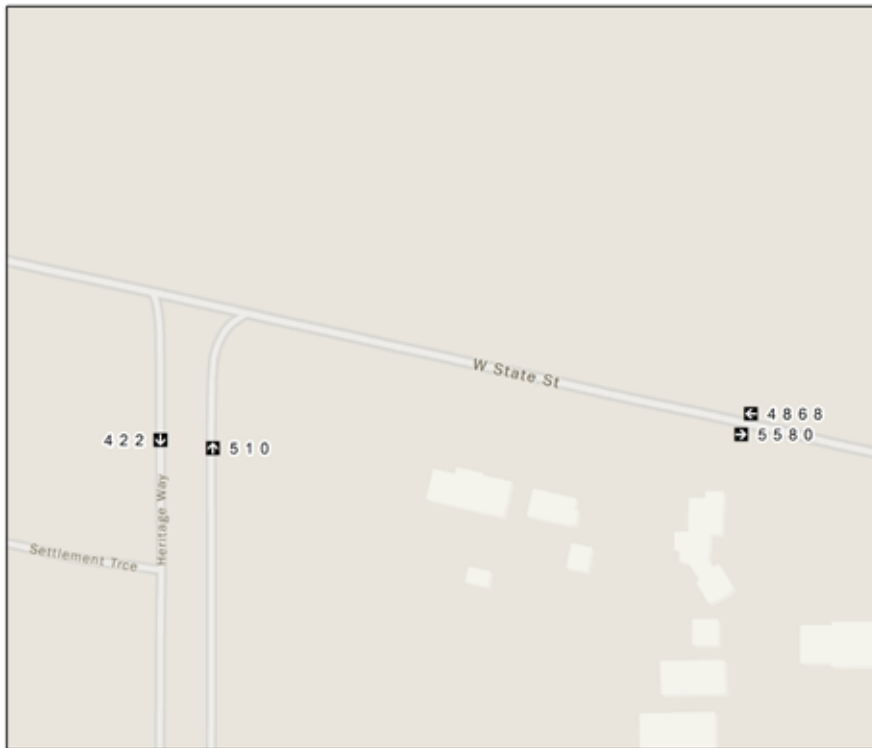
Enterprise drive is experiencing a traffic volume pattern that is somewhat abnormal. Typically a transportation planner expects to find two distinct peaks, representing the AM peak-hour traffic and the PM-peak hour traffic. For Enterprise Drive, the P.M. peak hour traffic is less pronounced.

Consistent traffic volumes, combined with the stop-controlled intersection, and no access management are contributing toward the public perception of traffic congestion in the area.



# CURRENT PATTERNS AND TRENDS

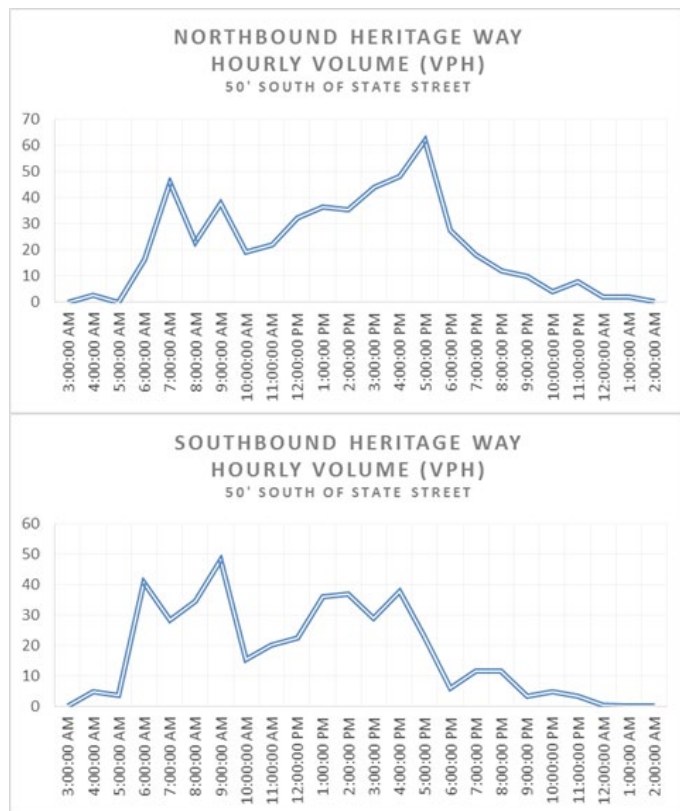
## Focus Area #3: State Street and Heritage Way



Traffic volumes on State Street east of Heritage Way are fairly consistent with traffic volumes between Enterprise Drive and Heritage Way at 10,448 VPD.

Heavy vehicle (i.e. trucks, buses, etc.) volumes heading into Pendleton are relatively minor, representing less than 1% of total daily traffic. Westbound heavy vehicle traffic coming from Pendleton is consistent with the eastbound traffic, representing less than 1% of daily volume.

Because South Madison Community School Corporation's administrative and bus garage is located within the Falls Pointe Business Park, these heavy vehicle volumes are expected despite vehicle restrictions through Downtown Pendleton.



Traffic volumes on Heritage Way are consistent with what would be expected on most roadways. The southbound volume entering Falls Pointe Business Park sees the highest volume in the AM period, while the northbound departing traffic sees the highest volume in the PM period.

# CURRENT PATTERNS AND TRENDS

## Focus Area #4: Heritage Way



Heritage Way and Enterprise Drive were both analyzed approximately 0.1 miles south of State Street to determine which approach is being used by heavy vehicles entering Falls Pointe Business Park.

The traffic survey indicates that only 24 trucks enter and exit using Heritage Way. This represents 2.93% of the 409 VPD on the northbound approach, and 3.26% of the 368 vehicles per day on the southbound approach. The total volume for the road was recorded as 777 AADT, with heavy vehicles representing 3.09% of the total volume.

## Focus Area #5: Enterprise Drive



Enterprise Drive is experiencing significantly more heavy vehicle volume than Heritage Way. There were 336 trucks using Enterprise Drive on the day of the traffic survey. This accounted for 32.12% of the 532 VPD in the northbound direction, and 29.49% of the 559 VPD in the southbound direction. The total volume for the road was reported as 1,091 AADT, with heavy vehicles representing 30.80% of the total volume.

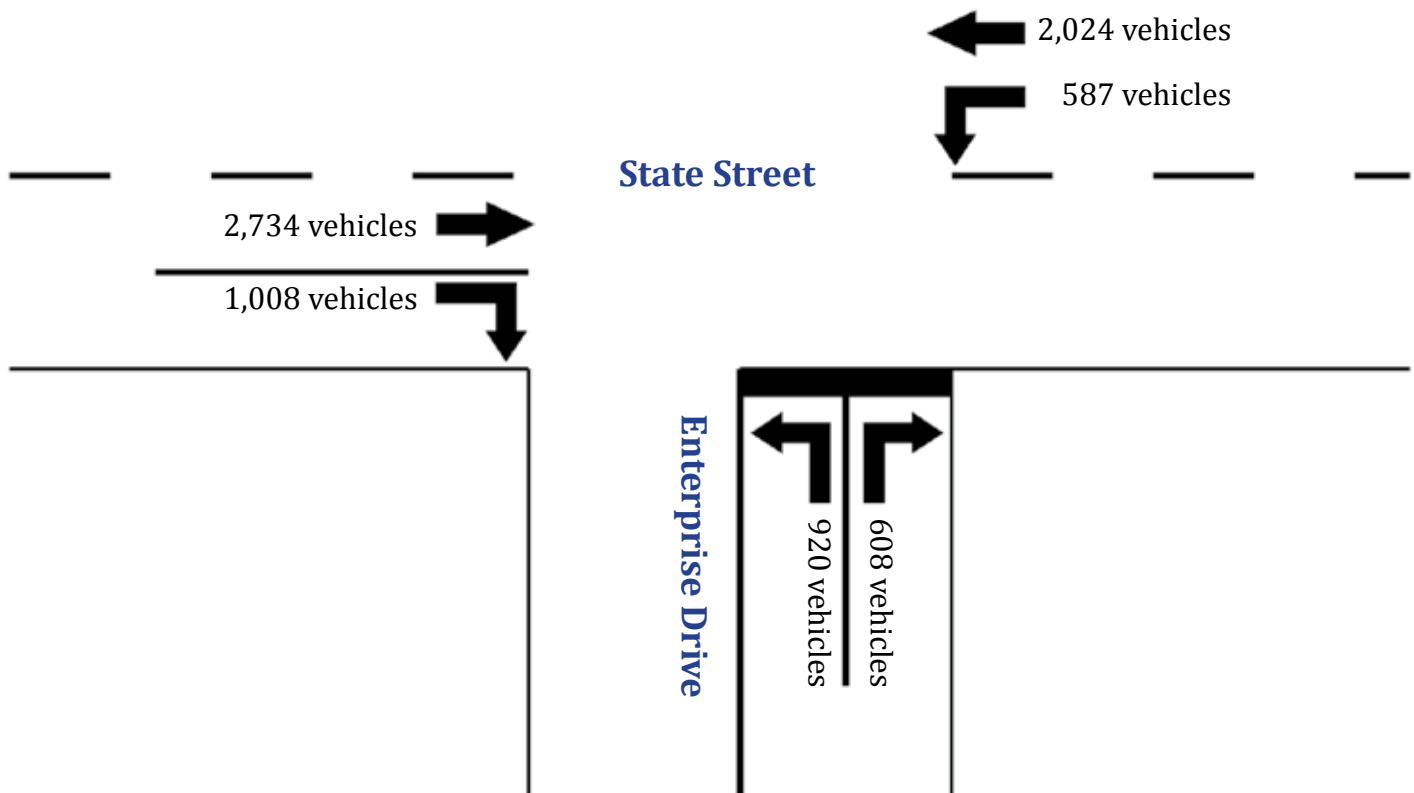
This has significant implications for Enterprise Drive and State Street because heavy vehicles take longer to accelerate, increasing the time it takes for a vehicle to enter and clear an intersection. A heavy volume of trucks will contribute to congestion at intersections, more so than just passenger cars alone.



# CURRENT PATTERNS AND TRENDS

## Intersection Turning Movement Study (8 Hours)

State Street and Enterprise Drive (11:00 AM - 7:00 PM)

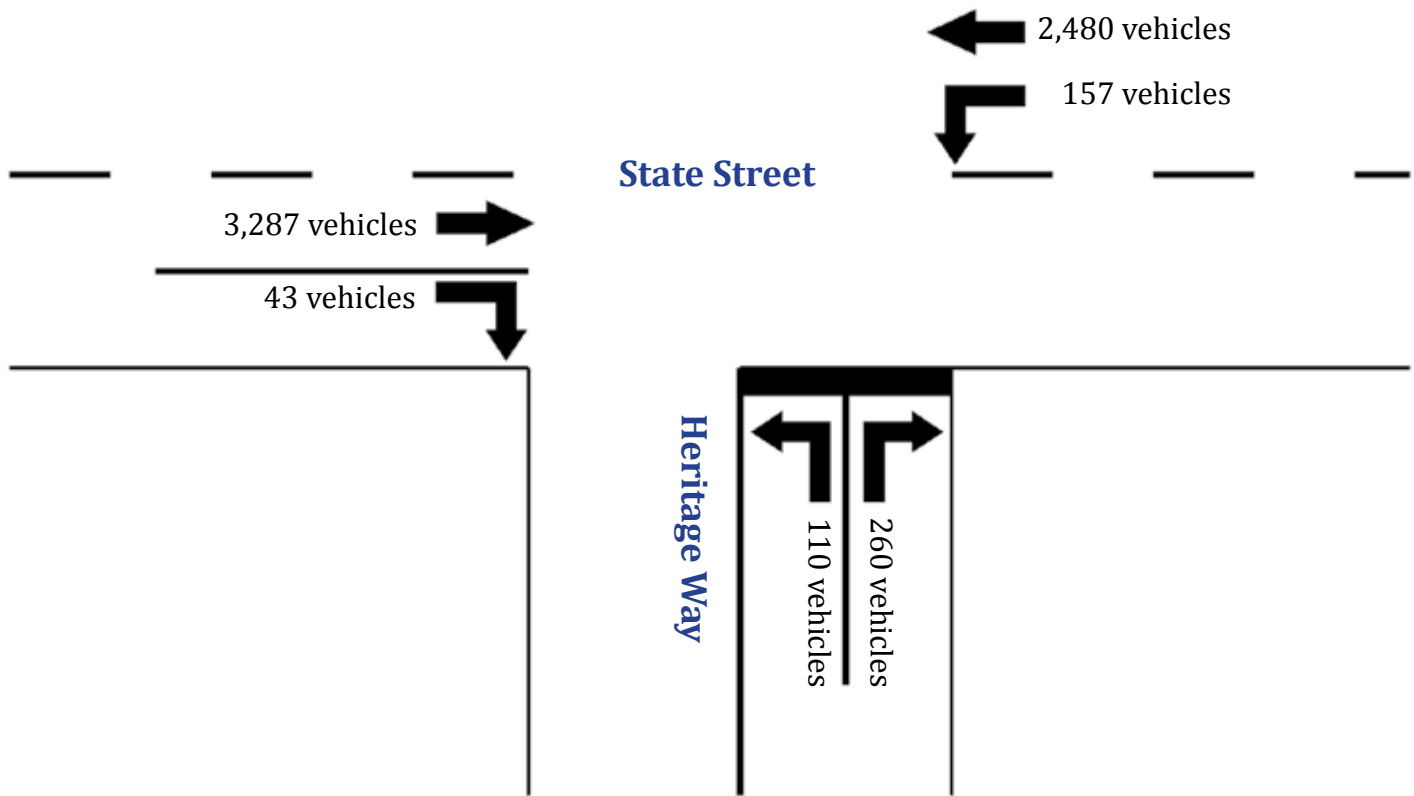


Turning movement counts are ideal for determining what is happening at an intersection and if alternative intersection configurations will be sufficient to handle current and future volumes. These counts typically span no more than 8 hours, and this time period was selected because it represents the hours during the day for which there is the highest traffic volume entering the intersection. The Enterprise Drive and State Street turning movement count indicates that a majority of the traffic volumes are through trips going into and out of the Town of Pendleton. 26.93% of the eastbound traffic turns right into Falls Pointe Business Park from State Street and 22.48% of the westbound traffic turns left into Falls Pointe Business Park. Of the eastbound vehicles making right turn maneuvers into Falls Pointe Business Park, 13.49% of these are medium and heavy vehicles. Only 2.21% of the westbound vehicles making left turns represent medium and heavy vehicles.

On the northbound approach, 39.79% of the vehicles are making a right turn maneuver. This turning maneuver is considered to be easier for motorists to make because it does not interfere with traffic as much as a left turn movement. 60.20% of the vehicles are making a left-turn maneuver. This turning movement represents a more difficult maneuver to conduct because it requires the motorist to yield to two directions of traffic. Of the vehicles making left turn movements, 13.26% of these are medium and heavy vehicles.

# CURRENT PATTERNS AND TRENDS

## Intersection Turning Movement Study (8 Hours) State Street and Heritage Way (11:00 AM - 7:00 PM)



Heritage Way and State Street experience much different turning movements than Enterprise Drive and State Street. As already shown in the traffic survey, Heritage Way is the less used drive into Falls Pointe Business Park. However, for future planning in this area, Heritage way is ideally suited to handle future growth because of its increased capacity and connectivity to undeveloped land north and southeast of Falls Pointe Business Park.

The majority of the traffic movements at this intersection are through the intersection, with only 1.29% of the eastbound traffic making a right turn onto Heritage Way and 5.95% of the westbound traffic making a left turn onto Heritage Way.

Turning movements from Heritage Way onto State Street are mostly right turn movements. 70.27% of the traffic was performing a right turn maneuver, while 29.73% of traffic was performing a left turn maneuver. 7.27% of the left turn movements are medium and heavy vehicles, while 13.46% of the vehicles turning right are medium and heavy vehicles.

# CURRENT PATTERNS AND TRENDS

## Intersection Crash Analysis



### *Critical crash flagged intersections*

Crash analysis is performed by separating the crashes that occur at intersections and crashes that occur on road segments. For each of these, an observed crash rate and critical crash rate are calculated and compared to each other to determine if the roadway warrants additional study. If the observed crash rate is higher than the critical crash rate, the intersection or segment is flagged for further analysis. The critical crash rate accounts for variation between functional and operational characteristics by taking into consideration the weighted average crash rate for all stop controlled intersections within the Town of Pendleton.

As part of the analysis of existing conditions, a critical crash analysis was performed on the intersections at Enterprise Drive and Heritage Way. The study analyzed the crash rates of these two intersection compared to all crash rates of stop-controlled intersections on functionally classified roads minor collector and higher. The analysis indicates that crashes at Enterprise Drive and State Street exceed the critical crash rate, and are likely not occurring because of random chance with 95% statistical confidence. There were 28 total reported crashes at the intersection during the 5-year analysis period, with an average of 5.6 crashes per year. The critical crash analysis is a tool to identify problem intersections, a complete intersection safety audit must be performed and effective enforcement and education alternatives exercised before mitigation improvements are made.

## Intersection Comprehensive Crash Cost Analysis

Crash cost refers to the economic value of damages and losses caused by a vehicle crash. The economic costs of crashes are referred to as the human capital costs. Human capital costs have direct and indirect costs. Direct costs attributed to human capital costs include medical costs (i.e. emergency room visit, inpatient care, prescriptions, therapy, rehabilitation), but also emergency service costs, travel costs, occupational costs, insurance costs, legal representation, travel delay, and subsequent delivery cost increases. Indirect costs can be attributed to non-medical costs, such as production losses from absent workers, costs paid by relatives, or other economic markets. This report utilizes comprehensive costs, which take into account human capital crash costs, but also the value of resources that society dedicates to reducing the risk of loss of life, physical and emotional suffering, diminished quality of life, and permanent physical/cosmetic damage.

# CURRENT PATTERNS AND TRENDS

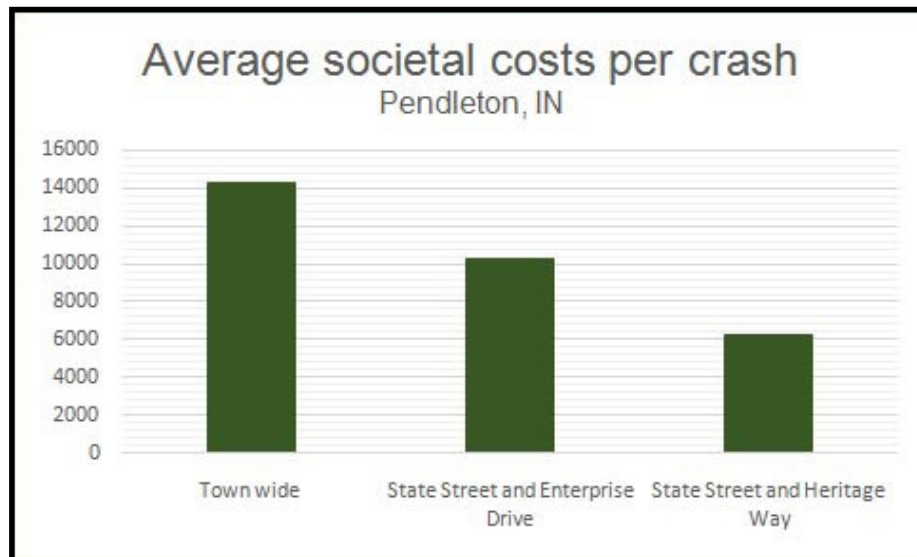
Crash costs were estimated from the Federal Highway Administration's report "Crash Cost Estimates by Maximum Police-Reported Injury Severity within Selected Crash Geometries." To account for inflation from 2001 to 2012, two adjustment factors were calculated based off the Consumer Price Index (CPI) and the Employment Cost Index (ECI) to bring crash costs to their most current year estimate.

The intersection of State Street and Enterprise Drive has an average yearly comprehensive crash cost of \$287,546.48, with an average cost of \$14,286.95 per crash that has occurred at the intersection during the 5-year analysis period.

The intersection of State Street and Heritage Way has an average yearly comprehensive crash cost of \$49,619.47, with an average cost of \$6,202.43 per crash that has occurred at the intersection during the 5-year analysis period.

The total unsignalized intersection comprehensive cost for the Town of Pendleton account for nearly \$3,343,146.21 in total societal costs. On average, the total comprehensive cost of a crash in Pendleton in the 5-year study period was \$14,286.95.

These totals are important for future project justification because these numbers can be used in benefit and cost analysis, and leveraging Federal Highway Safety Improvement Programming (HSIP) funds.

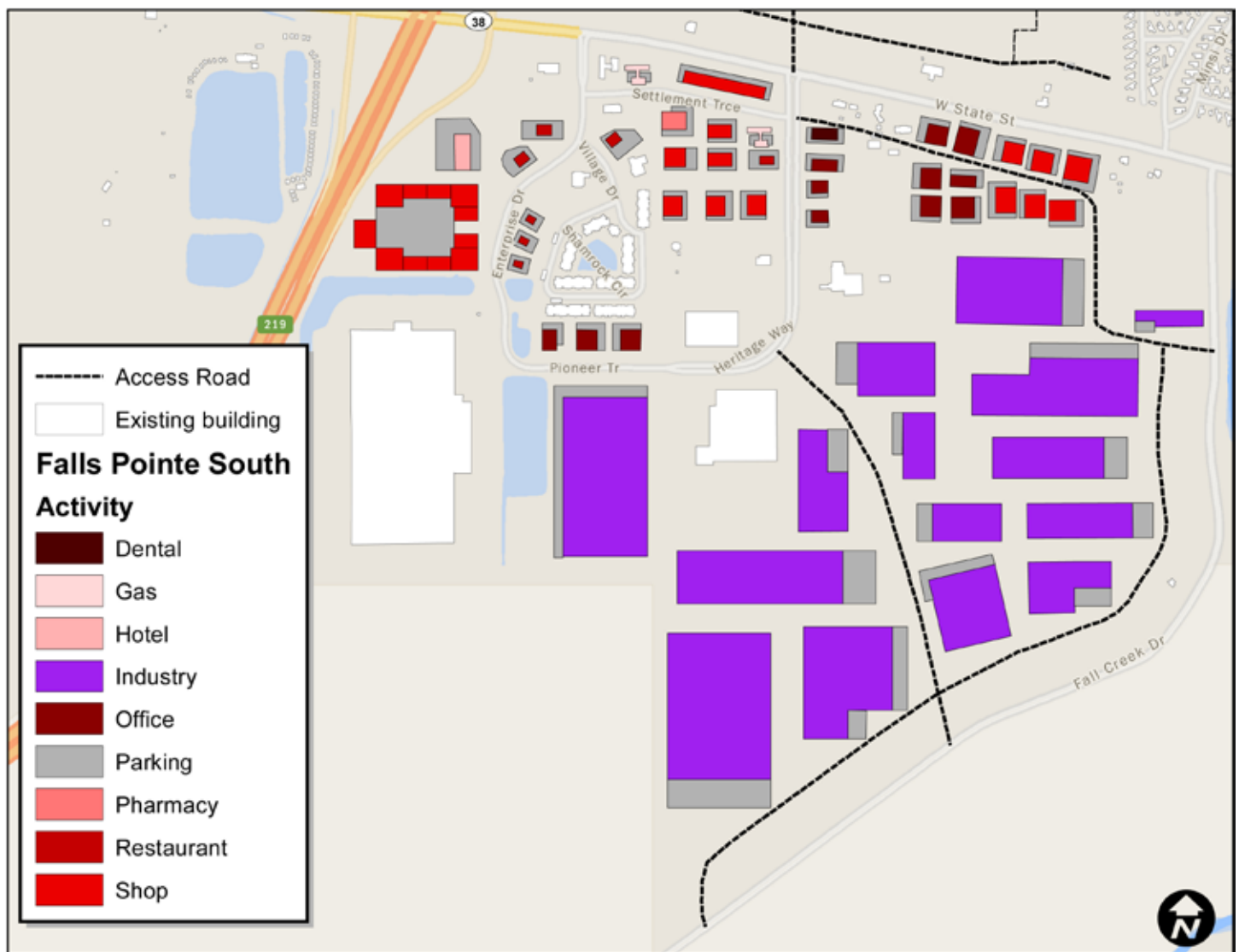


# SCENARIO PLANNING EXERCISE

## Scenario #1: Southern Half Potential Build-out

There are three scenarios presented in this report: the Southern Half Potential Build-Out (Scenario 1), the Northern Half Potential Build-Out (Scenario 2), and a Northern Half Worst-Case Build-Out (Scenario 3). All scenarios were created with a mix of specific and general uses in mind to better reflect potential outcomes and trip generation of the area.

Scenario 1 would require access roads for the increased amount of truck traffic that would be coming through the area. Access roads would run parallel to Fall Creek Drive, connect Fall Creek Drive to Heritage Way, and run parallel to State Street between Fall Creek Drive and Heritage Way. Access Roads are designated on the maps by a dashed line. The additional trip generation from this scenario as it is laid out would be 52,007 vehicle trips. Added to the current levels of 10,860 vehicle trips, it would bring the total scenario vehicle trip generation to 62,867 vehicle trips.



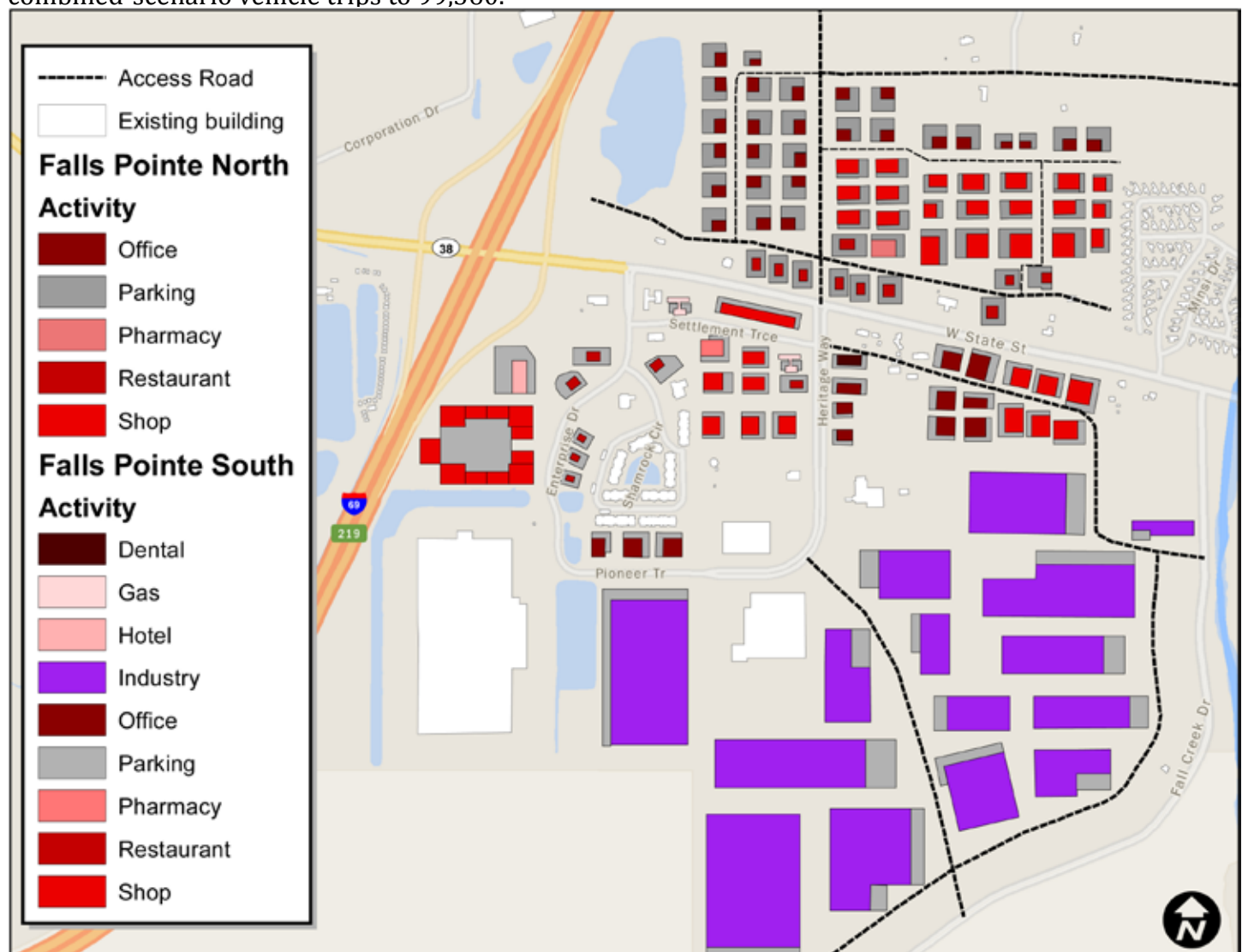
Scenario 1: Southern Half Potential Build-Out

# SCENARIO PLANNING EXERCISE

## Scenario #2: Northern Half Potential Build-out

The Northern Half Potential Build-Out (Scenario #2) represents a scenario with smaller retail and office with structures under 20,000 square feet, and therefore would not meet the conditionally permitted size limits. This scenario would likely focus on more local businesses and regional chains, with some larger national chains possible with current average store sizes under 20,000 square feet (such as pharmacies). While there are many possible outcomes, in general smaller footprint and multi-story buildings would follow the goals of the town to preserve the small town feel and character.

Scenario 2 was generated with multiple access roads going through the development and connecting to Heritage Way. Additional trip generation from this scenario would add another 36,493 vehicle trips. Combined with the current vehicle trips and the trips generated by Scenario 1, this would bring the total, combined-scenario vehicle trips to 99,360.



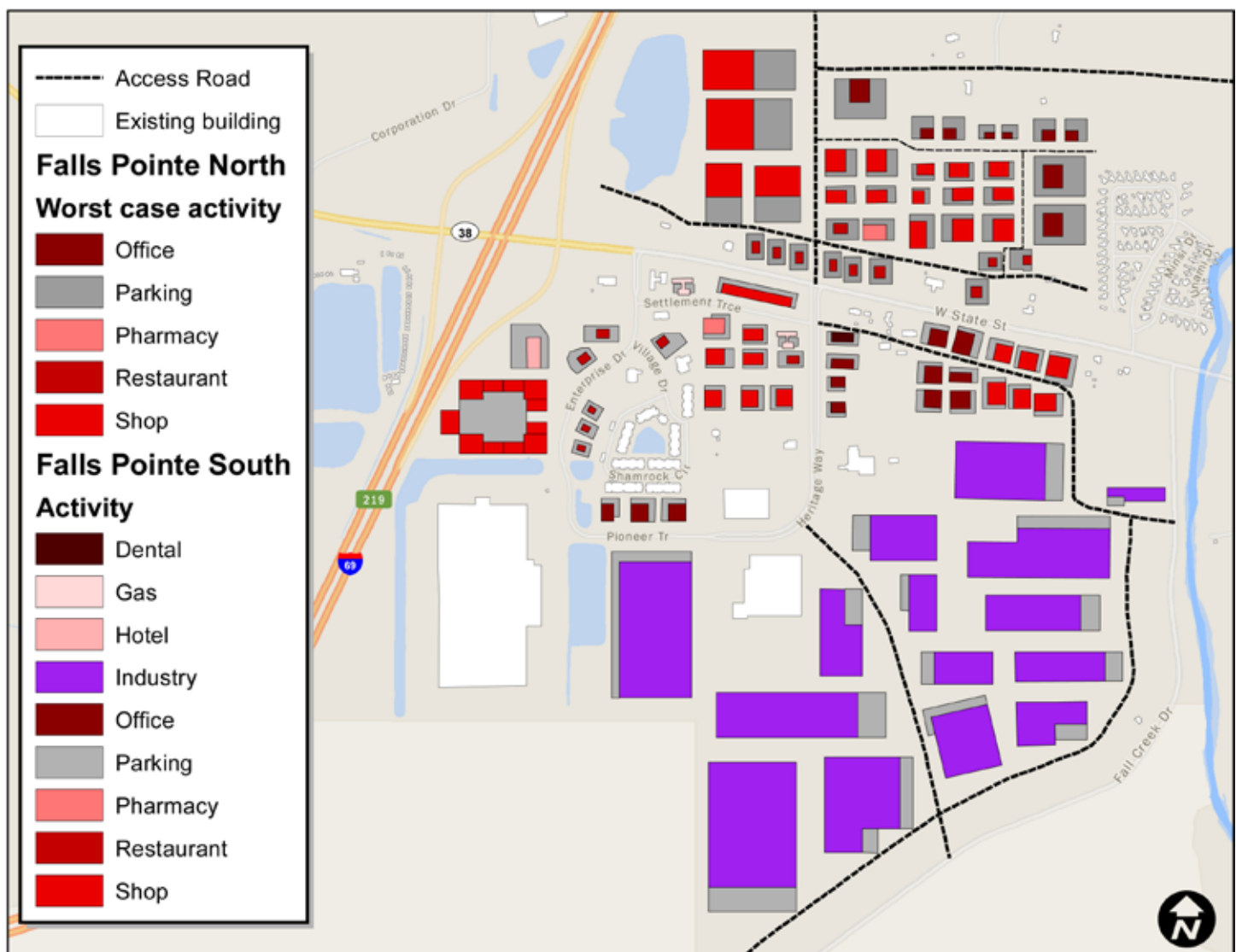
Scenario 2: Northern Half Potential Build-Out



# SCENARIO PLANNING EXERCISE

## Scenario #3: Northern Half Worst-case Build-out

As Pendleton is faced with growing pressure from development in the Indianapolis region that is continuing along Interstate 69, it is reasonable that big box retailers and large commercial developers will be interested in the town. The Northern Half Worst-Case Build-Out Scenario (Scenario #3) represents the potential outcome of permitting conditional uses for structures over 20,000 square feet and follows common development patterns. This scenario accounts for the sizes and trips generated by users such as Wal-Mart, Lowe's, and smaller big box chains. Building sizes were based on average size structures of common chains and ones that typically occur near each other (e.g. Wal-Mart and Lowe's). Office structures were also enlarged for this scenario to account for larger footprint multi-story structures similar to what is being built near Fishers, IN and other communities.



Scenario 3: Worst-Case Potential Build-Out

# SCENARIO PLANNING EXERCISE

The Worst-Case Scenario kept most of the same access roads as Scenario 2, eliminating one due to the change to big box retailers. This scenario generates an additional 43,258 vehicle trips, which is the highest of all of the scenarios. Added to the current vehicle trips and the trips generated from Scenario 1, this would bring the total vehicle trip generation to 106,125. This is an increase of 6,765 vehicle trips over the Scenario 1 & 2 combination.

# ALTERNATIVE TRAFFIC CONFIGURATIONS

## Option #1: Traffic Signal

Evaluation of a traffic signal at an unsignalized intersection must look at (1) if a signal is needed at a location, and (2) the impact of the traffic signal at a given intersection. Typically on arterial corridors traffic signals are spaced at no less than 1/4 mile apart to maintain a safe and efficient movement of vehicles through the corridor. Signal spacing less than 1/4 mile results in a less efficient movement of vehicles, and as the area grows will likely increase the level of congestion and return a poor level of service to the community.

This traffic signal study was performed under current conditions, and represents the impact of what a traffic signal would have today. As recommended by the Federal Highway Administration, a traffic signal should not be installed if it will seriously disrupt the progressive flow of traffic on the corridor. This study will perform a preliminary traffic signal warrant study by standards defined in the Manual of Uniform Traffic Control Devices (MUTCD).

### State Street and Enterprise Drive Signal Need Study

Warrant 1: Eight-hour vehicular volume: SATISFIED  
Warrant 2: Four-hour vehicular volume: SATISFIED  
Warrant 3: Peak hour: SATISFIED  
Warrant 4: Pedestrian volume: UNSATISFIED  
Warrant 5: School crossing: UNSATISFIED  
Warrant 6: Coordinated Signal System: UNSATISFIED  
Warrant 7: Crash Experience: PARTIALLY MET  
Warrant 8: Road network: UNSATISFIED

### State Street and Heritage Way Signal Need Study

Warrant 1: Eight-hour vehicular volume: UNSATISFIED  
Warrant 2: Four-hour vehicular volume: UNSATISFIED  
Warrant 3: Peak hour: UNSATISFIED  
Warrant 4: Pedestrian volume: UNSATISFIED  
Warrant 5: School crossing: UNSATISFIED  
Warrant 6: Coordinated Signal System: UNSATISFIED  
Warrant 7: Crash Experience: UNSATISFIED  
Warrant 8: Road network: UNSATISFIED

The State Street and Enterprise Drive signal needs study indicated that vehicular volume for warrants 1 through 3 were met. This indicates that current traffic volume could potentially benefit from a traffic signal. In addition, the crash experience at the intersection was partially met because of the average number of yearly crashes occurring at the intersection. However, adequate enforcement and education trials must be performed at the location in order to satisfy this warrant. State Street and Heritage Way did not satisfy any of the signal needs warrants, and would not potentially benefit from a signal given current traffic conditions. The next part of this analysis is to determine the impact of a traffic signal at State Street and Enterprise Drive to determine if the installation of a traffic signal will result in any adverse impacts to the progressive flow of traffic along this section of the State Street corridor.

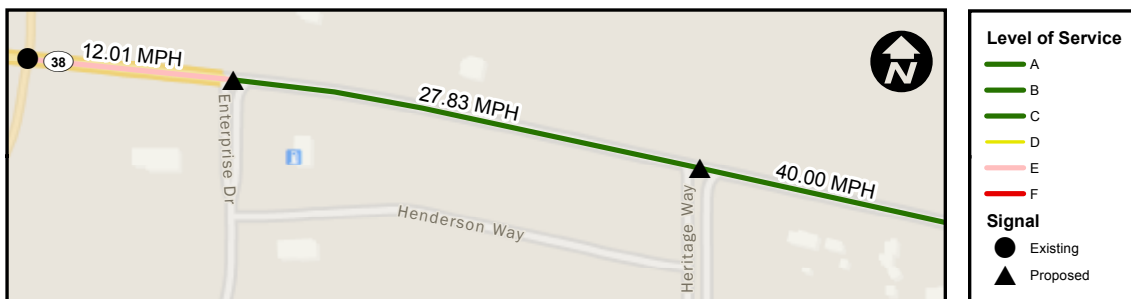
# ALTERNATIVE TRAFFIC CONFIGURATION

## Option #1: Traffic Signal - Two Signal Progression

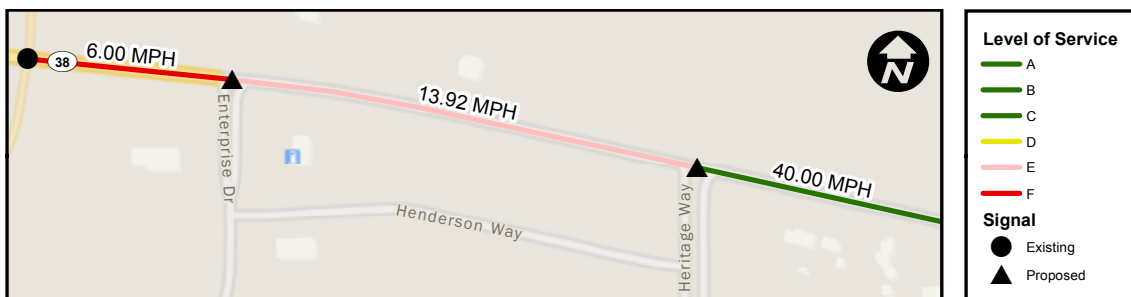
The first option analyzed was a two-signal option, one at Enterprise Drive and another at Heritage Way. The signal progression was analyzed with two common patterns, alternating and simultaneous. Alternating cycle patterns are set in a way that when one light is green, the following light is red. This allows vehicles to arrive at the next signal together in a platoon, just before the light will turn green. Simultaneous signal patterns are programmed to have all lights on the corridor turn green at the same time. In addition, cycle lengths of 60, 90, and 120 seconds were used. It is uncommon to find traffic signal cycles above 120 seconds, and below 60 seconds as they do not provide sufficient benefits to traffic flow. An exception would be cycle lengths below 60 seconds in Downtown areas where street spacing and block size are small and consistent.

An analysis of signal progression on State Street indicates that under the two signal alternating pattern, 60 second progression speeds of 12.01 MPH between Enterprise Drive and Exit 219 ramps will occur resulting in a level of service "E" for this facility. Between Enterprise drive and Heritage Way, progression speeds of 27.83 MPH will occur resulting in a level of service of "B" for this section. The 60 second alternating pattern resulted in the highest level of service. The use of a simultaneous signal pattern resulted in level of service "E" and "F" in all cases. When using 90 and 120 second alternating patterns, the level of service never exceeded an "F" between Enterprise Drive and Exit 219. Between Heritage way and Enterprise Drive the 90 second alternating pattern resulted in a level of service "D", with the 120 second alternating pattern resulting in a level of service "E" for the same section.

The use of any of the two-signal progression options **is not recommended** because it will result in facility breakdown and gridlock conditions, especially between Enterprise Drive and Exit 219. Under this configuration the current facility will not be able to handle future growth without extensive and expensive changes to the geometry of the entire facility.



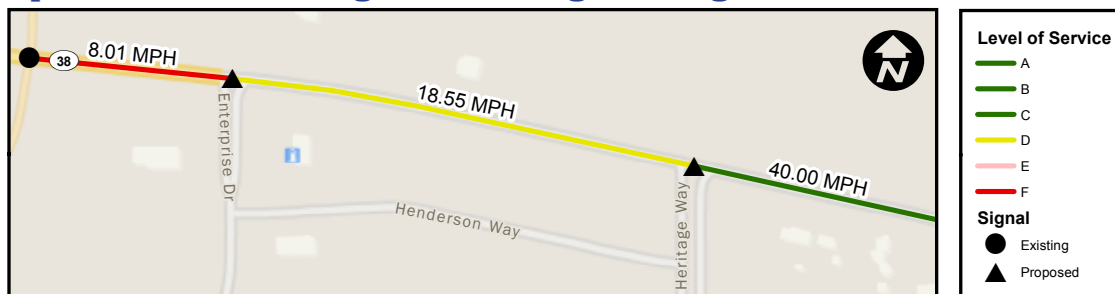
60 second cycle length: alternating pattern



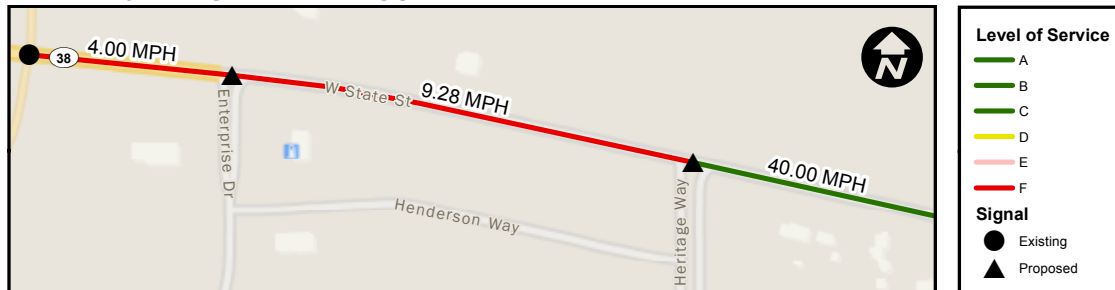
60 second cycle length: simultaneous pattern

# ALTERNATIVE TRAFFIC CONFIGURATION

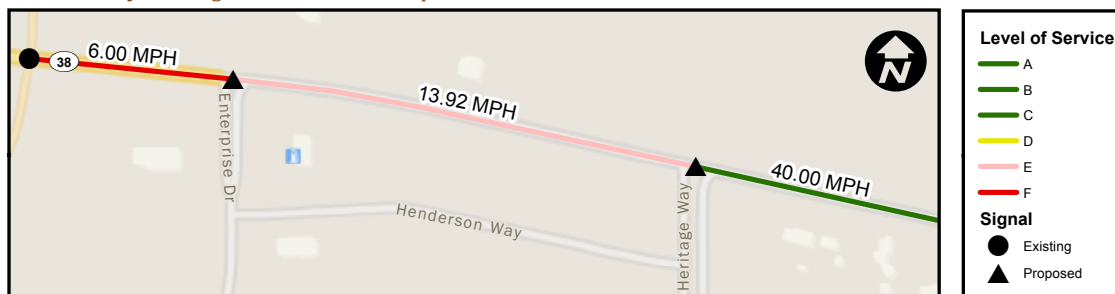
## Option #1: Traffic Signal - Two Signal Progression



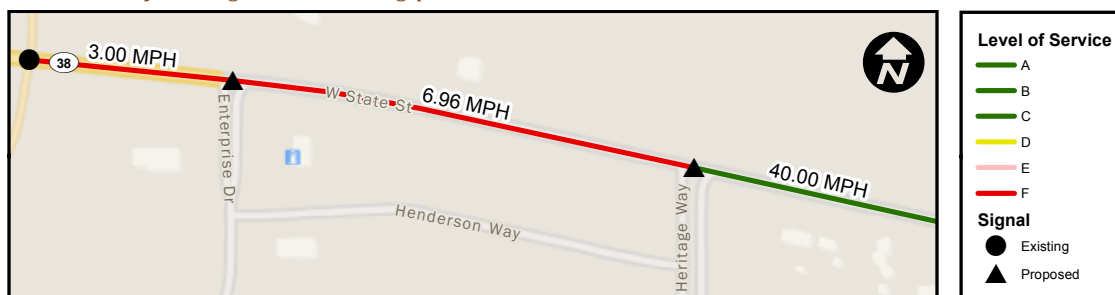
90 second cycle length: alternating pattern



90 second cycle length: simultaneous pattern



120 second cycle length: alternating pattern



120 second cycle length: simultaneous pattern

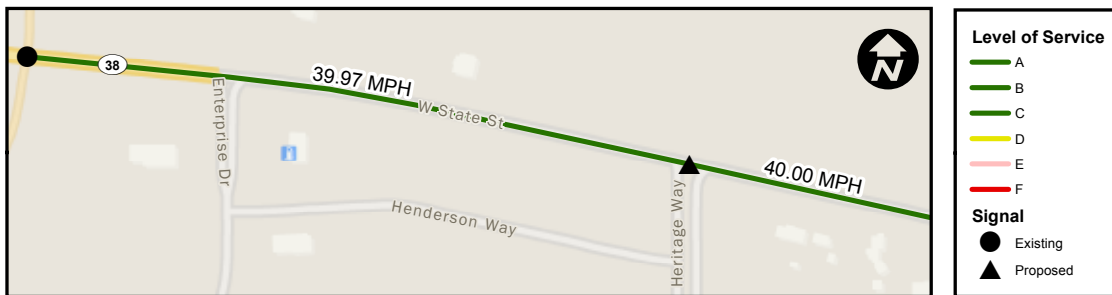
# ALTERNATIVE TRAFFIC CONFIGURATION

## Option #1: Traffic Signal - One Signal Progression

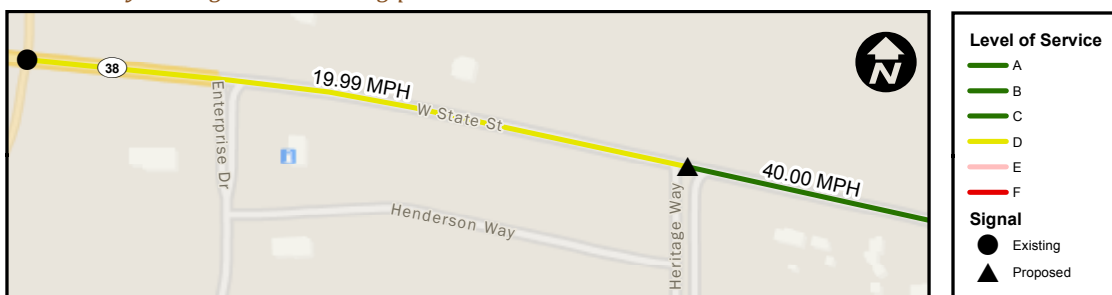
The second option analyzed was a one signal progression option where the traffic control sign was placed at State Street and Enterprise Drive. The configurations analyzed are the same as the two-signal progression option analyzed, with alternative and simultaneous patterns at 60, 90, and 120 second cycle lengths.

The intersection spacing between Heritage Way and the Exit 219 light provide adequate spacing in excess of 1/4 of a mile. As a result, the alternating pattern provides the best level of service on the corridor for 60 and 90 second cycle lengths. For the 60 second alternating pattern the corridor continues to operate at a level of service “A” with progression speeds of 39.97 MPH, while the 90 second alternating pattern degrades the corridor to a level of service “C” with progression speeds of 26.65 MPH, which is still a reasonably good level of service. Not until cycle lengths are changed to a 120 seconds for the alternating pattern does the corridor operate at a level of service “D”, which is a moderate level of service. The simultaneous pattern results in no desirable traffic configurations on the corridor. The 60 second cycle length results in a level of service “D” under present conditions, and degrades to “E” with 90 second cycle lengths, and results in a level of service “F” under 120 second cycle lengths.

The one signal traffic control configuration at Heritage Way and State Street is a feasible project, which will result in ideal levels of service currently and the ability to accommodate future growth along the corridor. Given the importance of this intersection for the future growth of this area, the intersection should be considered for an upgrade. However, access management principles must be applied at Enterprise Drive and State Street to accommodate increases in traffic volume on State Street, and reduce the adverse impacts the intersection will have on traffic flow and safety in the community. Given that a traffic signal is not recommended at Enterprise Drive and State Street, an alternative treatment at this location must be applied.



60 second cycle length: alternating pattern

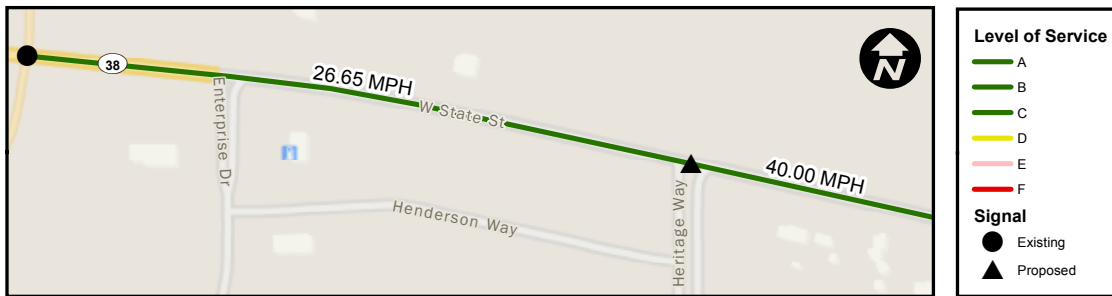


60 second cycle length: simultaneous pattern

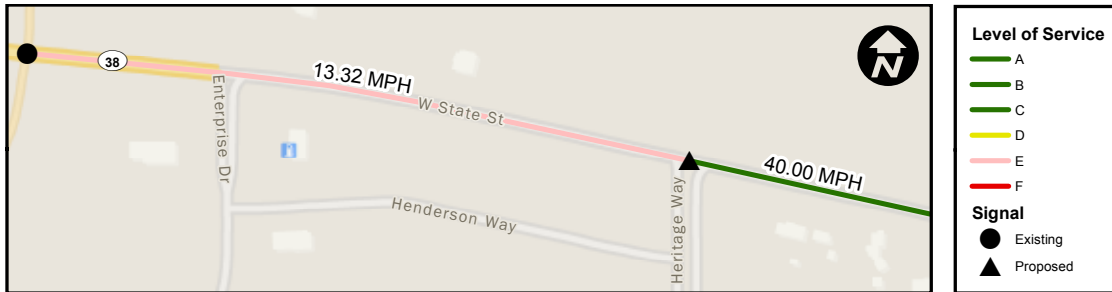


# ALTERNATIVE TRAFFIC CONFIGURATION

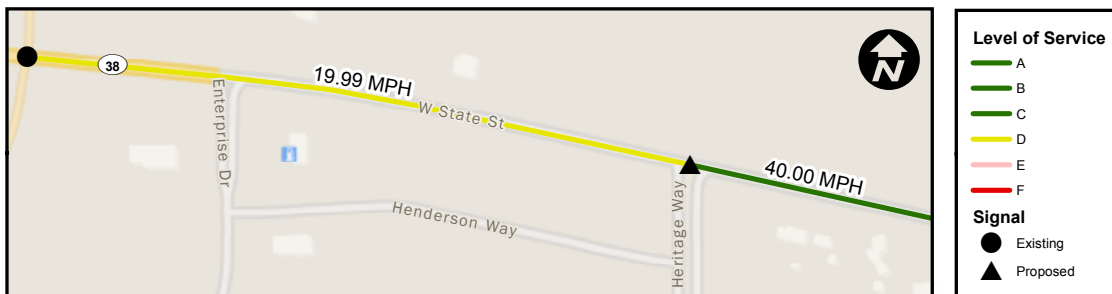
## Option #1: Traffic Signal - One Signal Progression



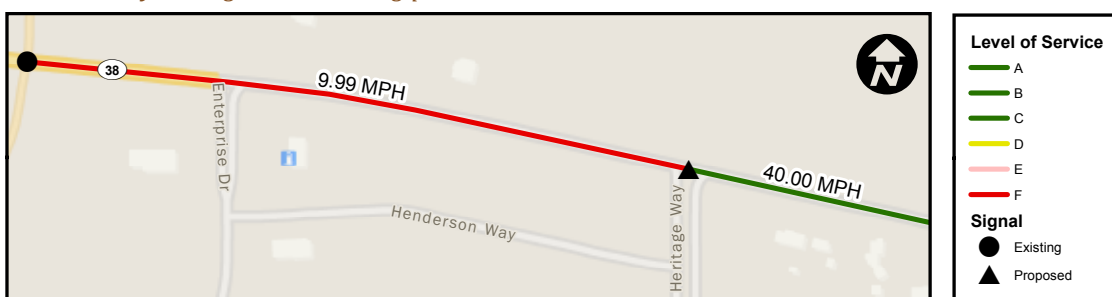
90 second cycle length: alternating pattern



90 second cycle length: simultaneous pattern



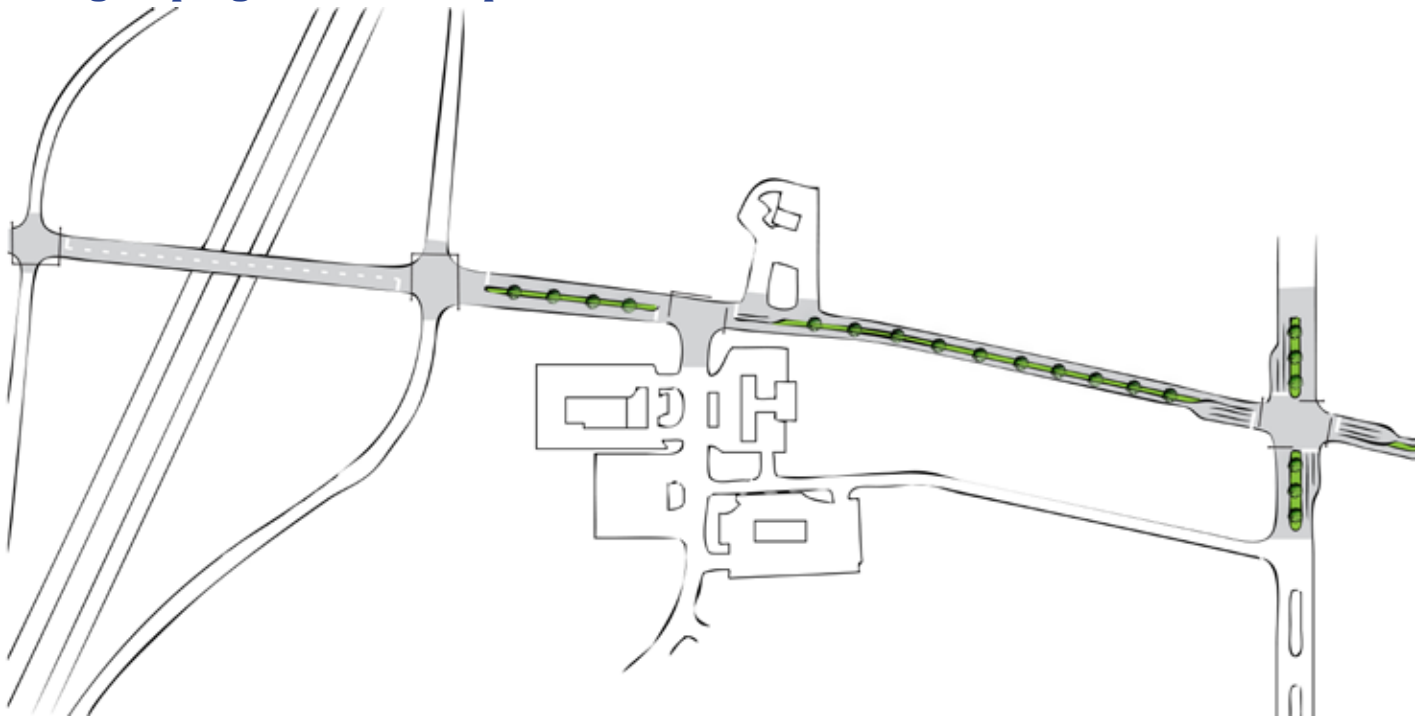
120 second cycle length: alternating pattern



120 second cycle length: simultaneous pattern

# CONCEPTUAL CONFIGURATION

## Two-signal progression concept



The two-signal progression concept depicts what a future roadway configuration could be with two traffic signals at Enterprise Drive and Heritage Way. The Indiana Department of Transportation (INDOT) currently has plans to improve the Exit 219 interchange as part of the I-69 expansion program to a peanut roundabout design. If a signal is installed at Enterprise Drive and State Street, a roundabout will no longer work because of the close proximity. In this configuration, the only allowable traffic configuration would be to the use of signals at all interchanges. Because this configuration would result in gridlock conditions, and low levels of service on the corridor, this concept is not the recommended solution to traffic congestion on the State Street corridor.

# ALTERNATIVE TRAFFIC CONFIGURATION

## Option #2: Roundabout

The second option for easing congestion on the State Street corridor involves the addition of a series of roundabouts at the Exit 219, Enterprise Drive, and Heritage Way intersections. The Exit 219 roundabout concept is part of existing INDOT plans to add a peanut roundabout to handle future traffic on the entering and exiting traffic ramps for Interstate 69.

The addition of a roundabout can have several benefits, including an increase in capacity of the roadway by 30-50%, because traffic is always on the move. One of the most important benefits of a roundabout is the reduction of crashes, mainly high-speed right-angle collisions. Using crash modification factors for the conversion of a stop-controlled intersection to a single-lane or multi-lane roundabout, it was determined that crashes could be reduced at Enterprise Drive and State Street by 24.89%. Of the crashes that have occurred at Enterprise Drive and State Street, 42.86% are right-angle collisions. Right-angle collisions are the single most fatal traffic collision (second to head-on collisions). The installation of a roundabout would almost eliminate the possibility of a right-angle collision, and completely eliminate the left-turn movement.

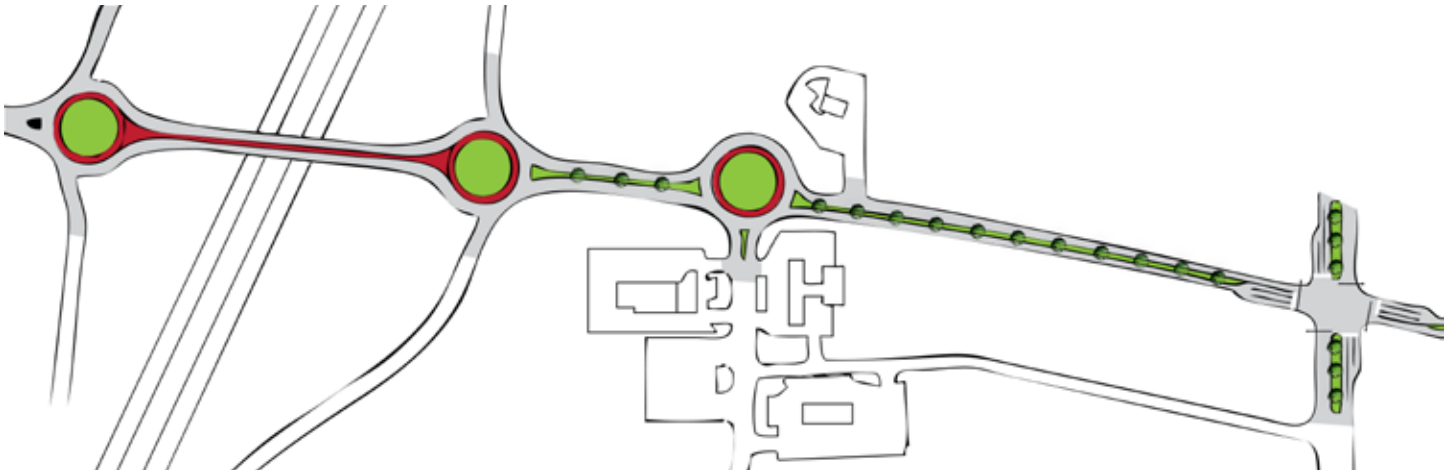
A planning-level feasibility study was performed under current traffic conditions for a roundabout at Enterprise Drive and State Street. The results of the study indicate that the average delay for a vehicle would be 6.49 seconds, which results in a level of service “A” for the intersection. The level of service on all approaches to the proposed roundabout received a level of service “A” designation. A feasibility study was not performed on Heritage Way and State Street because the traffic volumes are lower than Enterprise Drive and State Street, and would technically be feasible.

### State Street and Enterprise Drive Proposed Roundabout Efficiency

Approach	Delay (seconds)	Level of Service
Eastbound	6.27	A
Westbound	5.21	A
Northbound	7.40	A
Total intersection	6.59	A

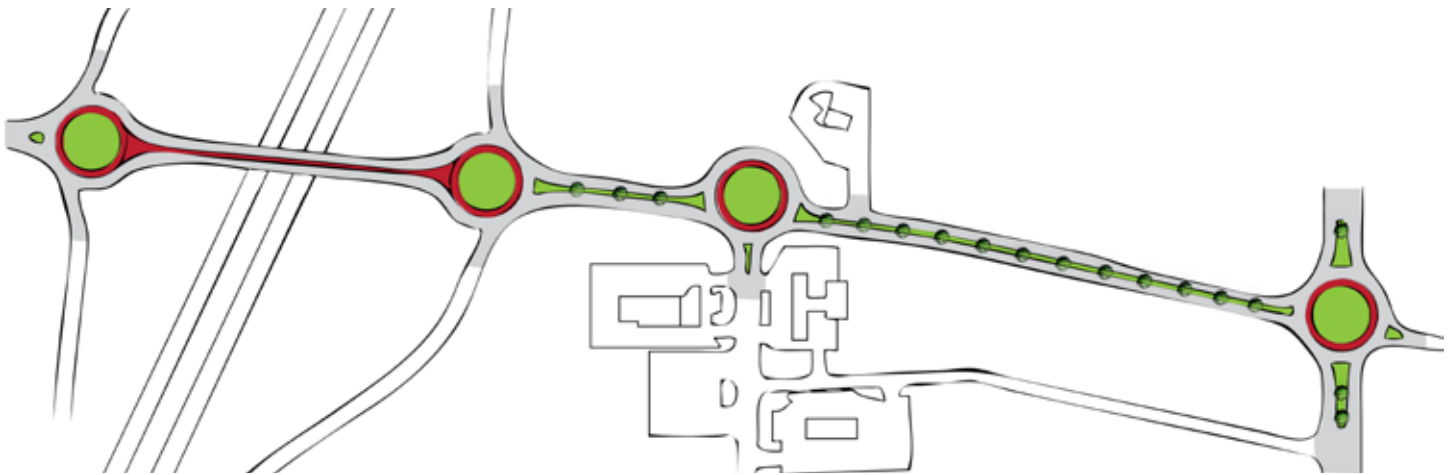
# CONCEPTUAL CONFIGURATION

## Option #2A: 2 Roundabout and 1 Traffic Signal Concept



Option 2A calls for the construction of a roundabout at Enterprise Drive and State Street. The plan shows the Exit 219 peanut roundabout, and the installation of a traffic signal at Heritage Way and State Street. It is intended in this concept that heavy vehicle traffic would be directed to Heritage Way and State Street where it can be better controlled, and heavy vehicles would be restricted on Enterprise Drive.

## Option #2B: 3 Roundabout Concept



Option 2B calls for the construction of roundabouts at Enterprise Drive and State Street, and Heritage Way and State Street. The plan also has the Exit 219 peanut roundabout. Heavy vehicle traffic would still be directed to Heritage Way and State Street, where a larger multilane roundabout would ease the navigation of the roundabout for entering heavy vehicle volume.

# ALTERNATIVE TRAFFIC CONFIGURATION

## Option #3: Right-in, Right-out

The right in, right out option is a proven access management method that is an alternative that reduces conflicts and improves safety along arterial roadways. The right in, right out configuration would force an immediate mid-block U-turn or a J-turn at a downstream signal where the movement can be controlled. The U-turn or J-turn prohibit the left turn onto highways, and eliminate traffic signals that would not fit into the time-space progression patterns on arterial roads. According to the National Cooperative Highway Research Program, where incorporated in intersection design, the right-in, right-out U-turn provision enables direct left turns to be rerouted and signal phasing to be simplified (1).

The installation of a right in, right out intersection at Enterprise Drive and State Street would result in a 17.80% reduction in crashes. In addition, a slight increase in the capacity of the roadway would be observed because of the elimination of the conflicting left-turn movement off of Enterprise Drive. Heavy vehicles would be rerouted to Heritage Way, where a traffic control signal could better regulate traffic and provide efficient signal progression between Exit 219 and Heritage Way.

1. Gluck, Jerome, Herbert Levinson, and Vergil Stover. "National Cooperative Highway Research Program Report 420: Impacts of Access Management Techniques." *Transportation Research Board of the National Academies of Science*. (2000): 1-270. Print.

# CONCEPTUAL CONFIGURATION

## Option #3: Right-in, Right-out



The right-in, right-out concept would restrict left turns into and out of Enterprise Drive, directing this traffic to Heritage Way. This option would direct all heavy vehicle traffic to Heritage Way, where a traffic signal (or possibly a roundabout) could better regulate these vehicle types. The right-in, right-out concept is a proven method of access management, and will have direct efficiency and safety benefits to users.



# ALTERNATIVE TRAFFIC CONFIGURATION

## Option #4: Do Nothing - Impacts of Growth

As Pendleton grows, and the Falls Pointe Business Park area of the State Street corridor receives more business attention, the transportation system will begin to experience more pressure. The presence of light-industrial in the master plan for Falls Pointe Business Park implies that the area must not only be optimized for passenger cars, but also heavy vehicles. The presence of heavy vehicles makes design of the intersections more complicated, and harder decisions will have to be made to ensure that Falls Pointe Business Park remains attractive to the light industrial, basic-sector type employers.

The existing traffic configurations will need to be changed at some point in the future to maintain a safe and efficient movement of goods and people through the State Street corridor. As the area urbanizes, the effective carrying capacity of the roadway will be determined at the intersections rather than the number of lanes available. As a result, the treatment options chosen at each intersection will have profound impacts well into the future. In anticipation of this, changes to the intersections and existing street grid, as well as planned future streets, should be built in a way that not only accommodates future growth, but also compliments the type of growth that is wanted in the area.

# CONCLUSION

The State Street corridor serves as the primary connection between Pendleton and Interstate 69. The corridor spans the entire east-west length of the Town of Pendleton, and is the primary roadway that connects the major activity centers together. As Pendleton grows, new demands will be placed on the roadway that will necessitate changes to the roadway and have an impact on the type and quality of growth that occurs.

The current study examined traffic conditions near Falls Pointe Business Park, which lies halfway between the west side of Pendleton and Downtown Pendleton. The Falls Pointe Business Park is located directly on Pendleton's primary access to Interstate 69, and the dominant industry within the business park is light Industrial.

The Falls Pointe Business Park area consists of a series of complex intersections, and better analysis is needed to be performed to select the ideal treatments for the area. This may include the use of micro simulation models to determine how the intersections interact with each other under different scenarios.

The need for access management on the entire corridor is important to preserving the quality of the transportation system in Pendleton. Without effective access management, Pendleton can expect a roadway which will drive high-quality jobs to other more attractive locations in the region. Without access management, the State Street corridor will become more dangerous, crash frequency will increase as more "friction points" (i.e. drive cuts, poorly spaced signals, etc.) are added along the corridor.

State Street is beginning to feel the pains of poor access management now with the intersection at Enterprise Drive. Close proximity to signals at Exit 219 make the placement of a traffic signal impractical, and will result in an increase in congestion. The Madison County Council of Governments Transportation Planning Department recommends that the Town of Pendleton begin a coordinated corridor plan between the Town of Pendleton, Madison County Council of Governments, and the Indiana Department of Transportation. During this process, proven access management should be discussed and implemented in the final plan. Roadway design should complement adjacent and planned land-uses in such a way that both creates a safe and efficient roadway for all modes of transportation, but also accommodates the needs of the land-uses it is intended to serve.