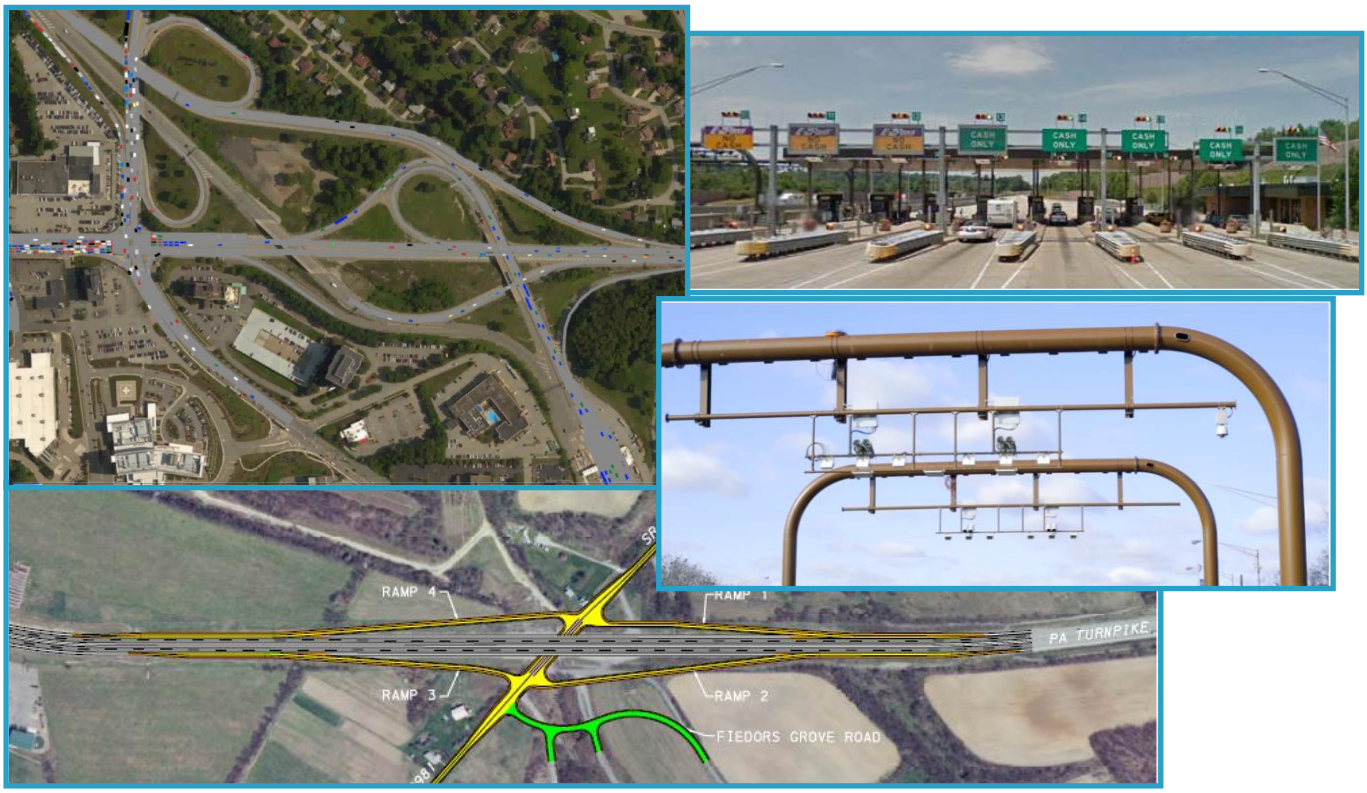
# Regional Cashless Tolling Planning Study

ASSESSMENT OF FUTURE IMPACTS TO I-76
INTERCHANGES AND ADJACENT ROADWAYS

September 15, 2016

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*SPC would like to thank our Technical Advisory Committee (TAC) for their time and efforts on this study. The TAC consisted of staff from:*

*Allegheny County*
*Beaver County*
*Butler County*
*Lawrence County*
*PennDOT District 10-0*
*PennDOT District 11-0*
*PennDOT District 12-0*
*Pennsylvania Turnpike Commission*
*Westmoreland County*

# Executive Summary

Cashless Tolling is a growing trend in the United States with more than 35 toll facilities across the country having adopted cashless tolling systems. Cashless tolling involves constructing overhead gantries that either read a transponder, or, for motorists traveling without a transponder, a photograph of the vehicle license plate is taken and a bill issued to the registered owner. The Pennsylvania Turnpike Commission is giving serious consideration to installing cashless tolling system-wide. The Turnpike Commission introduced cashless tolling in January 2016 with the opening of its first cashless tolling point at the Delaware River Bridge in southeastern Pennsylvania. Continued cashless conversion across the PA Turnpike system will eliminate the need for conventional toll plaza facilities. This may create opportunities for a more modernized highway with enhanced flexibility to improve existing or add new access points that support mobility, reduce congestion, reduce environmental impacts and can be constructed at more affordable investment levels. The purpose of this study is to assist the PA Turnpike, the Pennsylvania Department of Transportation and other regional stakeholders with:

- determining what the potential impacts are at existing interchanges along the mainline Turnpike (I-76) within the SPC region and to make recommendations for mitigating those potential impacts; and
- to evaluate the potential for new access ramps along the mainline Turnpike (I-76).

To evaluate the effects of cash vs. cashless toll systems, traffic simulation models were developed for each location. For this study, PTV VISSIM Version 7.00 software from PTV Group was utilized. The main purpose of evaluating the existing toll interchanges was to determine what the effect of transitioning from the current cash/ E-Z Pass system to a cashless system will have on the downstream roadways at each interchange and what improvements could reduce travel delay at these locations.

This evaluation included the following interchanges/toll plazas:

| | |
|---|---|
| Interchange 28-Cranberry | Interchange 57-Pittsburgh |
| Warrendale Toll Plaza (MP 30) | Interchange 67-Irwin |
| Interchange 39-Butler Valley | Interchange 75-New Stanton |
| Interchange 48-Allegheny Valley | Interchange 91-Donegal |

This study concludes that the existing turnpike interchange areas will see no increase in delay or travel time once a cashless tolling system is implemented. The main reason for this is the high usage of E-ZPass on the system (75% on average) and the resulting lack of major congestion at the existing toll plazas during the peak periods. This represents a significant change from what was experienced with all-cash transactions many years ago. Concept-level improvements at certain interchanges were identified as potential strategies to alleviate congestion issues experienced by motorists. These issues are existing and are not attributed to converting to an all-cashless tolling system.

Another primary aspect of the study was to evaluate the potential for new access ramps along the mainline turnpike with the implementation of cashless tolling. The purpose of this task was to identify locations that currently do not have direct access to mainline I-76 where it may be desirable to provide a full or partial access via a cashless tolling interchange. New access locations were evaluated for the potential to improve operational conditions for commuter, freight, and emergency vehicle traffic as well as the potential to facilitate economic development.

The new access evaluation was broken into 2 levels. The first level involved developing qualitative rating criteria for 9 potential new access locations:

- SR 551 (Little Beaver Township, Lawrence County)
- SR 65 (North Sewickley Township, Beaver County)
- SR 68 (New Sewickley Township, Beaver County)

- SR 910 (Richland Township, Allegheny County)
- SR 28 (Harmar Township, Allegheny County)
- SR 380 (Plum Borough, Allegheny County)
- SR130 (Penn Township, Westmoreland County)
- SR 136 (Hempfield Township, Westmoreland County)
- SR 981 (Mount Pleasant Township, Westmoreland County)

Based upon the results of the qualitative evaluation and consultation with the Technical Advisory Committee for this study, four locations were chosen for a more detailed evaluation including concept-level plan layouts. Along with the layouts, the detailed evaluation covered traffic demand from the network model, a planning level cost estimate, and identification of preliminary environmental constraints related to the potential new interchange project.

The detailed level evaluation consisted of developing conceptual level plans, cost estimates and traffic demand information for the following locations:

  - SR 910
  - SR 28
  - SR 130
  - SR 981

New cashless tolling access appears to be feasible at each of the above four locations. The new access interchange concepts as well detailed cost breakdowns for each are shown in section 4.2 of this study.

# Table of Contents

# Appendices



# List of Tables

# List of Figures

# 1 Introduction

## 1.1 Cashless Tolling

Cashless tolling is a growing trend in the United States with more than 35 toll facilities across the country having adopted cashless tolling systems. Cashless tolling involves constructing overhead gantries that either read an E-Z Pass transponder, or, for motorists that don't have one, photograph the license plate for billing purposes. Tolling agencies that converted reported measurable benefits gained from cashless tolling such as: increased safety, improved mobility, improved customer convenience, reduced emissions and increased operational efficiencies.

The Pennsylvania Turnpike Commission (PTC) is giving serious consideration to installing cashless tolling system-wide. In March 2012, the PTC completed a system-wide assessment entitled "All-Electronic Tolling Feasibility Report", which concluded that "AET conversion was feasible from a financial and physical perspective."

***Figure 1-1: Example of Cashless Tolling Gantry Over a Mainline Roadway***

The PTC introduced cashless tolling in January, 2016 with the opening of its first cashless tolling point at the Delaware River Bridge in southeastern Pennsylvania. The new cashless tolling point is part of an early phase of the PA Turnpike/Interstate 95 (I-95) Interchange Project that will directly connect the PA Turnpike and I-95.

The next steps are projected to include pilot projects which, in the SPC region, involve upgrading the existing toll plazas along the Beaver Valley Expressway and Findlay Connector with cashless tolling technology. Currently, existing toll booth facilities act as a control point in terms of arrival rate for vehicles exiting the Turnpike onto adjacent state and local roadways. With the implementation of cashless tolling and subsequent elimination of toll booth facilities, increased arrival rates could impact intersections and interchanges of Turnpike off-ramps with state and local roadways and adjacent intersections. The purpose of this study is to assist the PTC, the Pennsylvania Department of Transportation and other regional stakeholders in determining what the potential impacts are within the SPC region and to make recommendations for mitigating those potential impacts.

## 1.2 Outline of Study

The Southwestern Pennsylvania Commission (SPC) and its study partners wish to model and evaluate the effects of cashless tolling on the downstream roadways at existing interchanges and evaluate 9 new access ramp locations along the mainline Turnpike (I-76 and I-70/76) from State Route (SR) 551(Milepost 3) to the Donegal Interchange (Milepost 91).

### 1.2.1 Evaluation of Existing Toll Interchanges

The main purpose of evaluating the existing toll interchanges was to determine what the effect of transitioning from the current cash/E-ZPass system to a cashless system will have on the downstream roadways at each interchange and what improvements could reduce travel delay at these locations.

This evaluation included the following interchanges/toll plazas:

Interchange 28-Cranberry

Warrendale Toll Plaza (MP 30)

Interchange 39-Butler Valley

Interchange 48-Allegheny Valley

Interchange 57-Pittsburgh

Interchange 67-Irwin

Interchange 75-New Stanton

Interchange 91-Donegal

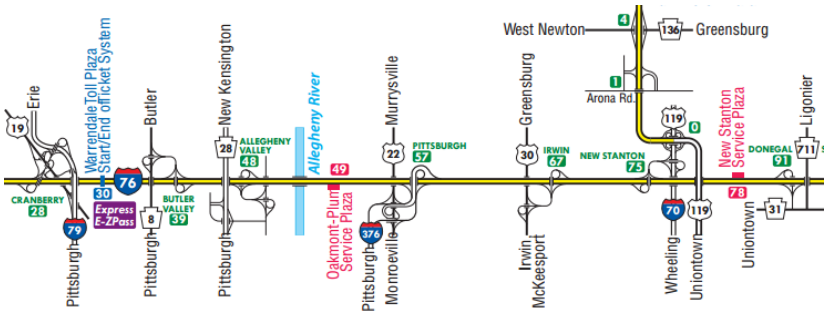


***Figure 1-2: Schematic of Turnpike I-76 System depicting studied interchanges***

Each of the above locations was initially evaluated to determine if developing a traffic simulation model was an effective means to evaluate. Interchange 28-Cranberry, Warrendale Toll Plaza and Interchange 91-Donegal were not selected for traffic simulation modeling. The Cranberry Interchange is unique in that it does not have a direct toll plaza at the interchange. With the design of the I-79 Cranberry Connector project, the PTC realized a large footprint would be needed to expand the existing toll plaza in Cranberry. In 2003, the Warrendale Mainline Plaza was made fully operational to "substitute" for collecting revenue at the Cranberry interchange and other interchanges to the west. The Plaza is approximately 2.5 miles east of the Cranberry Interchange and features 8 traditional toll lanes Westbound, 5 toll lanes Eastbound and one "Fast" E-ZPass lane in each direction. Because of the distance from Cranberry and the fact that much of the traffic from the Warrendale Plaza is not destined to Cranberry, it was felt the effect of cashless tolling would be minimal.

Interchange 91-Donegal was not modeled because this interchange was studied by the PTC and PennDOT District 12-0 and modifications to this interchange with SR 31 are currently in design and are scheduled for construction in Year 2017. Recommendations made from the Donegal Interchange Study are shown in Section 3.3.8 of this report.

To evaluate the effects of cash vs. cashless toll systems, traffic simulation models (PTV VISSIM v. 7.00) were developed for the remaining interchanges identified for study. VISSIM is a popular traffic microsimulation model software that has the capability to model unique traffic situations, including toll plazas. It can provide both detail performance measures and graphic simulation videos to evaluate traffic conditions.

The models of each interchange utilized current geometric and traffic data, and then were calibrated and reviewed to accurately reflect both data collected and observational data (i.e., traffic counts and queuing information). Once the model for each interchange was calibrated, traffic was projected to the year 2022 (the evaluation year for the study). Performance measures were identified and the effects of both the cash system and cashless system were measured.

Once the simulations were analyzed, deficiencies with regard to delay and level of service were identified at each location. Possible improvements were identified with the assistance of the study's Technical Advisory Committee and these improvements were also modeled to determine their potential benefits.

### 1.2.2 Potential New Access Ramps with Cashless Tolling

Another primary aspect of the study was to evaluate potential new access ramps along the mainline Turnpike upon implementing cashless tolling. New access ramps along the Turnpike under a cashless system are more cost effective than under the current ticketing system. Ramps and interchanges in the cashless system will not require toll plazas; therefore, the capital, operational and right-of-way costs associated with conventional plazas is substantially reduced.

The purpose of this task was to identify locations currently without direct access to mainline I-76 or Turnpike where it may be desirable to provide full or partial access via a cashless tolling interchange. New access locations were evaluated for the potential to improve operational conditions for commuter, freight, and emergency vehicle traffic as well as the potential to facilitate economic development.

The new access evaluation was divided into 2 levels. The first level involved developing qualitative rating criteria for 9 potential new access locations:

- SR 551 (Little Beaver Township, Lawrence County)
- SR 65 (North Sewickley Township, Beaver County)
- SR 68 (New Sewickley Township, Beaver County)
- SR 910 (Richland Township, Allegheny County)
- SR 28 (Harmar Township, Allegheny County)
- SR 380 (Plum Borough, Allegheny County)
- SR 130 (Penn Township, Westmoreland County)
- SR 136 (Hempfield Township, Westmoreland County)
- SR 981 (Mount Pleasant Township, Westmoreland County)

Based upon the qualitative evaluation results , four locations were selected for second level evaluation. The second level detailed evaluation included the following:

- Traffic information from the network model to estimate any additional traffic increases on both the Turnpike and the existing roadway network.
- Development of a planning level cost estimate for the potential new access points and related state roadway improvements based on estimated quantities and unit costs of right-of-way acquisitions, bridge and wall structures, earthwork, pavement and drainage structures, and major utility involvements. Contingency budgets for each of the other elements associated with the construction of the new infrastructure were also included.
- Identification of any preliminary environmental constraints related to the potential new interchange project.
- Conceptual interchange drawing layouts.

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# 2 Data Collection

Data were provided from numerous sources to support this study, including the Pennsylvania Turnpike Commission (PTC), Southwestern Pennsylvania Commission (SPC), and data collected by the project team specifically for this project. The purpose of this chapter is to describe the data that was available and identify their source. Data included turning movement counts (TMC), automated traffic recorder counts (ATR), queuing, origin-destination information, and numerous traffic-related parameters from the toll plazas including vehicle classification, lane utilization, traffic growth, and existing electronic tolling usage. Other data included signal permit drawings, plans for known improvements in the vicinity of toll plazas, field views, and aerial photography.

The study area includes 33 intersections and analysis points as follows:

Cranberry (Warrendale Plaza) Interchange
1) I-76 off-ramps and SR 19 (signalized)
2) I-76 off-ramp and I-79 Southbound merge point
3) I-76 off-ramp and I-79 Northbound merge point

Butler Valley Interchange
4) SR 8 and West Hardies Road (signalized)
5) I-76 off-ramp and SR 8 Northbound merge point
6) I-76 off-ramp and SR 8 Southbound merge point
7) SR 8 and East Bardonner Road (signalized)

Allegheny Valley Interchange
8) SR 910 (Indianola Road) and Freeport Road (signalized)
9) Freeport Road and Alpha Drive West (signalized)
10) Freeport Road and Alpha Drive East (signalized)
11) I-76 off-ramp and Freeport Road Southbound merge point
12) I-76 off-ramp and Freeport Road Northbound merge point

Pittsburgh Interchange (Monroeville)
13) Business Route 22 and McMasters Drive (signalized)
14) I-376 Westbound and Haymaker Road Southbound on-ramp merge point
15) Business Route 22 and SR 48 (Mosside Blvd/Haymaker Rd.-signalized)
16) I-376 Westbound and Haymaker Road Northbound on-ramp merge point
17) I-76 off-ramp and Business Route 22 Westbound merge point
18) I-76 off-ramp and I-376 westbound merge point
19) I-76 off-ramp diverge point (toward SR 22 and I-376)
20) I-76 off-ramp and Business Route 22 Eastbound merge point
21) Business Route 22 and Cochran Drive (signalized)

Irwin Interchange
22) SR 30 and Ronda Court/Rocky Road (signalized)
23) I-76 off-ramp and SR 30 Westbound merge point
24) I-76 off-ramp and SR 30 Eastbound merge point
25) SR 30 and Arona Road (signalized)

New Stanton Interchange
26) I-70 Westbound and relocated New Stanton Interchange on-ramp merge point
27) I-70 Westbound and relocated New Stanton Interchange off-ramp diverge point
28) I-76 off-ramp and I-70 Westbound merge point

29) I-76 off-ramp and I-70 Eastbound merge point
30) Business 66 Eastbound diverge point with SR 119 Southbound
31) Business 66 Eastbound and SR 119 on-ramp merge point

Donegal Interchange
32) I-76 off-ramp and SR 31
33) SR 31 and SR 711

## 2.1 Turning Movement Counts/Automated Traffic Recorder (ATR) Counts

The follow turning movement counts and ATR counts were available to support the study.

### 2.1.1 Southwestern Pennsylvania Commission (SPC) Counts

SPC provided traffic counts at the following locations:

| Location | Type (Vehicle, class, or turning) |
|---|---|
| **Butler Valley Interchange** | |
| SR 8 and Hardies Rd (signalized) | turning movement |
| SR 8 and Bardonner Rd (signalized) | turning movement |
| SR 8 Mainline Northbound | vehicle |
| SR 8 Mainline Southbound | vehicle |
| I-76 off-ramp to SR 8 Northbound | class |
| I-76 off-ramp to SR 8 Southbound | class |
| | |
| **Allegheny Valley Interchange** | |
| Freeport Rd Mainline Eastbound | vehicle |
| Freeport Rd Mainline Westbound | vehicle |
| I-76 off-ramp to Freeport Rd Eastbound | class |
| I-76 off-ramp to Freeport Rd Westbound | class |
| | |
| **Pittsburgh Interchange** | |
| SR 22 and McMasters Dr (signalized | turning movement |
| SR 22 and SR 48 (signalized) | turning movement |
| SR 22 and Cochran Dr (signalized) | turning movement |
| SR 22 Mainline Eastbound | vehicle |
| SR 22 Mainline Westbound | vehicle |
| SR 48 SB ramp to I-376 Westbound | class |
| SR 48 NB ramp to I-376 Westbound | class |
| SR 22 WB ramp to I-376 Westbound | class |
| I-376 EB ramp to SR 22 Eastbound | class |
| I-76 ramp to SR 22 Eastbound | class |
| I-76 ramp to I-376 Westbound | class |
| I-76 ramp to SR 22 Westbound | class |
| | |
| **Irwin Interchange** | |
| SR 30 and Arona Rd (signalized) | turning movement |
| SR 30 Mainline Eastbound | vehicle |

| | |
|---|---|
| SR 30 Mainline Westbound | vehicle |
| I-76 off-ramp to SR 30 Eastbound | class |
| I-76 off-ramp to SR 30 Westbound | class |
| SR 30 and Ronda Ct/Rocky Rd (signalized) | turning movement |
| **New Stanton Interchange** | |
| I-76 off-ramp to SR 119/Toll 66 | class |
| I-76 off-ramp to I-70 Westbound | class |
| I-70 off-ramp to Center Ave | class |
| I-70 off-ramp to SR 119 SB | class |
| **Donegal Interchange** | |
| I-76 off ramp to intersection of SR 31 | vehicle |
| SR 31 Mainline Eastbound | vehicle |
| SR 31 Mainline Westbound | vehicle |

SPC counts were collected at various times for the purposes of this study and are provided in Appendix C.

### 2.1.2 French Engineering Counts

French Engineering collected one week of ATRs in and around the New Stanton Interchange using Wavetronix microwave counters. Ramps in the Center Avenue (New Stanton), mainline Turnpike, and Toll 66/US 119 interchanges were counted in addition to mainline I-70 volumes. Turning movement counts were also collected at three locations in the Allegheny Valley Interchange during the AM (7:30-8:30) and PM (5:00-6:00) peak periods. All ATRs and TMCs were collected in February 2016. These traffic counts are provided in the Appendix C.

| Location | Type |
|---|---|
| **Allegheny Valley Interchange** | |
| SR 910 and Freeport Rd (signalized) | turning movement |
| Freeport Rd and Alpha Drive West (signalized) | turning movement |
| Freeport Rd and Alpha Drive East (signalized) | turning movement |
| **New Stanton Interchange** | |
| I-70 mainline eastbound (mainline and ramps) | vehicle |
| I-70 mainline westbound (mainline and ramps) | vehicle |

## 2.2 Queuing

French Engineering collected queue information at the exiting toll plazas and on the first signalized approach encountered after leaving a toll plaza. This information was necessary to aid in the calibration of the VISSIM model as well as providing a good estimate of how much queue would be transferred from the toll plazas to downstream signalized intersections if the toll plazas were completely cashless.

Queues were monitored for two hours at each interchange, one hour each in the two highest volume periods of the week. Queues in the PM peak hour were monitored at all interchanges. For some interchanges, the AM peak hour was monitored, while in others it was the Saturday peak. The following is a summary by interchange of the time periods and signalized intersection approaches that were monitored:

| Interchange | Periods | Signalized Approaches |
|---|---|---|
| Butler Valley | PM and Saturday | SR 8 at Hardies Road NB and SR 8 at Bardonner Rd SB |
| Allegheny Valley | AM and PM | WB Freeport Rd at Alpha Drive East and EB Freeport Rd at Pearl Ave |
| Monroeville | PM and Saturday | WB Business 22 at SR 48 and EB SR 22 at Cochran Dr |
| Irwin | PM and Saturday | WB SR 30 at Rocky Rd/Ronda Ct and EB SR 30 at Arona Rd |
| New Stanton | AM and PM | None - Freeway-to-Freeway Interchange |

Queue monitoring was performed by recording the maximum queue (in terms of number of vehicles) every minute for 60 consecutive minutes. Technicians were also instructed to provide a narrative of any congestion issues or relevant observations. For example, in the Allegheny Valley Interchange, the technicians noted that the queues at the first signalized intersection to the west extended into the exiting toll plaza. Queue data are provided in the Appendix C.

## 2.3 Data from the Pennsylvania Turnpike Commission

AECOM requested traffic data from the PTC at the toll plazas for each interchange study area. Various data reports were provided from PTC and the type of data each report provides is described below:

1. Origin – Destination (Daily) – Daily traffic volumes, by class of vehicle, between each interchange and the other Turnpike interchanges
2. Interchange by Lane (Hourly) – The hourly volume of traffic for each toll lane at the interchange
3. Lane Usage (Daily) – Traffic Volumes, percentile of Electronic Toll Collection (ETC) use, and the lane usage (ETC, Non-ETC or Mixed) by toll lane at the interchange by time periods
4. Market Penetration – Daily, AM Peak and PM Peak ETC usage (volumes and percent) for each day of the month
5. Traffic Counts (Hourly) – Entering traffic and exiting traffic using the interchange, separated by cars and trucks, and by ETC and non-ETC volumes for each hour of the day.
6. 2014 Growth Report – 3, 5, and 10 year growth trends at the interchange for traffic entering and exiting Turnpike

This data is provided in Appendix C for various dates from October 2015 to March 2016 for each interchange study area. However, not all data was used for the study and calibration of the model. The data that was used for the model calibration correspond to the dates and times of the queue data collection.

## 2.4 Other Data

This section describes information that was collected that was not count-based data.

1. Planned Improvements - AECOM collected information from PTC, PennDOT, SPC, and others on any planned improvements to the existing interchanges that will be incorporated by the study design year of 2022. These included:
   - Butler Valley Interchange – recent intersection/approach improvements to the SR 8/Hardies Road intersection

- New Stanton Interchange – planned improvements to the I-70 New Stanton Interchange by District 12-0
- Donegal Interchange – planned improvements the SR 31 corridor by District 12-0

2. Signal Permit Drawings - The most recent signal plans were provided by PennDOT for the intersections identified for analysis above

3. Aerial Mapping – AECOM, McCormick Taylor and Lochner acquired the most recent aerial mapping for each interchange area

4. Field reconnaissance – The AECOM team conducted a field view of each interchange area to verify field conditions in relation to the aerial mapping, collected speed limit information, and to verify traffic count needs

5. SPC Growth Rates – SPC provided traffic growth rates for each interchange study area

# 3 Evaluation of Existing Toll Interchanges

## 3.1 Introduction/Evaluating Procedures

The evaluation of existing toll facilities presents a number of inputs and methodologies that require consistency and a set evaluating procedure to produce calibrated and uniform models of the five interchanges that were modeled as part of this study. A procedure was developed by the AECOM team prior to modeling the interchanges in VISSIM Version 7.00. The procedure considered numerous factors for each interchange such as geometrics, traffic data, growth, E-ZPass market share, and lane usage. The following provides a summary of the evaluating procedure developed by the project team.

The base network for each of the interchange models utilized scaled Bing mapping that is a component of the VISSIM program. This allows for geometrics of the interchange and adjacent roadway network to be modeled accurately. The vehicle model distributions for each network used the North American default guidelines provided by PTV VISSIM in January 2010. This vehicle model was developed based on car sales data in 2005. The top 30 vehicles sold from 2000 to 2004 in each category (car, SUV, light trucks) were summarized and percentages for each category were used. These are presented in Appendix C.

Likewise, the heavy vehicle distribution was based on the Comprehensive Truck Size and Weight study published by the FHWA in August 2000. The percentages per vehicle class are provided in Appendix C.

Signal permit plans were requested from the PennDOT District 11-0 and District 12-0 Traffic Units for each of the signalized intersections within the modeled interchange networks. The timing plans for the peak periods were utilized and coded to include detection, signal heads, channelized rights, and ramp queue preemption. Only two of the interchanges modeled had ramp queue preemption, the Monroeville and Irwin Interchanges. Lastly, where necessary, signal timings were verified in the field.

As previously described, traffic volumes were developed for two peak hours at each interchange. The peak hours were determined from the ATR counts provided by SPC and Toll Plaza Hourly Volume data provided by the PTC. These traffic volumes and truck percentages per interchange are provided in the table below. It should also be noted that traffic volumes were also developed for the 30 minutes prior to the peak periods in order to seed the VISSIM networks. Seeding can be defined as the initialization period to populate the network so that the number of vehicles entering the system is approximately the same to the number of vehicles exiting the system. During the 30 minute seeding period, performance measures are not collected.

The peak periods varied between interchanges with some interchanges showing a typical weekday AM and PM peak, while others (such as Butler and Pittsburgh) had higher traffic volumes during Saturday. The hourly volumes from the Turnpike onto the local state roadway network range from 380 vehicles at the Butler Interchange during the Saturday peak to as high as 1470 vehicles in the AM peak at the Allegheny Valley Interchange. Likewise, truck percentages on average were between 3-10% throughout the region. There were only 1% trucks during the Saturday peak at the Butler Interchange. Truck percentages at the New Stanton Interchange ranged between 28-34%, which is significantly higher than average. This interchange experiences some of the highest truck percentages for the entire Turnpike system.

***Table 3-1:*** **Turnpike Off-Ramp Traffic Volumes and Truck Percentages by Interchange (Year 2016)**

| Interchange | Turnpike Ramp onto State Roadway | Peak Hour Period 1 (veh/hr) and % Trucks | Peak Hour Period 2 (veh/hr) and % Trucks |
|---|---|---|---|
| **Butler-(39)** | NB | 500 (5%) PM Peak | 240 (1%) SAT Peak |
| | SB | 340 (5%) PM Peak | 140 (1%) SAT Peak |
| **Allegheny-(48)** | EB | 1120 (10% ) AM Peak | 700 (7%) PM Peak |
| | WB | 350 (10%) AM Peak | 450 (7%) PM Peak |
| **Pittsburgh-(57)** | EB | 410 (5%) PM Peak | 210(4%) SAT Peak |
| | WB | 760 (5%) PM Peak | 460 (4%) SAT Peak |
| **Irwin-(67)** | EB | 690 (5%) PM Peak | 390 (3%) SAT Peak |
| | WB | 560 (5%) PM Peak | 270 (3%) SAT Peak |
| **New Stanton-(75)** | EB | 300 (34%) AM Peak | 450 (28%) PM Peak |
| | WB | 490 (34%) AM Peak | 710 (28%) PM Peak |

The analysis year for the comparison of the toll plazas in the cash and cashless scenarios was 2022. Based on discussions with the PTC staff, this year was selected as it's the assumed opening year for the cashless system for the purposes of this study. Therefore, the existing traffic was grown to 2022 using growth rates provided by both the Turnpike and SPC's LRP Forecast (Cycle-10 Years 2015 to 2040). The linear growth rates for the interchanges are provided in the table below. Trends within the area on the local roadway network and Turnpike system are both positive through Year 2022. The growth ranges from 0.33% at the Allegheny Valley and Pittsburgh Interchanges to 1.23% at the Butler Valley Interchange.

***Table 3-2: Annual Traffic Growth Rates by Interchange***

| Interchange | Turnpike (%/Year) | State Road (%/Year) |
|---|---|---|
| **Butler-(39)** | 1.23% | 1.03% |
| **Allegheny-(48)** | 0.33% | 0.59% |
| **Pittsburgh-(57)** | 0.33% | 0.50% |
| **Irwin-(67)** | 0.37% | 0.73% |
| **New Stanton-(75)** | 0.56% | 0.50% |

E-ZPass market penetration is a very important input when modeling toll facilities. Market penetration is defined as the daily, AM peak, and PM peak EZ-Pass usage (volumes and percent) for each day of the month. For each of the hours modeled, the E-ZPass usage for that hour was determined from data provided by the Turnpike and used to calibrate the model. The table below presents the 2014 average E-ZPass market penetration per interchange. Overall within the SPC region, E-ZPass usage averages are 69% for automobiles and 85% for trucks throughout 2014 (peak period usage is higher).

***Table 3-3: Year 2014 Average E-ZPass Market Penetration by Interchange and Vehicle Classification***

| Interchange | Class 1 (Auto) | Class 2-9 (Trucks) |
|---|---|---|
| **Butler-(39)** | 73% | 85% |
| **Allegheny-(48)** | 71% | 85% |
| **Pittsburgh-(57)** | 68% | 84% |
| **Irwin-(67)** | 70% | 86% |
| **New Stanton-(75)** | 63% | 83% |

Hourly lane usage per interchange was also requested from the PTC for each day data was collected in the field. The lane usage provides traffic volumes, percentage of E-ZPass use and the lane use by toll lane per interchange. There are four lane use types within the Turnpike system: Cashless Tolling/Express E-Z Pass lanes, E-ZPass-only toll exits, mixed-use, and cash-only toll exits. Modeling the lane usage is imperative to providing a calibrated model as capacity varies greatly with each type. The table below provides the capacity, or discharge rate, per lane type. A cash-only lane has a capacity of approximately 200 veh/hr, while cashless tolling can discharge between 1900-2200 veh/hr.

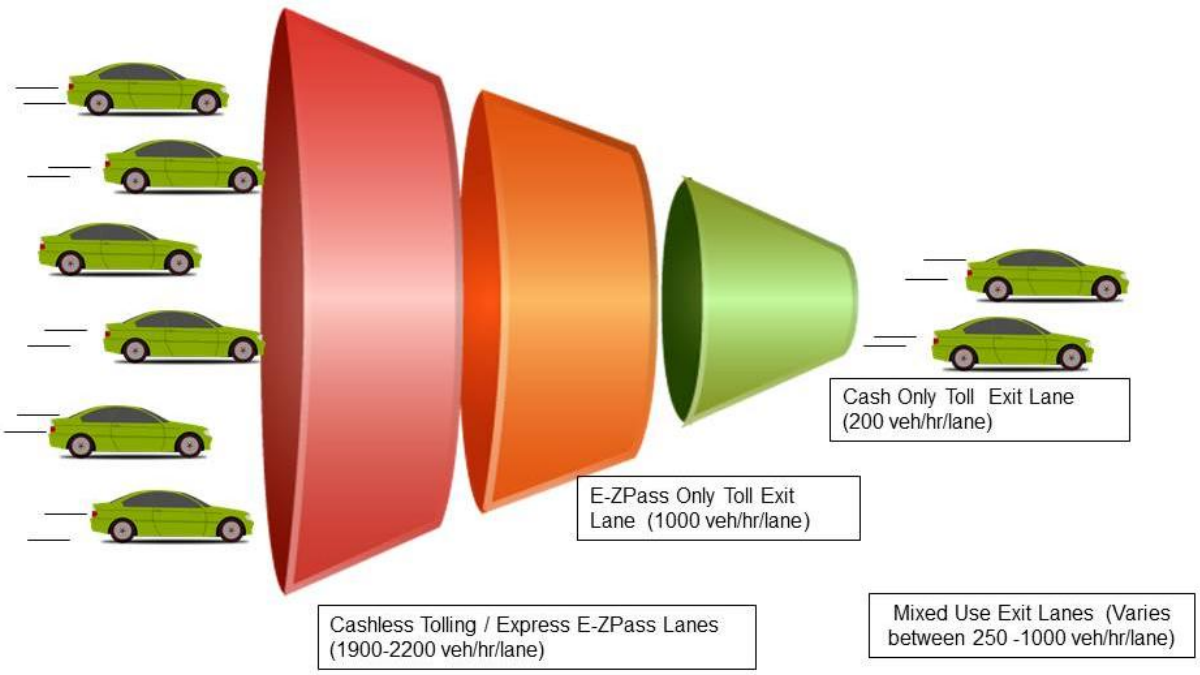



***Figure 3-1: Toll Lane Types and Capacities***

As mentioned in Section 2, queuing was collected at each of the toll plazas and signalized intersections within the study area during the peak periods. This data was used when calibrating the models to assure the models represent realistic traffic conditions in the study area. The maximum queue, in number of vehicles, was collected every minute during the peak period at the toll plazas and the average and maximum queues are provided in the table below. Queues at the toll plaza were approximately 2 vehicles on average with the exception of the Pittsburgh/Monroeville Interchange that experienced an average of 5 vehicles in both peak periods. The maximum queues overall were also at the Pittsburgh/Monroeville Interchange with 12 vehicles in the PM peak and 8 during the Saturday peak. The remaining interchanges experienced maximum queues of approximately 5-6 vehicles on average.

***Table 3-4: Toll Plaza Queuing (vehicles) during the Peak Periods***

| Interchange | Queue | Peak Hour Time Period 1 | Peak Hour Time Period 2 |
|---|---|---|---|
| **Butler-(39)** | Average | 1.8 (PM Peak) | 1.6 (SAT Peak) |
| | Maximum | 6 (PM Peak) | 5 (SAT Peak) |
| **Allegheny-(48)** | Average | 1.8 (AM Peak) | 1.7 (PM Peak) |
| | Maximum | 6 (AM Peak) | 4 (PM Peak) |
| **Pittsburgh-(57)** | Average | 5.5 (PM Peak) | 5.2 (SAT Peak) |
| | Maximum | 12 (PM Peak) | 8 (SAT Peak) |
| **Irwin-(67)** | Average | 1.7 (PM Peak) | 2.2 (SAT Peak) |
| | Maximum | 5 (PM Peak) | 5 (SAT Peak) |
| **New Stanton-(75)** | Average | 1.9 (AM Peak) | 2 (PM Peak) |
| | Maximum | 6 (AM Peak) | 7 (PM Peak) |

Modeling of the toll plaza facilities in both the cash and cashless scenarios was also uniform for each of the interchanges. This was done by modeling the different lane uses using the same model parameters. The E-ZPass lanes were modeled by providing a reduced speed area of 80 feet for the toll plaza facility itself. The speed in this area ranged between 7-19 mph in the model. Although the posted speed limit at the toll plaza is 5 mph, using the posted speed limit does not provide accurate results as most motorists are not traveling at this posted speed. Likewise, the cash exit lanes also provided the same reduced speed area and speed range but provided a dwell time ranging between 6 and 15 seconds that simulates the stop experienced when paying the toll collector. The toll plaza lane widths were set at 16.5 feet for each of the simulations and a reduced decision was placed upstream of each of the toll plazas that ranged between 20 and 30 mph. For the cashless scenarios the toll plaza dwell times, reduced speed

area, and multiple lane types were removed. For each interchange, the existing number of lanes approaching the toll plaza was kept consistent to the adjacent roadway network.

Performance measures were also developed as part of the operating procedures for the study. Three performance measures were selected to be part of this study and are provided below:

- Travel time (sec)
    - From upstream of the toll plaza location to a logical location on the state roadway network
- From upstream of the merge point with the Turnpike ramp on the local roadway to a logical point downstream Queuing (feet)
    - From a point on the local roadway network where queuing is occurring (usually a signalized intersection)
- Levels of Service
    - Signalized Intersection
      Merge point of the Turnpike ramp onto the local roadway net

## 3.2 Comparison of Cash vs. Cashless Tolling in Year 2022

### 3.2.1 Interchange 39-Butler Valley

**Description of Interchange**

The Butler Valley interchange study area includes a toll plaza with three exiting toll lanes, two signalized intersections and two merge areas. The analyzed intersections and merge points are listed and shown in the figure below:

1. SR 8and E Hardies Road-Signalized intersection
2. SR 8and E Bardonner Road-Signalized intersection
3. I-76 off-ramp and SR 8 –Northbound merge point
4. I-76 off-ramp and SR 8 –Southbound merge point


***Figure 3-2: Butler Valley Interchange and the analysis locations***

The traffic signal at SR 8 with E Hardies Rd is coordinated with a cycle length of 190 seconds. There is an emergency vehicle preemption phase for all movements with video detection for the SR 8 northbound and southbound approaches. This intersection was recently upgraded to include a northbound right turn lane and optimized signal timings. The traffic signal at SR 8 and E Bardonner road operates with a cycle

length of120 seconds. The eastbound and westbound intersection approaches are not aligned, but these minor roads operate as one traffic signal with split timings.

**Peak Periods Analyzed/Volumes**

From the peak period analysis, it was determined that the two peak periods at this interchange were PM weekday and Saturday afternoon. The weekday PM peak period analyzed was from 5:00 PM - 6:00 PM and the Saturday peak occurred from 3:00 PM – 4:00 PM. The corresponding peak hour traffic volumes for both periods at the exiting Turnpike ramps and SR 8 mainline are shown in the table below.

***Table 3-5: Butler Interchange Year 2022 Peak Hour Volumes***

| Location | Year 2022 Weekday PM Peak Volume (5:00 PM – 6:00 PM) | Year 2022 Saturday Peak Volume (3:00 PM – 4:00 PM) |
|---|---|---|
| I-76 EB Off-Ramp | 291 | 133 |
| I-76 WB Off-Ramp | 618 | 280 |
| SR 8 NB | 1652 | 1453 |
| SR 8 SB | 1083 | 1238 |

**E-ZPass Market Share**

The E-ZPass market share for the I-76 exiting vehicles at the Butler Interchange during the peak periods is provided in the table below. The majority of vehicles traveling on the Turnpike are utilizing E-ZPass. Car E-ZPass users reached approximately 85% during the weekday PM peak hour. Overall E-ZPass market share ranged between 73% and 86% at the Butler Interchange.

***Table 3-6: Butler Interchange E-ZPass User Percentages during Peak Period***

| | % E-ZPass (Weekday PM Peak) | %E-ZPass (Saturday Peak) |
|---|---|---|
| Overall | 86 | 73 |
| Class 1 (Auto) | 85 | 71 |
| Class 2-9 (Trucks) | 90 | 73 |

**Current Toll Lane Types/Lane Usage**

The type of lane usage for the exiting toll lanes varies depending on time of day and day of week. During data collection the lane usage for both peak periods is depicted in the table on the next page. Although there is a significant E-ZPass utilization at this interchange, 2 of the 3 exit lanes were posted as Cash Only.

**Table 3-7: Butler Interchange Lane Usage during Simulated Peak Periods**

| Toll Plaza Exiting Lane | Lane Use (Weekday PM Peak) | Lane Use (Saturday Peak) |
|---|---|---|
| Lane 4 | Cash | Cash |
| Lane 5 | E-ZPass | E-ZPass |
| Lane 6 | Cash | Cash |

**Current Queuing**

Existing queuing data was collected at three locations within the study area: the toll plaza, SR 8 northbound south of the Hardies Road intersection, and SR 8 southbound north of the Bardonner intersection during both peak periods. The longest queue was observed and measured at each location every minute. The data was aggregated into 15 minute increments and is summarized in the tables below and the next few pages for each location and peak periods. An overall summary of the queue data is also provided in the tables. The tables provide both the average and maximum queue every 15 minutes in both number of vehicles and feet. The toll plaza did not experience significant queuing during either PM or Saturday Peaks. Maximum queuing at the toll plaza was 56 feet during the PM peak period with an average of 21 feet (approximately 1 vehicle). During the Saturday peak toll plaza queuing was slightly longer than the PM when comparing the overall average and maximum lengths. The maximum queues ranged between 56 and 93 feet with an average of 30 feet.

***Table 3-8: Butler Interchange Queuing at Toll Plaza (PM Peak)***

| Time (PM) | Average (Vehicles) | Max (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:15 | 1 | 3 | 27 | 56 |
| 4:15-4:30 | 1 | 3 | 17 | 56 |
| 4:30-4:45 | 1 | 3 | 19 | 56 |
| 4:45-5:00 | 1 | 3 | 21 | 56 |
| **Overall** | 1 | 3 | 21 | 56 |

**Table 3-9: Butler Interchange Queuing at Toll Plaza (Sat Peak)**

| Time (PM) | Average (Vehicles) | Max (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:15 | 1 | 3 | 22 | 56 |
| 4:15-4:30 | 2 | 5 | 36 | 93 |
| 4:30-4:45 | 2 | 4 | 35 | 74 |
| 4:45-5:00 | 1 | 3 | 27 | 56 |
| **Overall** | 2 | 4 | 30 | 69 |

The longest queues within the Butler Interchange study area were experienced at the SR 8 and Hardies Road intersection. Average Queuing at SR 8/Hardies Road ranged between 197 feet and 279 feet for the PM peak hour and 141 feet and 179 feet for the Saturday peak hour. The maximum queues were 463 feet and 555 feet for the PM and Saturday peak hours, respectively. The overall average queue was 228 feet (approximately 12 vehicles) for the PM peak hour and 157 feet (approximately 9 vehicles) for the Saturday peak hour.

***Table 3-10: Butler Interchange Queuing at SR 8/Hardies Rd PM Peak***

| Time (PM) | Average (Vehicles) | Max (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:15 | 12 | 17 | 227 | 315 |
| 4:15-4:30 | 11 | 14 | 197 | 259 |
| 4:30-4:45 | 11 | 20 | 211 | 370 |
| 4:45-5:00 | 15 | 25 | 279 | 463 |
| **Overall** | 12 | 19 | 228 | 352 |

***Table 3-11: Butler Interchange Queuing at SR 8/Hardies Rd (Sat Peak)***

| Time (PM) | Average (Vehicles) | Max (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:15 | 9 | 14 | 158 | 259 |
| 4:15-4:30 | 8 | 18 | 152 | 333 |
| 4:30-4:45 | 10 | 30 | 179 | 555 |
| 4:45-5:00 | 8 | 20 | 141 | 370 |
| **Overall** | 9 | 21 | 157 | 379 |

Average queues at SR 8 and Bardonner Road ranged between 80 feet and 102 feet during the PM peak hour, and 28 feet and 64 feet during the Saturday peak hour. The maximum queues experienced were 278 feet and 185 feet for the PM and Saturday peak hours, respectively.

***Table 3-12: Butler Interchange Queuing at SR 8/Bardonner Rd PM Peak***

| Time (PM) | Average (Vehicles) | Max (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:15 | 5 | 13 | 88 | 241 |
| 4:15-4:30 | 6 | 15 | 102 | 278 |
| 4:30-4:45 | 4 | 14 | 80 | 259 |
| 4:45-5:00 | 5 | 11 | 93 | 204 |
| **Overall** | 5 | 13 | 91 | 245 |

***Table 3-13: Butler Interchange Queuing at SR 8/Bardonner Rd (Sat Peak)***

| Time (PM) | Average (Vehicles) | Max (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:15 | 2 | 4 | 28 | 74 |
| 4:15-4:30 | 2 | 7 | 44 | 130 |
| 4:30-4:45 | 2 | 10 | 35 | 185 |
| 4:45-5:00 | 3 | 10 | 64 | 185 |
| **Overall** | 2 | 8 | 43 | 143 |

**Model Calibration**

The base traffic model was calibrated to reflect actual traffic counts and queue measurements. These measurements were checked against model queue output to assure the model represents realistic traffic conditions in the study area. The traffic count and model volume comparisons through each exit toll plaza lane, as well as approaching volumes at the intersections, are shown in tables provided in Appendix C for each interchange. As shown in the tables, volume calibration differences are within acceptable tolerances. Based on the actual data and model parameter comparisons, there is confidence in the model that it is fully calibrated and is a realistic representation of traffic conditions at the Butler Interchange.

**Comparison Results of Cash vs. Cashless Tolling**

The results from the model comparing cash versus cashless tolling scenarios are presented in the tables below. Based on the results, it can be concluded that if the toll plaza is removed and is converted to cashless tolling, there will be little effect on traffic from the increased arrival rates. The level of service (LOS) and queuing at the intersections do not degrade with cashless tolling compared to cash tolling and in some cases conditions actually improve. At the SR 8 and Bardonner intersection, the overall delay decreased by 1 second when converting to cashless tolling. Also, the merge areas do not experience any significant impacts from cashless tolling. In fact, the travel times from the toll plaza to the adjoining NB and SB intersections show some improvement because the elimination of the toll plazas allows drivers to continue through the former plaza areas without slowing down or stopping. For example, the southbound travel time from the toll plaza to SR 8/Bardonner decreased by 19 seconds compared with the cash scenario.

***Table 3-14: Butler Valley Interchange Comparison Results of Cash vs. Cashless Tolling (SR 8)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| From Toll Plaza Area to SR 8 NB | 234 | 217 | -17 | -7% | 203 | 184 | -19 | -9% |
| From Toll Plaza Area to SR 8 SB | 370 | 351 | -19 | -5% | 351 | 330 | -21 | -6% |
| **Queuing (ft)** | | | | | | | | |
| Hardies Rd NB (Avg) | 136 | 132 | -4 | -3% | 96 | 94 | -2 | -2% |
| Hardies Rd NB (Max) | 536 | 455 | -81 | -15% | 526 | 468 | -57 | -11% |
| Bardonner Rd SB (Avg) | 125 | 118 | -7 | -6% | 73 | 74 | 1 | 2% |
| Bardonner Rd SB (Max) | 671 | 647 | -25 | -4% | 615 | 533 | -82 | -13% |
| **Level of Service (Delay in Seconds)** | | | | | | | | |
| Delay at SR 8 and Hardies Rd intersection | D (38.0) | D (38.3) | 0 | 1% | C (28.8) | C (28.7) | 0 | 0% |
| Delay at SR 8 and Bardonner Rd intersection | E (77.6) | E (76.7) | -1 | -1% | E (65.9) | E (64.6) | -1 | -2% |
| Merge Area with SR 8 SB | E (42.2) | E (42.3) | 0 | 0% | C (27.3) | D (28.2) | 1 | 3% |
| Merge Area with SR 8 NB | B (19.0) | B (18.9) | 0 | -1% | C (20) | C (20.8) | 1 | 4% |

### 3.2.2 Interchange 48-Allegheny Valley

**Description of Interchange**

The Allegheny Valley Interchange study area is comprised of a toll plaza with five exiting toll lanes, three signalized intersections, and two merge areas. They are listed in the figure below:

1. SR 0910 Indianola Road and SR 1001 Freeport Road
2. Freeport Road and Alpha Drive West
3. Freeport Road and Alpha Drive East
4. I-76 off-ramp and Freeport Road Westbound merge point
5. I-76 off-ramp and Freeport Road Eastbound merge point

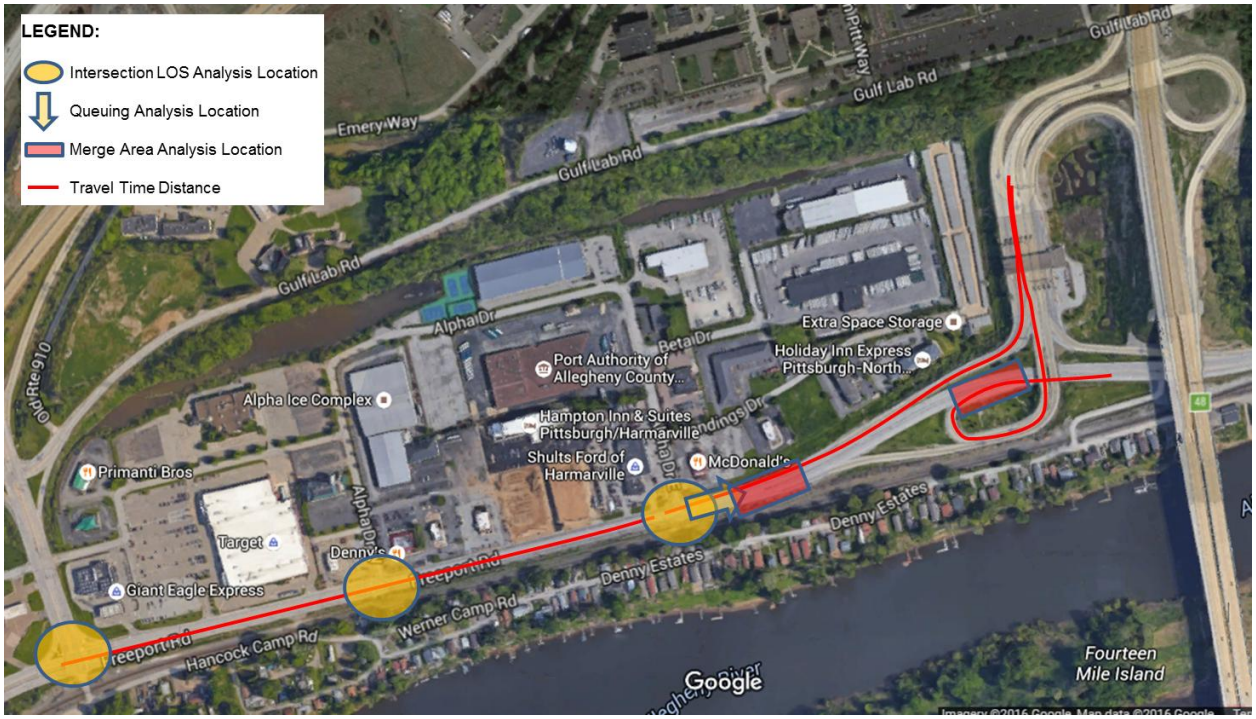



***Figure 3-3: Allegheny Valley Interchange and the analysis locations.***

**Peak Periods Analyzed/Volumes**

From the peak period analysis it was determined that the two peak periods were the AM and PM weekday peaks. The AM weekday peak was from 7:30 AM – 8:30 AM and the PM weekday peak occurred from 5:00 PM – 6:00 PM. The peak hour volumes exiting the turnpike ramps to Freeport Road for the two peak periods are shown in the table below. The majority of traffic exiting I-76 at the Allegheny Valley Interchange is traveling westbound to Freeport Road.

*Table 3-15: Allegheny Valley Interchange Year 2022 Peak Hour Volumes*

| Location | Year 2022 Weekday AM Peak Volume (7:30 AM – 8:30 AM) | Year 2022 Weekday PM Peak Volume (5:00 PM – 6:00 PM) |
|---|---|---|
| I-76 Off-Ramp to Freeport Road EB | 358 | 456 |
| I-76 Off-Ramp to Freeport Road WB | 1142 | 715 |

**E-ZPass Market Share**

The E-ZPass market share for the I-76 exiting vehicles at the Allegheny Valley interchange during the peak periods is given in the table below. The majority of vehicles exiting the Turnpike at Allegheny Valley are using EZ-Pass. Overall, E-ZPass market share ranged between 81% and 87%.

*Table 3-16: Allegheny Valley Interchange E-ZPass User Percentage during Peak Period*

| | % E-ZPass (Weekday AM Peak Hour) | % E-ZPass (Weekday PM Peak Hour) |
|---|---|---|
| Overall | 87% | 81% |
| Class 1 (Auto) | 87% | 80% |
| Class 2-9 (Trucks) | 88% | 82% |

**Current Toll Lane Types/Lane Usage**

The type of lane usage for the exiting toll lanes for both peak periods is depicted in table below. The lane usage during the peak hours was consistent during the entire hour at the Allegheny Valley Interchange.

*Table 3-17: Allegheny Valley Interchange Lane Usage during Simulated Peak Periods*

| Toll Plaza Exiting Lane | Lane Use (Weekday AM Peak) | Lane Use (Weekday PM Peak) |
|---|---|---|
| Lane 5 | Cash | Cash |
| Lane 6 | E-ZPass | E-ZPass |
| Lane 7 | Cash | Cash |
| Lane 8 | E-ZPass | E-ZPass |
| Lane 8 | Cash | Cash |

**Current Queuing**

Existing queuing data was collected at two locations within the study area: at the toll plaza and the westbound approach to Alpha Drive East. The data was collected every minute and aggregated into 5 minute increments and is summarized in the tables on the next pages. The tables provide both the average and maximum queue every five minutes in both number of vehicles and feet. To calculate the average and maximum length, from the number of vehicles, the truck percentage during each peak was applied and then 25 feet was used for passenger car length and 55 feet was used for truck length.

Average queuing at the toll plaza ranged between 17 and 106 feet and 22 and 70 feet during the AM and PM peak periods, respectively. Maximum queuing at the toll plaza ranged between 28 and 168 feet during the AM peak hour. During the PM peak hour, queuing was less when comparing the average and maximum queue lengths. The maximum queues ranged between 27 and 108 feet for the PM peak hour.

***Table 3-18: Allegheny Valley Interchange Queuing at Toll Plaza (AM Peak)***

| Time (AM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Average Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 8:00-8:05 | 4 | 6 | 106 | 168 |
| 8:05-8:10 | 2 | 5 | 67 | 140 |
| 8:10-8:15 | 1 | 3 | 39 | 84 |
| 8:15-8:20 | 1 | 2 | 34 | 56 |
| 8:20-8:25 | 2 | 3 | 62 | 84 |
| 8:25-8:30 | 2 | 3 | 56 | 84 |
| 8:30-8:35 | 3 | 6 | 78 | 168 |
| 8:35-8:40 | 1 | 2 | 34 | 56 |
| 8:40-8:45 | 1 | 1 | 17 | 28 |
| 8:45-8:50 | 2 | 4 | 50 | 112 |
| 8:50-8:55 | 2 | 2 | 50 | 56 |
| 8:55-9:00 | 1 | 1 | 17 | 28 |
| **Overall** | 2 | 6 | 50 | 168 |

***Table 3-19: Allegheny Valley Interchange Queuing at Toll Plaza (PM Peak)***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Average Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:05 | 2 | 3 | 54 | 81 |
| 4:05-4:10 | 2 | 3 | 43 | 81 |
| 4:10-4:15 | 2 | 3 | 60 | 81 |
| 4:15-4:20 | 1 | 2 | 22 | 54 |
| 4:20-4:25 | 2 | 3 | 49 | 81 |
| 4:25-4:30 | 1 | 2 | 33 | 54 |
| 4:30-4:35 | 1 | 2 | 33 | 54 |
| 4:35-4:40 | 2 | 2 | 43 | 54 |
| 4:40-4:45 | 1 | 1 | 22 | 27 |
| 4:45-4:50 | 3 | 4 | 70 | 108 |
| 4:50-4:55 | 2 | 4 | 65 | 108 |
| 4:55-5:00 | 2 | 2 | 49 | 54 |
| **Overall** | 2 | 4 | 45 | 108 |

Alpha Drive East is the first intersection on Freeport Road westbound after the I-76 off-ramp. In the AM peak hour, significant queuing was observed on the westbound approach to Alpha Drive East. The queue monitoring started at 8:00 AM and it was noted in the field that queuing was substantial beginning at 7:30 AM. The highest recorded queues are in the first five minutes of data collection. It was noted that the queuing from Alpha Drive East queued into the toll plaza. There was no substantial queuing in the PM peak hour.

Average queuing at Alpha Drive East ranged 157 and 437 feet and maximum queuing ranged between 224 and 728 feet (approximately 26 vehicles) during the AM peak. During the PM peak, queuing was significantly less. Average queuing ranged between 92 and 205 feet and maximum queues ranged between 163 and 352 feet (approximately 13 vehicles).

***Table 3-20: Allegheny Valley Interchange Queuing at Alpha Drive East (AM Peak)***

| Time (AM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Average Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 8:00-8:05 | 16 | 26 | 437 | 728 |
| 8:05-8:10 | 11 | 20 | 319 | 560 |
| 8:10-8:15 | 12 | 17 | 330 | 476 |
| 8:15-8:20 | 12 | 15 | 330 | 420 |
| 8:20-8:25 | 15 | 20 | 426 | 560 |
| 8:25-8:30 | 10 | 14 | 274 | 392 |
| 8:30-8:35 | 8 | 15 | 230 | 420 |
| 8:35-8:40 | 12 | 18 | 347 | 504 |
| 8:40-8:45 | 10 | 14 | 280 | 392 |
| 8:45-8:50 | 7 | 12 | 185 | 336 |
| 8:50-8:55 | 11 | 18 | 302 | 504 |
| 8:55-9:00 | 6 | 8 | 157 | 224 |
| **Overall** | 11 | 26 | 301 | 728 |

***Table 3-21: Allegheny Valley Interchange Queuing at Alpha Drive East (PM Peak)***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Average Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:05 | 8 | 12 | 206 | 325 |
| 4:05-4:10 | 6 | 11 | 168 | 298 |
| 4:10-4:15 | 8 | 13 | 206 | 352 |
| 4:15-4:20 | 6 | 11 | 157 | 298 |
| 4:20-4:25 | 7 | 10 | 184 | 271 |
| 4:25-4:30 | 4 | 9 | 103 | 244 |
| 4:30-4:35 | 4 | 6 | 98 | 163 |
| 4:35-4:40 | 4 | 8 | 103 | 217 |
| 4:40-4:45 | 3 | 6 | 92 | 163 |
| 4:45-4:50 | 6 | 11 | 173 | 298 |
| 4:50-4:55 | 6 | 9 | 163 | 244 |
| 4:55-5:00 | 6 | 9 | 152 | 244 |
| **Overall** | 6 | 13 | 153 | 352 |

**Model Calibration**

The base traffic model was calibrated to reflect actual traffic counts and queue measurements. These measurements were checked against model queue output to assure the model represents realistic traffic conditions in the study area. The traffic count and model volume comparisons through each exit toll plaza lane as well as approaching volumes at the intersections are shown in tables provided in Appendix C for each interchange. As shown in the tables, volume calibration differences are within acceptable tolerances. Based on the overall volume comparisons, there is confidence the model is fully calibrated and is an accurate representation of traffic conditions at the Allegheny Valley Interchange.

**Comparison Results of Cash vs. Cashless Tolling**

The results from the model comparing cash versus cashless tolling scenarios are displayed in the tables on the next pages**.** Based on the results, it can be concluded that the removal of the toll plaza will not have a negative impact on traffic operations. The travel times, queuing and Levels of Service (LOS) do not degrade with the implementation of cashless tolling.

In the westbound direction on Freeport Road, the overall travel times decrease. This can be attributed mostly to the removal of delay associated with the toll plaza. The travel times from Alpha Drive East to just west of SR 910/Indianola Road increased by 1 and 2 seconds in the AM and PM peak hours, respectively. At the Alpha Drive East intersection, the LOS actually improves slightly when the intersection services random arrivals directly from the Turnpike as compared to traffic metered by the toll plaza. The LOS differences are nominal at the SR 910/Indianola Road intersection. This pattern is consistent in both the AM and PM peak hours.

***Table 3-22: Allegheny Valley Interchange Cash vs. Cashless Tolling on Freeport Rd. Westbound***

| | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to West of just west of Alpha Drive East | 137 | 116 | -21 | -15% | 81 | 67 | -14 | -17% |
| 2) From Just west of Alpha Drive East to West of SR 910 & Freeport Road | 95 | 97 | 2 | 2% | 98 | 99 | 1 | 1% |
| **Queuing (ft)** | | | | | | | | |
| 2) Alpha Drive East Westbound Approach (avg) | 622 | 522 | -100 | -16% | 80 | 80 | 0 | 0% |
| 2) Alpha Drive East Westbound Approach (max) | 1658 | 1678 | 20 | 1% | 385 | 404 | 19 | 5% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area from Toll Plaza to Westbound Freeport Road (pc/hr/ln) | F (184)* | F (161)* | N/A | N/A | D (31.1) | D (31.2) | 0.1 | 0.3% |
| 2) Intersection with Alpha Drive East (delay) | D (37.6) | D (35.0) | -2.6 | -4% | C (21.7) | C (20.6) | -1.1 | -5% |
| 3) Intersection with Alpha Drive West (delay) | C (24.2) | C (23.8) | -0.4 | 0% | C (21.0) | C (20.6) | -0.4 | 0% |
| 4) Intersection with SR 910/Indianola Rd. (delay) | C (21.0) | C (21.2) | 0.2 | 0% | C (24.2) | C (24.4) | 0.2 | 0% |

*Ramp Operation impacted by adjacent signal at Alpha Drive East

In the eastbound direction on Freeport Road, the overall travel times decrease as well. Similar to the westbound direction the travel time improvement can be attributed mostly to the removal of delay associated with the toll plaza. The LOS degrades slightly at I-76 to Freeport Road eastbound merge point, but is still expected to operate at a LOS B.

***Table 3-23: Allegheny Valley Interchange Cash vs. Cashless Tolling on Freeport Rd. Eastbound***

| | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to Eastbound Freeport Road | 73 | 56 | -17 | -23% | 71 | 56 | -15 | -21% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with Freeport Road (pc/mi/ln) | B (12.9) | B (13.0) | 0.1 | 1% | C (23.9) | C (24.2) | 0.3 | 1% |

### 3.2.3 Interchange 57-Pittsburgh/Monroeville Interchange

**Description of Interchange**

The Pittsburgh/Monroeville Interchange study area is comprised of a toll plaza with seven exiting toll lanes (six were open during the data collection and modeling of the interchange), three signalized intersections and five merge areas. The three signalized intersections were analyzed, but only two merge areas were deemed critical for this analysis. They are listed below:

- Business Route 22 (SR 2048) and McMasters Drive/Lowes Drive – Signalized Intersection
- Business Route 22 (SR 2048) and SR 00048 (Mosside Blvd)/SR 2057 (Haymaker Rd) – Signalized Intersection
- US 22 and Cochran Drive – Signalized Intersection
- I-76 off-ramp and Business 22 (SR 2048) westbound merge point
- I-76 off-ramp and US 22 eastbound merge point

The figure below shows the Pittsburgh/Monroeville Interchange and the analysis locations.


***Figure 3-4: Pittsburgh/Monroeville Interchange Study Area***

The traffic signals at SR 2048 with McMaster Drives and SR 0048 are coordinated with a cycle length of 180 seconds. There is a queue preemption phase for the SR 2057 (Haymaker Blvd) southbound movement with video detection on the I-376 eastbound off ramp towards southbound SR 0048. The traffic signal at US 22 and Cochran Drive was recently upgraded to an adaptive signal control system which has improved traffic flow on US 22 from the merge from I-376 and US 22 merge points to US 22/Cochran Drive intersection.

### Peak Period Analyzed/Volumes

From the peak period analysis it was determined the two peak periods were PM weekday and Saturday peak. The weekday PM peak period analyzed occurred from 4:15 PM - 5:15 PM and Saturday peak occurred from 1:00 PM – 2:00 PM. The corresponding peak hour volumes at the exiting Turnpike ramps and US 22 mainline for the two peak periods are shown in the table on the next page**.**

***Table 3-24: Pittsburgh/Monroeville Year 2022 Peak Hour Volumes***

| Location | Year 2022 Weekday PM Peak Volume (4:15 PM – 5:15 PM) | Year 2022 Saturday Peak Volume (1:00 PM – 2:00 PM) |
|---|---|---|
| I-76 Off Ramp to US 22 EB | 416 | 211 |
| I-76 Off Ramp to US 22 WB | 774 | 471 |
| I-76 Off Ramp to I-376 WB | 628 | 644 |
| US 22 EB | 655 | 810 |
| US 22 WB | 618 | 790 |

### E-ZPass Market Share

The E-ZPass market share for the I-76 exiting vehicles at the Pittsburgh/Monroeville Interchange during the peak periods is given in table below. The majority of vehicles traveling on the Turnpike use E-ZPass. Truck E-ZPass users reached nearly 90% (approximately 88%) during the weekday PM peak hour. Overall E-ZPass market share ranged between 65% and 77% at the Monroeville Interchange.

***Table 3-25: Pittsburgh/Monroeville E-ZPass User Percentages during Peak Period***

| | % E-ZPass (Weekday PM Peak) | %E-ZPass (Saturday Peak) |
|---|---|---|
| Overall | 77 | 65 |
| Class 1 (Auto) | 76 | 64 |
| Class 2-9 (Trucks) | 88 | 84 |

### Current Toll Lane Types/Lane Usage

The type of lane usage for the exiting toll lanes for both peak periods is depicted in the table and figure on the next page. Of the seven exit lanes at the Monroeville Interchange, one was closed during the data collection period (Lane 9). The 2022 VISSIM analysis for both the cash modeling showed this lane as opened and Lane 10 became EZ-Pass only while Lane 9 remained a cash lane. However, this lane needed to be closed during the calibration of the 2015 Existing Model as this was the condition during the data collection.

***Table 3-26: Pittsburgh/Monroeville Lane Usage during Peak Period***

| Toll Plaza Exiting Lane | Lane Use (Weekday PM Peak) | Lane Use (Saturday Peak) |
|---|---|---|
| Lane 5 | E-ZPass | Mixed Use |
| Lane 6 | E-ZPass | E-ZPass |
| Lane 7 | Cash | Cash |
| Lane 8 | Cash | Cash |
| Lane 9 | Closed for Maintenance | Closed for Maintenance |
| Lane 10 | Cash | Cash |
| Lane 11 | E-ZPass | E-ZPass |

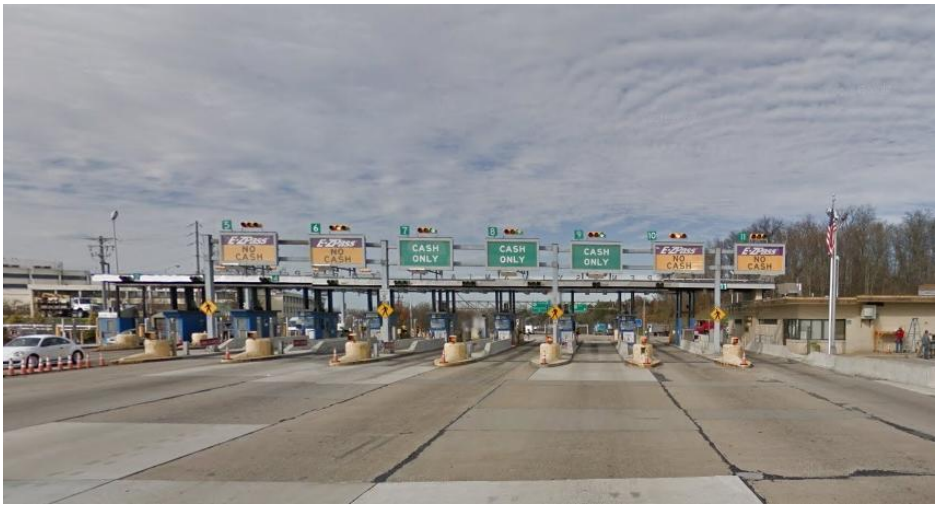



***Figure 3-5: Typical Exit Lane Configuration at the Pittsburgh/Monroeville Interchange***

**Current Queuing**

Existing queuing data was collected at three locations within the study area: the toll plaza, the SR 2048/SR 0048 intersection and SR 2048/Cochran Drive intersection during both peak periods. The longest queue was observed and measured at each location every minute. The data was aggregated into 5 minute increments and is summarized in the tables below for each location and peak periods. The tables provide both the average and maximum queue every five minutes in both number of vehicles and feet. An overall summary of the queue data is also provided in the tables.

The toll plaza did not experience significant queuing during PM or Saturday peaks. Maximum queuing at the toll plaza ranged between 56 and 222 feet during the PM peak period with an average of 102 feet (approximately 6 vehicles). During the Saturday peak, toll plaza queuing was slightly less than the PM when comparing the overall average and maximum lengths. The maximum queues ranged between 109 and 146 feet with an average of 94 feet (approximately 5 vehicles).

**Table 3-27: Pittsburgh/Monroeville Interchange Queuing at Toll Plaza (PM Peak)**

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:15-4:20 | 6 | 9 | 114 | 167 |
| 4:20-4:25 | 3 | 4 | 59 | 74 |
| 4:25-4:30 | 5 | 7 | 100 | 130 |
| 4:30-4:35 | 6 | 9 | 104 | 167 |
| 4:35-4:40 | 6 | 7 | 107 | 130 |
| 4:40-4:45 | 2 | 3 | 33 | 56 |
| 4:45-4:50 | 3 | 4 | 48 | 74 |
| 4:50-4:55 | 4 | 7 | 74 | 130 |
| 4:55-5:00 | 5 | 6 | 89 | 111 |
| 5:00-5:05 | 10 | 12 | 189 | 222 |
| 5:05-5:10 | 9 | 10 | 170 | 185 |
| 5:10-5:15 | 8 | 10 | 141 | 185 |
| **Overall** | 6 | 7 | 102 | 136 |

***Table 3-28: Pittsburgh/Monroeville Interchange Queuing at Toll Plaza (Sat Peak)***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 1:00-1:05 | 5 | 7 | 88 | 127 |
| 1:05-1:10 | 6 | 8 | 109 | 146 |
| 1:10-1:15 | 6 | 8 | 113 | 146 |
| 1:15-1:20 | 6 | 8 | 109 | 146 |
| 1:20-1:25 | 5 | 7 | 98 | 127 |
| 1:25-1:30 | 6 | 8 | 106 | 146 |
| 1:30-1:35 | 4 | 6 | 80 | 109 |
| 1:35-1:40 | 4 | 6 | 66 | 109 |
| 1:40-1:45 | 4 | 7 | 80 | 127 |
| 1:45-1:50 | 5 | 7 | 87 | 127 |
| 1:50-1:55 | 4 | 6 | 76 | 109 |
| 1:55-2:00 | 6 | 8 | 117 | 146 |
| **Overall** | 5 | 7 | 94 | 131 |

Average Queuing at SR 2048/Cochran Drive ranged between 99 feet and 252 feet for the PM peak hour and 36 feet and 124 feet for the Saturday peak hour. The maximum queue for the PM peak hour reached approximately 500 feet and 400 feet for the Saturday peak hour. The overall average queue was 183 feet (approximately 10 vehicles) for the PM peak hour and 75 feet (approximately 4 vehicles) for the Saturday peak hour.

***Table 3-29: Pittsburgh/Monroeville Interchange Queuing at SR 2048/Cochran Dr. PM Peak***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:15-4:20 | 5 | 21 | 99 | 389 |
| 4:20-4:25 | 7 | 19 | 130 | 352 |
| 4:25-4:30 | 11 | 20 | 196 | 370 |
| 4:30-4:35 | 12 | 23 | 215 | 426 |
| 4:35-4:40 | 7 | 16 | 137 | 296 |
| 4:40-4:45 | 10 | 21 | 178 | 389 |
| 4:45-4:50 | 10 | 19 | 185 | 352 |
| 4:50-4:55 | 10 | 16 | 181 | 296 |
| 4:55-5:00 | 11 | 24 | 207 | 444 |
| 5:00-5:05 | 14 | 26 | 252 | 481 |
| 5:05-5:10 | 12 | 22 | 222 | 407 |
| 5:10-5:15 | 11 | 26 | 196 | 481 |
| **Overall** | 10 | 21 | 183 | 390 |

***Table 3-30: Pittsburgh/Monroeville Interchange Queuing at US 22/Cochran Dr. Sat Peak***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 1:00-1:05 | 4 | 16 | 70 | 291 |
| 1:05-1:10 | 3 | 9 | 58 | 164 |
| 1:10-1:15 | 3 | 8 | 55 | 146 |
| 1:15-1:20 | 2 | 7 | 36 | 127 |
| 1:20-1:25 | 6 | 22 | 117 | 401 |
| 1:25-1:30 | 7 | 18 | 124 | 328 |
| 1:30-1:35 | 7 | 22 | 120 | 401 |
| 1:35-1:40 | 3 | 13 | 47 | 237 |
| 1:40-1:45 | 4 | 11 | 73 | 200 |
| 1:45-1:50 | 3 | 8 | 47 | 146 |
| 1:50-1:55 | 4 | 15 | 76 | 273 |
| 1:55-2:00 | 4 | 10 | 73 | 182 |
| **Overall** | 4 | 13 | 75 | 241 |

The longest queues within the Monroeville Interchange study area were experienced at the Business 22 (SR 2048) and SR 48/SR 2057 intersection as can be seen in the tables on the next pages. Average queues ranged between 162 and 322 feet during the PM peak and 232 and 439 feet during the Saturday peak hour. The maximum queue experienced during the PM Peak hour was 415 feet. However, it should be noted that queues were actually longer than what was measured in the field because at certain points the queue was no longer visible from the I-376 off-ramp at the diverge point from the Parkway East. The maximum queue during the Saturday peak was 703 feet (approximately 40 vehicles) and was almost 500 feet when averaged over the entire hour.

***Table 3-31: Business 22 (SR 2048) and SR 0048/SR 2057 Queues during the PM Peak Hour***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:15-4:20 | 9 | 16 | 162 | 277 |
| 4:20-4:25 | 13 | 15 | 222 | 260 |
| 4:25-4:30 | 17 | 20 | 291 | 346 |
| 4:30-4:35 | 19 | 21 | 322 | 364 |
| 4:35-4:40 | 14 | 18 | 242 | 312 |
| 4:40-4:45 | 15 | 20 | 256 | 346 |
| 4:45-4:50 | 15 | 23 | 263 | 398 |
| 4:50-4:55 | 16 | 24 | 280 | 415 |
| 4:55-5:00 | 14 | 17 | 235 | 294 |
| 5:00-5:05 | 17 | 23 | 298 | 398 |
| 5:05-5:10 | 15 | 18 | 263 | 312 |
| 5:10-5:15 | 18 | 24 | 305 | 415 |
| **Overall** | 15 | 20 | 262 | 345 |

***Table 3-32: Business 22 (SR 2048) and SR 0048/SR 2057 Queues during the Sat Peak Hour***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 1:00-1:05 | 17 | 26 | 302 | 457 |
| 1:05-1:10 | 20 | 30 | 358 | 527 |
| 1:10-1:15 | 25 | 40 | 439 | 703 |
| 1:15-1:20 | 18 | 30 | 316 | 527 |
| 1:20-1:25 | 20 | 31 | 351 | 545 |
| 1:25-1:30 | 13 | 19 | 232 | 334 |
| 1:30-1:35 | 15 | 23 | 260 | 404 |
| 1:35-1:40 | 16 | 26 | 281 | 457 |
| 1:40-1:45 | 14 | 20 | 249 | 351 |
| 1:45-1:50 | 16 | 28 | 281 | 492 |
| 1:50-1:55 | 23 | 30 | 401 | 527 |
| 1:55-2:00 | 15 | 24 | 267 | 422 |
| **Overall** | 18 | 27 | 312 | 479 |

**Model Calibration**

The base traffic model was calibrated to reflect actual traffic counts and queue measurements were compared with the model queue output to assure the model represents realistic traffic conditions in the study area. These measurements were checked against model queue output to assure the model represents realistic traffic conditions in the study area. The traffic count and model volume comparisons through each exit toll plaza lane as well as approaching volumes at the intersections are shown in tables provided in Appendix C for each interchange. As shown in the tables, volume calibration differences are within acceptable tolerances. Based on the overall volume comparisons, there is confidence the model is fully calibrated and is an accurate representation of traffic conditions at the Pittsburgh/Monroeville Interchange.

### Comparison Results of Cash vs. Cashless Tolling

The results from the model comparing cash versus cashless tolling scenarios are presented in the tables below and on the next page. Based on the results, it can be concluded that when the toll plaza is removed and is converted to cashless tolling, there will be little to positive effect on traffic from the increased arrival rates. The level of service (LOS) and queuing at the intersections do not degrade with cashless tolling compared to cash tolling. At the SR 2048/SR 0048 intersection, the overall LOS delay only increased by 1 second when converting to cashless tolling. Also, the merge areas do not show any significant impacts from cashless tolling. In fact, the travel times from the toll plaza to the adjoining EB and WB intersections show some improvement because the elimination of the toll plazas allows drivers to no longer need to slow down or stop at the toll plaza. For example, the westbound travel time from the toll plaza to SR 2048/McMasters Drive decreased by 17 seconds with the cashless scenario for the PM Peak and 20 seconds for the Saturday peak. Delay at the Cochran Drive intersection when comparing cash versus the cashless shows very little change (approximately 0.1 seconds). This can be attributed to the adaptive signal system that was recently implemented at this intersection.

***Table 3-33: Pittsburgh/Monroeville Interchange Comparison Results of Cash vs. Cashless Tolling (Westbound to SR 2048/McMasters Dr)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to SR 2048/McMasters Dr | 190 | 173 | -17 | -9% | 182 | 162 | -20 | -11% |
| 2) From 2000 ft. Upstream on SR 2048 to US 22/McMasters Dr | 83 | 83 | 0 | 0% | 80 | 80 | 0 | 0% |
| **Queuing (ft.)** | | | | | | | | |
| From SR 2048/SR 0048 (Avg) | 931 | 953 | 22 | 2% | 258 | 244 | -14 | -5% |
| From SR 2048/SR 0048 (Max) | 1533 | 1471 | -63 | -4% | 913 | 831 | -82 | -9% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with SR 2048 (Density in pc/mi/ln) | C (25.1) | C (26.2) | 1.1 | 4% | B (19.9) | C (20.2) | 0.3 | 2% |
| 2) SR 2048/SR 48 (Average Delay/Veh in Seconds) | F (83.2) | F (84.1) | 1 | 1% | D (53.0) | D (52.7) | -0.3 | -1% |
| 3) SR 2048/McMasters Dr/Lowes Dr (Average Delay/Veh in Seconds) | C (25.5) | C (25.9) | 0.4 | 2% | B (16.5) | B (16.7) | 0.2 | 1% |

***Table 3-34: Pittsburgh/Monroeville Interchange Comparison Results of Cash vs. Cashless Tolling (Eastbound to SR 2048/Cochran Dr.)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to SR 2048/Cochran Drive | 118 | 98 | -20 | -17% | 114 | 93 | -21 | -19% |
| 2) From 2000 ft. Upstream on SR 2048 to US 22/Cochran Drive | 40 | 40 | 0 | 0% | 40 | 39 | -1 | -3% |
| **Queuing (ft.)** | | | | | | | | |
| From SR 2048/Cochran Drive (Avg) | 44 | 43 | -1 | -2% | 34 | 32 | -2 | -7% |
| From SR 2048/Cochran Drive (Max) | 515 | 534 | 19 | 4% | 529 | 551 | 22 | 4% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with SR 2048 (Density in pc/mi/ln) | C (24.4) | C (24.6) | 0.2 | 1% | B (17.4) | B (17.4) | 0 | 0% |
| 2) SR 2048/Cochran Drive (Average Delay/Veh in Seconds) | A (9.4) | A (9.3) | -0.1 | -1% | A (8.4) | A (8.2) | -0.2 | -2% |

### 3.2.4 Interchange 67-Irwin

#### Description of Interchange

The Irwin interchange study area is comprised of a toll plaza with five exiting toll lanes, two signalized intersections and two merge areas. They are listed below:

- SR 0030 (US 30) and Ronda Ct/Rocky Rd – Signalized Intersection
- SR 0030 (US 30) and SR 3071 (Arona Rd) – Signalized Intersection
- I-76 off-ramp and SR 0030 (US 30) westbound merge point
- I-76 off-ramp and SR 0030 (US 30) eastbound merge point

The figure below shows the Irwin Interchange and the analysis locations.

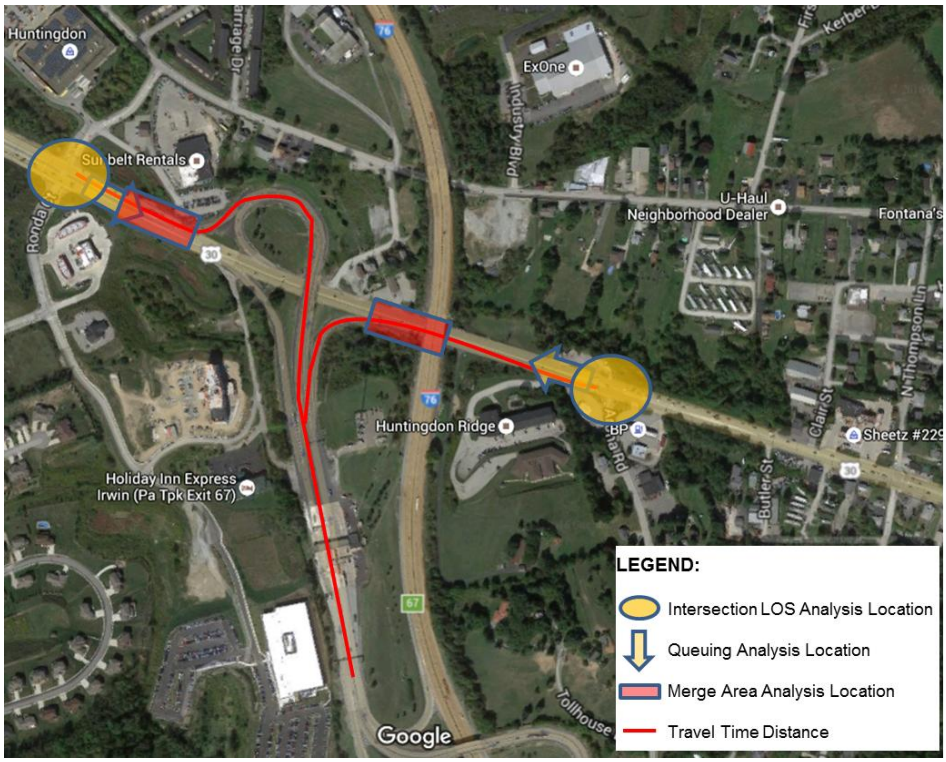



***Figure 3-6: Irwin Interchange Study Area***

The signals at US 30/Ronda Court and US 30/Arona Road are coordinated with a cycle time of 130 seconds. Also, a ramp preemption system exists with queue detection at the I-76 off ramp to US 30 WB. When activated, it preempts the westbound (US 30) left and through movement phase for the signal at US 30/Rocky Road and northbound (Arona Road) movement phase for the signal at US 30/Arona Road.

#### Peak Period Analyzed/Volumes

From the peak period analysis it was determined that the two peak periods were PM weekday and Saturday peak. The weekday PM peak period occurred from 4:15 PM - 5:15 PM and Saturday peak occurred from 3:45 PM – 4:45 PM. The corresponding peak hour volumes at the exiting Turnpike ramps and US 30 mainline for the two peak periods are shown in tables below**.**

***Table 3-35: Irwin Interchange E-ZPass User Percentages during Peak Period***

| Location | Year 2022 Weekday PM Peak Volume (4:15 PM – 5:15 PM) | Year 2022 Saturday Peak Volume (3:45 PM – 4:45 PM) |
|---|---|---|
| I-76 Off Ramp to US 30 EB | 701 | 395 |
| I-76 Off Ramp to US 30 WB | 573 | 279 |
| US 30 EB | 1202 | 993 |
| US 30 WB | 1296 | 1038 |

**E-ZPass Market Share**

The E-ZPass market share for the I-76 exiting vehicles at the Irwin Interchange during the peak periods is given in tables below. The majority of motorists exiting the Turnpike at the Irwin Interchange are E-ZPass users. Truck E-ZPass users reached 90% during the weekday PM peak hour. Overall E-ZPass market share ranged between 71% and 82% at the Irwin Interchange.

***Table 3-36: Irwin Interchange E-ZPass User Percentages during Peak Period***

| | % E-ZPass (Weekday PM Peak) | %E-ZPass (Saturday Peak) |
|---|---|---|
| Overall | 82 | 71 |
| Class 1 (Auto) | 82 | 69 |
| Class 2-9 (Trucks) | 90 | 88 |

**Current Toll Lane Types/Lane Usage**

The type of lane usage for the exiting toll lanes for both peak periods is depicted in table below**.** The figure below shows the exit lane configuration from Google Maps.

***Table 3-37: Irwin Interchange Lane Usage during Peak Period***

| Toll Plaza Exiting Lane | Lane Use (Weekday PM Peak) | Lane Use (Saturday Peak) |
|---|---|---|
| Lane 4 | Cash | Cash |
| Lane 5 | Cash | Cash |
| Lane 6 | E-ZPass | E-ZPass |
| Lane 7 | E-ZPass | E-ZPass |
| Lane 8 | Cash | Cash |


***Figure 3-7: Exiting Lane Configuration at the Irwin Interchange (Google Maps)***

**Current Queuing**

Existing queuing data was collected at three locations within the study area: the toll plaza, the SR 0030/Rocky Road intersection and SR 00300/SR 3071 (Arona Road) intersection during both peak periods. The longest queue was observed and measured at each location every minute. The data was aggregated into 5 minute increments and is summarized in the tables on the next pages for each location and peak period. The tables provide both the average and maximum queue every five minutes in both vehicles and feet. An overall summary of the queue data is also provided in the tables below.

The toll plaza experienced very little queuing during both PM and Saturday peaks. Average queuing at the toll plaza ranged from 25 feet to 63 feet for the PM peak and from 25 feet to 61 feet for the Saturday peak. Maximum queuing at the toll plaza ranged between 37 and 92 feet during the PM peak period with an overall average queue of 31 feet (approximately 2 vehicles). During the Saturday peak toll plaza queuing was similar to the PM peak with max queuing ranging from 36 to 90 feet and an overall average queue of 40 feet (approximately 2 vehicles).

***Table 3-38: Irwin Interchange Queuing at Toll Plaza (PM Peak)***

| Time Interval (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:15-4:20 | 2 | 5 | 37 | 92 |
| 4:20-4:25 | 2 | 5 | 43 | 92 |
| 4:25-4:30 | 1 | 2 | 25 | 37 |
| 4:30-4:35 | 2 | 3 | 33 | 55 |
| 4:35-4:40 | 3 | 5 | 63 | 92 |
| 4:40-4:45 | 1 | 2 | 25 | 37 |
| 4:45-4:50 | 1 | 2 | 25 | 37 |
| 4:50-4:55 | 2 | 3 | 33 | 55 |
| 4:55-5:00 | 2 | 4 | 33 | 74 |
| 5:00-5:05 | 1 | 2 | 25 | 37 |
| 5:05-5:10 | 2 | 3 | 41 | 55 |
| 5:10-5:15 | 1 | 2 | 18 | 37 |
| **Overall** | 2 | 3 | 31 | 58 |

***Table 3-39: Irwin Interchange Queuing at Toll Plaza (Sat Peak)***

| Time Interval (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 3:45-3:50 | 3 | 4 | 48 | 72 |
| 3:50-3:55 | 2 | 3 | 36 | 54 |
| 3:55-4:00 | 2 | 4 | 40 | 72 |
| 4:00-4:05 | 2 | 4 | 36 | 72 |
| 4:05-4:10 | 3 | 4 | 50 | 72 |
| 4:10-4:15 | 2 | 4 | 40 | 72 |
| 4:15-4:20 | 2 | 4 | 36 | 72 |
| 4:20-4:25 | 3 | 5 | 61 | 90 |
| 4:25-4:30 | 2 | 3 | 40 | 54 |
| 4:30-4:35 | 2 | 4 | 32 | 72 |
| 4:35-4:40 | 2 | 3 | 36 | 54 |
| 4:40-4:45 | 1 | 2 | 25 | 36 |
| **Overall** | 2 | 4 | 40 | 66 |

The tables below show queuing at US 30/Arona Road for both peak periods. Average queuing at US 30/Arona Road ranged from 109 feet to 306 feet for the PM peak and from 44 feet to 117 feet for the Saturday peak. Maximum queuing ranged from 255 feet to 437 feet for the PM peak and 91 to 273 feet for the Saturday peak. The overall average queue for the PM peak was 224 feet (approximately 12 vehicles) and 75 feet (approximately 4 vehicles) for the Saturday peak.

***Table 3-40: Irwin Interchange Queuing at US 30/Arona Rd (PM Peak)***

| Time Interval (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:15-4:20 | 14 | 24 | 249 | 437 |
| 4:20-4:25 | 11 | 18 | 197 | 328 |
| 4:25-4:30 | 6 | 14 | 109 | 255 |
| 4:30-4:35 | 9 | 21 | 157 | 382 |
| 4:35-4:40 | 11 | 24 | 208 | 437 |
| 4:40-4:45 | 17 | 24 | 306 | 437 |
| 4:45-4:50 | 13 | 24 | 233 | 437 |
| 4:50-4:55 | 12 | 24 | 211 | 437 |
| 4:55-5:00 | 15 | 22 | 273 | 401 |
| 5:00-5:05 | 12 | 24 | 219 | 437 |
| 5:05-5:10 | 13 | 24 | 237 | 437 |
| 5:10-5:15 | 16 | 24 | 288 | 437 |
| **Overall** | 12 | 22 | 224 | 405 |

***Table 3-41: Irwin Interchange Queuing at US 30/Arona Rd (Sat Peak)***

| Time Interval (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 3:45-3:50 | 6 | 10 | 106 | 182 |
| 3:50-3:55 | 3 | 8 | 61 | 146 |
| 3:55-4:00 | 3 | 7 | 62 | 127 |
| 4:00-4:05 | 4 | 8 | 73 | 146 |
| 4:05-4:10 | 3 | 6 | 51 | 109 |
| 4:10-4:15 | 4 | 10 | 80 | 182 |
| 4:15-4:20 | 4 | 10 | 76 | 182 |
| 4:20-4:25 | 6 | 15 | 117 | 273 |
| 4:25-4:30 | 2 | 5 | 44 | 91 |
| 4:30-4:35 | 4 | 11 | 80 | 200 |
| 4:35-4:40 | 3 | 8 | 62 | 146 |
| 4:40-4:45 | 5 | 11 | 84 | 200 |
| **Overall** | 4 | 9 | 75 | 165 |

The tables below show queuing at US 30/Rocky Road for both peak periods. Average queuing at US 30/Rocky Road ranged from 115 feet to 240 feet for the PM peak and from 58 feet to 193 feet for the Saturday peak. Maximum queuing ranged from 164 feet to 328 feet for the PM peak and 127 to 310 feet for the Saturday peak. The overall average queue for the PM peak was 167 feet (approximately 9 vehicles) and 140 feet (approximately 8 vehicles) for the Saturday peak.

***Table 3-42: Irwin Interchange Queuing at US 30/Rocky Rd (PM Peak)***

| Time Interval (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:15-4:20 | 9 | 11 | 164 | 200 |
| 4:20-4:25 | 6 | 9 | 115 | 164 |
| 4:25-4:30 | 7 | 11 | 131 | 200 |
| 4:30-4:35 | 11 | 15 | 200 | 273 |
| 4:35-4:40 | 13 | 18 | 240 | 328 |
| 4:40-4:45 | 9 | 12 | 160 | 219 |
| 4:45-4:50 | 8 | 11 | 146 | 200 |
| 4:50-4:55 | 8 | 12 | 146 | 219 |
| 4:55-5:00 | 9 | 13 | 168 | 237 |
| 5:00-5:05 | 11 | 14 | 193 | 255 |
| 5:05-5:10 | 9 | 11 | 168 | 200 |
| 5:10-5:15 | 10 | 13 | 178 | 237 |
| **Overall** | 9 | 13 | 167 | 228 |

***Table 3-43: Irwin Interchange Queuing at US 30/Rocky Rd (Sat Peak)***

| Time Interval (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Ave Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 3:45-3:50 | 9 | 14 | 155 | 255 |
| 3:50-3:55 | 8 | 16 | 152 | 291 |
| 3:55-4:00 | 3 | 6 | 58 | 109 |
| 4:00-4:05 | 10 | 17 | 189 | 310 |
| 4:05-4:10 | 7 | 13 | 127 | 237 |
| 4:10-4:15 | 4 | 7 | 76 | 127 |
| 4:15-4:20 | 9 | 15 | 157 | 273 |
| 4:20-4:25 | 7 | 17 | 131 | 310 |
| 4:25-4:30 | 9 | 14 | 168 | 255 |
| 4:30-4:35 | 6 | 11 | 117 | 200 |
| 4:35-4:40 | 8 | 13 | 153 | 237 |
| 4:40-4:45 | 11 | 17 | 193 | 310 |
| **Overall** | 8 | 13 | 140 | 243 |

**Model Calibration**

The base traffic model was calibrated to reflect actual traffic counts and queue measurements were compared with the model queue output to assure the model represents realistic traffic conditions in the study area. These measurements were checked against model queue output to assure the model represents realistic traffic conditions in the study area. The traffic count and model volume comparisons through each exit toll plaza lane as well as approaching volumes at the intersections are shown in tables provided in Appendix C for each interchange. As shown in the tables, volume calibration differences are within acceptable tolerances. Based on the overall volume comparisons, there is confidence the model is fully calibrated and is an accurate representation of traffic conditions at the Irwin Interchange.

**Comparison Results of Cash vs. Cashless Tolling**

The results from the model comparing cash versus cashless tolling scenarios are presented in the tables below. It can be concluded from the results that converting to cashless tolling will have little impact on traffic at the adjoining intersections eastbound and westbound from the toll plaza as well as merge areas. Level of service at the intersection and merge areas did not degrade when converting from cash to cashless system. The queuing results were similar as well as it showed no change from cash to a cashless tolling. There was actually an improvement in travel times from the toll plaza westbound to US 30/Ronda Court and from the toll plaza eastbound to US 30/Arona Road for the PM peak and Saturday peak.

***Table 3-44: Irwin Interchange Comparison Results of Cash vs. Cashless Tolling (Westbound to Ronda Ct/Rocky Rd)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to US 30/Ronda Ct | 141 | 132 | -9 | -6% | 115 | 104 | -11 | -9% |
| 2) From 2000 ft. Upstream on SR 30 to US 30/Ronda Ct | 82 | 83 | 1 | 1% | 58 | 58 | 0 | 0% |
| **Queuing (ft.)** | | | | | | | | |
| From US 30/Ronda Ct (Avg) | 339 | 340 | 1 | 0% | 145 | 151 | 6 | 4% |
| From US 30/Ronda Ct (Max) | 1349 | 1372 | 23 | 2% | 528 | 529 | 1 | 0% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with US 30 (Density in pc/mi/ln) | F (76.7) | F (77.3) | 0.6 | 1% | C (21.5) | C (21.5) | 0 | 0% |
| 2) US 30/Ronda Ct (Average Delay/Veh in Seconds) | D (43.3) | D (42.9) | -0.4 | -1% | C (24.6) | C (24.9) | 0.3 | 1% |

***Table 3-45: Irwin Interchange Comparison Results of Cash vs. Cashless Tolling (Eastbound to Arona Rd)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to US 30/Arona Rd | 108 | 100 | -8 | -7% | 97 | 84 | -13 | -14% |
| 2) From 2000 ft. Upstream on US 30 to US30/Arona Rd | 63 | 66 | 3 | 5% | 50 | 50 | 0 | 0% |
| **Queuing (ft.)** | | | | | | | | |
| From US 30/Arona Rd (Avg) | 224 | 224 | 0 | 0% | 100 | 100 | 0 | 0% |
| From US 30/Arona Rd (Max) | 1038 | 1018 | -20 | -2% | 517 | 475 | -42 | -8% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with US 30 (Density in pc/mi/ln) | D (28.6) | D (30.6) | 2 | 7% | B (15.6) | B (15.1) | -0.5 | -3% |
| 2) US 30/Arona Rd (Average Delay/Veh in Seconds) | C (25.0) | C (26.0) | 1 | 4% | B (13.6) | B (13.4) | -0.2 | -1% |

### 3.2.5 Interchange 75-New Stanton

**Description of Interchange**

The New Stanton Interchange study area is comprised of a toll plaza with seven exiting toll lanes. The following ramp junctions were analyzed:

- I-70 Westbound and Exit 57B New Stanton Interchange on-ramp merge point
- I-70 Westbound and Exit 57B New Stanton Interchange off-ramp diverge point
- I-76 off-ramp and I-70 Westbound merge point
- I-76 off-ramp and I-70 Eastbound merge point
- Business 66 Eastbound diverge point with SR 119 Southbound
- Business 66 Eastbound and SR 119 on-ramp merge point

The figure below shows the New Stanton Interchange and the analysis locations.


***Figure 3-8: New Stanton Interchange and the analysis***

At the I-76/New Stanton Interchange, the Turnpike accesses I-70, which is currently two-lane limited access facility with substandard acceleration and deceleration lanes. To the west is the Exit 57B New Stanton Interchange and to the east is the Business 66/SR 119 Interchange. The Exits 57A Hunker and 57B New Stanton Interchanges are currently under construction to consolidate the two substandard half interchanges into one modern, safe facility. The figure on the next page depicts the new I-79 New Stanton Interchange.


***Figure 3-9: Proposed I-79 New Stanton Interchange currently under construction***

**Peak Period Analyzed/Volumes**

From the peak period analysis, it was determined the two peak periods were the AM and PM weekday peaks. The weekday AM peak occurred from 7:45 AM – 8:45 AM, and the PM weekday peak occurred from 4:30 PM – 5:30 PM. The corresponding peak hour volumes at the exiting Turnpike ramps and the I-70 mainline for the two peak periods is shown in the table below.

***Table 3-46: New Stanton Interchange Year 2022 Peak Hour Volumes***

| Location | Year 2022 Weekday AM Peak Volume (7:45 AM – 8:45 AM) | Year 2022 Weekday AM Peak Volume (4:30 PM – 5:30 PM) |
|---|---|---|
| I-76 Off-Ramp to I-70 EB | 305 | 469 |
| I-76 Off-Ramp to I-70 WB | 510 | 731 |

The New Stanton Interchange processes a high percentage of trucks during the peak hours. The data collection indicated 34% trucks during the AM peak hour and 28% trucks during the PM peak hour.

**E-ZPass Market Share**

The E-ZPass market share for the I-76 exiting vehicles at the New Stanton Interchange during the peak periods is give in the table below. The majority of vehicles exiting the Turnpike at New Stanton are utilizing E-ZPass. Truck E-ZPass users reached 93% and 91% during the weekday AM and PM peak hours respectively. Overall, E-ZPass market share ranged between 79% and 86% at the New Stanton Interchange.

***Table 3-47: New Stanton Interchange EZ-Pass User Percentage during Peak Period***

| | % E-ZPass (Weekday AM Peak Hour) | % E-ZPass (Weekday PM Peak Hour) |
|---|---|---|
| Overall | 86% | 79% |
| Class 1 (Auto) | 82% | 78% |
| Class 2-9 (Trucks) | 93% | 91% |

**Current Toll Lane Types/Lane Usage**

The type of lane usage for the exiting toll lanes for both peak periods is depicted in the table below. Of the seven exit lanes at the New Stanton Interchange, most lanes were consistently utilized as E-ZPass only or cash only. The lanes labeled as mixed use in the table below indicates that the lane-usage changed during the peak hour. The mixed use lanes were determined to be cash or E-ZPass for the models based on the volumes and proportion of the peak hour that the lane was designated to be cash or E-ZPass. For the AM peak hour VISSIM analysis, lanes 5 and 10 were coded in the model as EZ-Pass lanes and all other lanes were coded as cash in the existing model.

***Table 3-48: New Stanton Interchange Lane Usage for the Exiting Toll Lanes***

| Toll Plaza Exiting Lane | Lane Use (Weekday AM Peak) | Lane Use (Weekday PM Peak) |
|---|---|---|
| Lane 5 | E-ZPass | E-ZPass |
| Lane 6 | Mixed Use | E-ZPass |
| Lane 7 | Cash | Cash |
| Lane 8 | Cash | Cash |
| Lane 9 | Mixed Use | E-ZPass |
| Lane 10 | Mixed Use | E-ZPass |
| Lane 11 | Cash | Cash |

**Current Queuing**

Existing queuing data was collected at the New Stanton toll plaza during both peak periods. The data was collected every minute and was aggregated into 5 minute increments and is summarized in the tables on the next pages. An overall summary of the queue data is also provided in the tables. The tables provide both the average and maximum queue every five minutes in both number of vehicles and feet. To calculate the average and maximum length, from the number of vehicles, the truck percentage during each peak was applied and then 25 feet was used for passenger car length and 55 feet was used for truck length at the New Stanton Interchange.

The toll plazas experienced similar queuing and low congestion during both peak hours. Average queuing at the toll plaza ranged between 35 and 99 feet and 53 and 114 during the AM and PM peak periods, respectively. During the AM peak hour, maximum queuing at the toll plaza ranged between 35 and 211 feet with an average of 68 feet. During the PM peak hour, maximum queues range between 67 and 234 feet, with an average of 67 feet.

***Table 3-49: New Stanton Interchange Queuing at Toll Plaza (AM Peak)***

| Time (AM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Average Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 8:00-8:05 | 2 | 3 | 56 | 106 |
| 8:05-8:10 | 2 | 3 | 56 | 106 |
| 8:10-8:15 | 1 | 2 | 42 | 70 |
| 8:15-8:20 | 2 | 3 | 70 | 106 |
| 8:20-8:25 | 2 | 3 | 63 | 106 |
| 8:25-8:30 | 3 | 6 | 99 | 211 |
| 8:30-8:35 | 2 | 3 | 84 | 106 |
| 8:35-8:40 | 2 | 3 | 63 | 106 |
| 8:40-8:45 | 3 | 5 | 92 | 176 |
| 8:45-8:50 | 2 | 4 | 84 | 141 |
| 8:50-8:55 | 1 | 1 | 35 | 35 |
| 8:55-9:00 | 2 | 5 | 77 | 176 |
| **Overall** | 2 | 6 | 68 | 211 |

***Table 3-50: New Stanton Interchange Queuing at Toll Plaza (PM Peak)***

| Time (PM) | Average Queue (Vehicles) | Max Queue (Vehicles) | Average Length (Ft) | Max Length (Ft) |
|---|---|---|---|---|
| 4:00-4:05 | 2 | 3 | 67 | 100 |
| 4:05-4:10 | 2 | 3 | 67 | 100 |
| 4:10-4:15 | 3 | 6 | 114 | 200 |
| 4:15-4:20 | 3 | 7 | 87 | 234 |
| 4:20-4:25 | 2 | 3 | 67 | 100 |
| 4:25-4:30 | 2 | 2 | 53 | 67 |
| 4:30-4:35 | 2 | 3 | 80 | 100 |
| 4:35-4:40 | 2 | 3 | 60 | 100 |
| 4:40-4:45 | 2 | 3 | 53 | 100 |
| 4:45-4:50 | 2 | 3 | 60 | 100 |
| 4:50-4:55 | 2 | 2 | 53 | 67 |
| 4:55-5:00 | 2 | 2 | 53 | 67 |
| **Overall** | 2 | 7 | 67 | 234 |

**Model Calibration**

The base traffic model was calibrated to reflect actual traffic counts and queue measurements were compared with the model queue output to assure the model represents realistic traffic conditions in the study area. These measurements were checked against model queue output to assure the model represents realistic traffic conditions in the study area. The traffic count and model volume comparisons through each exit toll plaza lane as well as approaching volumes at the intersections are shown in tables provided in Appendix C for each interchange. As shown in the tables, volume calibration differences are within acceptable tolerances. Based on the overall volume comparisons, there is confidence the model is fully calibrated and is an accurate representation of traffic conditions at the New Stanton Interchange.

**Comparison results of cash vs. cashless tolling**

The results from the models comparing the cash and cashless tolling scenarios are presented in the tables on the next page. Based on the results, it can be concluded that the removal of the toll plaza will not have a negative impact on traffic operations.

In the westbound direction on I-70, the improved operations for traffic exiting I-76 are only aided by the New Stanton Interchange Improvement Project currently under construction. The 2022 cashless VISSIM model includes the improvements associated with the New Stanton Interchange. Most notably, the improvements that greatly impact the operations include moving the interchange approximately 1,500 feet to the west by consolidating two substandard interchanges into one facility and the installation of an auxiliary lane between the I-76 and the New Stanton interchanges. These improvements were included in the model because they are expected to be completed by 2022.

***Table 3-51: New Stanton Interchange Cash vs. Cashless Tolling on I-70 Westbound***

| | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza to I-70 West of New Blair Blvd Int. | 162 | 128 | -34 | -21% | 146 | 129 | -17 | -12% |
| **Level of Service** | | | | | | | | |
| 1) Weave area between I-76 On-Ramp and New Blair Blvd Int. (pc/mi/ln) | A (8.8) | A (8.7) | -0.1 | -1% | B (11.6) | B (11.6) | 0 | 0% |
| 2) Merge Area with Westbound I-70 New Blair Blvd Int. (pc/mi/ln) | A (8.7) | A (8.6) | -0.1 | -1% | B (11.8) | B (11.8) | 0 | 0% |

In the eastbound direction on I-70, travel times improve as a result of the removal of the toll plaza. The toll plaza contributes to the majority of the delay because there are no back-ups expected at the I-76 and I-70 eastbound merge. The LOS results for the weave and merge segments on I-70 remain relatively unchanged with the removal of the toll plaza.

***Table 3-52: New Stanton Interchange Cash vs. Cashless Tolling on I-70 Eastbound***

| | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** | **Year 2022 Cash System** | **Year 2022 Cashless System** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza to I-70 East of US 119 Interchange | 117 | 88 | -29 | -25% | 106 | 88 | -18 | -17% |
| **Level of Service** | | | | | | | | |
| 1) Weave between I-76 Merge and US 119 Diverge (pc/mi/ln) | A (7.5) | A (7.3) | -0.2 | -3% | A (9.3) | A (9.3) | 0 | 0% |
| 3) Merge Area with Eastbound I-70 From SR 66 (pc/mi/ln) | A (4.0) | A (4.0) | 0 | 0% | A (4.9) | A (5.0) | 0.1 | 2% |

## 3.3 Evaluation of Potential Improvements at Existing Interchanges in Year 2022 (Build Scenario)

### 3.3.1 Overall

There are no adverse impacts that are projected to occur to the roadway network as a result of cashless tolling implementation. However, unacceptable Levels of Service (LOS) exist at certain locations today within the study areas. The following analysis and recommendations are presented in order to address unacceptable LOS due to existing conditions.

### 3.3.2 Interchange 39-Butler Valley

SR 8 at the Bardonner Road intersection still operates at a failing level of service with significant delay (>55 seconds). Possible improvements that could improve the level of service were identified and evaluated as following:

1. Adding dedicated right turn lane at SR 8 NB approach, between E Bardonner Road and W Bardonner Extension.
2. Adding dedicated left turn lane for the SB approach, at the intersection of SR 8 and Bardonner Road.

The figure below indicates the general location of the tested improvements.


***Figure 3-10: Tested Butler Valley Interchange Improvements***

The simulation results of the improvement scenario are shown in the table on the next page. With these improvements, operations at the SR 8/Bardonner Road intersection would improve in terms of overall delay which decreased by 20 seconds during the PM peak hour and 45 seconds during Saturday peak hour. In addition, when the signal was modeled in Synchro, a LOS D was achieved. Synchro and VISSIM calculate delay slightly differently, but it is anticipated that an acceptable overall intersection LOS would be achieved with the suggested improvements.

***Table 3-53: Butler Interchange Improvements Comparison on SR 8***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvement** | **Difference** | **% Difference** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvement** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| From Toll Plaza Area to SR 8 NB | 217 | 229 | 12 | 5% | 184 | 190 | 6 | 3% |
| From Toll Plaza Area to SR 8 SB | 351 | 357 | 6 | 2% | 330 | 333 | 3 | 1% |
| **Queuing (ft)** | | | | | | | | |
| Hardies Rd NB (Avg) | 132 | 158 | 26 | 19% | 94 | 102 | 8 | 8% |
| Hardies Rd NB (Max) | 455 | 530 | 75 | 16% | 468 | 509 | 41 | 9% |
| Bardonner Rd SB (Avg) | 118 | 146 | 28 | 24% | 74 | 91 | 17 | 23% |
| Bardonner Rd SB (Max) | 647 | 735 | 88 | 14% | 533 | 671 | 138 | 26% |
| **Level of Service (Delay in Seconds)** | | | | | | | | |
| Delay at SR 8 and Hardies Rd intersection | D (38.3) | D (40.6) | 2.3 | 6% | C (28.7) | C (29.4) | 0.7 | 2% |
| Delay at SR 8 and Bardonner Rd intersection | E (76.7) | E (56.8) | -19.9 | -26% | E (64.6) | B (19.8) | -44.8 | -69% |
| Merge Area with SR 8 SB | E (42.3) | E (49.5) | 7.2 | 17% | D (28.2) | C (27.1) | -1.1 | -4% |
| Merge Area with SR 8 NB | B (18.9) | B (18.5) | -0.4 | -2% | C (20.8) | C (20.4) | -0.4 | -2% |

### 3.3.3 Interchange 48-Allegheny Valley

The intersection of Freeport Road and Alpha Drive East still operates at a poor level of service in the AM peak hour with queuing on the westbound approach of Freeport Road. Possible improvements that could improve the level of service and traffic operations were identified.

1. Optimizing signals or implementing adaptive signals along Freeport Road.
2. Updating lane configurations at the signalized intersections.

The figure below indicates the general location of the tested improvements.


***Figure 3-11: Tested Allegheny Valley Interchange Improvement Locations***

The tables on the next pages provide the results of the signal retiming scenario. The current lane configuration paired with optimized signal timings resulted in improved operations along the corridor. Retiming/optimizing the signals improved operations along the corridor significantly, most notably at the Alpha Drive East intersection. At times during the peak hour, the maximum back of queue from the Alpha Drive East signal reaches the I-76 off-ramp merge to Freeport Road westbound. The westbound queue at the signal is expected to clear out each cycle, but due to the high through volume on Freeport Road and the close proximity of the merge point and the signal, it is likely that the signal operations would have a significant impact to the merge operations especially during peak periods.

***Table 3-54: Allegheny Valley Interchange Improvements on Freeport Rd Westbound***

| | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to West of just west of Alpha Drive East | 116 | 63 | -53 | -46% | 67 | 61 | -6 | -9% |
| 2) From Just west of Alpha Drive East to West of SR 910 & Freeport Road | 97 | 76 | -21 | -22% | 99 | 83 | -16 | -16% |
| **Queuing (ft.)** | | | | | | | | |
| 2) Alpha Drive East Westbound Approach (avg) | 522 | 83 | -439 | -84% | 80 | 56 | -24 | -30% |
| 2) Alpha Drive East Westbound Approach (max) | 1678 | 604 | -1074 | -64% | 404 | 399 | -5 | -1% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area from Toll Plaza to Westbound Freeport Road (pc/mi/ln) | F(161.0)* | E(59.1) | -105.4 | -65% | D(31.2) | D(30.2) | -1 | -3% |
| 2) Intersection with Alpha Road East (Delay) | D(35.0) | B (15.4) | -19.6 | -56% | C(20.6) | B (17.2) | -3.4 | -17% |
| 3) Intersection with Alpha Road West (Delay) | C(23.8) | B (10.2) | -13.6 | -57% | C(20.6) | B (14.2) | -6.4 | -31% |
| 4) Intersection with SR 910 (Delay) | C(21.2) | C (20.2) | -1 | -5% | C(24.4) | C (22.6) | -1.8 | -7% |

*Ramp Operation impacted by adjacent signal at Alpha Drive East

***Table 3-55: Allegheny Valley Interchange Improvements on Freeport Rd Eastbound***

| | AM Peak | | | | PM Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to Eastbound Freeport Road | 56 | 55 | -1 | -2% | 56 | 56 | 0 | 0% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with Freeport Road (pc/hr/ln) | B(13.0) | B(12.9) | -0.1 | -1% | C(24.2) | C(23.9) | 0.3 | 1% |

### 3.3.4 Interchange 57-Pittsburgh/Monroeville Interchange

The SR 2048/SR 0048 intersection still operates at a failing level of service with significant delay (>80 seconds). Possible improvements that could improve the level of service were identified and evaluated. They are listed below:

1. Adding an exclusive right turn lane at SR 48 SB approach (Haymaker Boulevard) and the addition of a second lane on the ramp from the I-376 to Haymaker Boulevard.
2. Adding a one-way slip ramp from Holiday Lane or Northern Pike onto the Turnpike to lower traffic demand from SR 48 NB onto the existing Turnpike entrance ramp.
3. Retiming/optimizing signals at SR 22/48 & McMasters/Lowe's Drive.

These improvements are illustrated in the figures below. As a result of the slip ramp connection, a number of trips would be removed from SR 0048 (Mosside Boulevard) making the right turn destined to the turnpike from Business 22 (SR 2048). The number of trips removed from this movement is anticipated to be 261 for the PM peak hour and 110 for the Saturday peak hour. This is a conservative estimate based on volume distributions from 2013 counts at SR 2048/SR 0048.


***Figure 3-12: Pittsburgh/Monroeville Interchange Possible Improvements to SR 2048/SR 0048 Intersection***


***Figure 3-13: Pittsburgh/Monroeville Interchange possible new access points to I-76 at Monroeville Interchange***

The results of the model comparing the cashless system and cashless system with improvement scenarios are provided in the table on the next page**.** Due to capacity constraints at the intersection, retiming and optimizing signals was not included in the evaluation. From the results, it can be concluded that there would be a slight improvement in overall delay at SR 2048/SR 0048 intersection (7.5 seconds). Also, average queues will decrease by approximately 300 feet. Adding an exclusive right turn lane and a second lane on the ramp from the I-376 to Haymaker Boulevard helps alleviate the SR 2057 traffic queue. Adding a slip ramp from Holiday Lane or Northern Pike to remove SR 0048 NB right traffic did not exhibit any benefit to the overall delay at the intersection. Because the SR 0048 (Mosside Boulevard) northbound right movement has a channelized right turn with yield control that currently does not experience significant delay.

***Table 3-56: Pittsburgh/Monroeville Interchange Results between Cashless System vs. Cashless System with Improvements (WB to SR 2048/McMasters Dr)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to SR 2048 /McMasters Dr | 173 | 174 | 1 | 0% | 162 | 162 | 0 | 0% |
| 2) From 2000 ft. Upstream on SR 2048 to US 22/McMasters Dr | 83 | 84 | 1 | 1% | 80 | 81 | 1 | 1% |
| **Queuing (ft.)** | | | | | | | | |
| From SR 2048/SR 48 (Avg) | 953 | 658 | -295 | -31% | 244 | 223 | -21 | -9% |
| From SR 2048/SR 48 (Max) | 1471 | 1534 | 63 | 4% | 831 | 769 | -62 | -7% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with SR 2048 (Density in pc/mi/ln) | C (26.2) | C (25.9) | -0.3 | -1% | C (20.2) | C (20.1) | -0.1 | 0% |
| 2) SR 2048/SR 48 (Average Delay/Veh in Seconds) | F (84.1) | E (76.6) | -7.5 | -9% | D (52.7) | D (47.9) | -4.8 | -9% |
| 3) SR 2048/McMasters Dr/Lowes Dr (Average Delay/Veh in Seconds) | C (25.9) | C (26.4) | 0.5 | 2% | B (16.7) | B (15.9) | -0.8 | -5% |

### 3.3.5 Interchange 67-Irwin

An existing area of concern is the I-76 off-ramp and SR 0030 (US 30) westbound merge area, which currently operates at a failing level of service. The list of potential improvements that were modeled is described below:

1. Addition of a slip ramp to Pennsylvania Avenue from the Turnpike, this reduces ramp traffic heading westbound to Rocky Road by 40% and trips eastbound by approximately 4%.
2. Extending EB right turn lane at Arona Road/ US 30 intersection upstream to lane drop.
3. Retiming/optimizing signals at Rocky Rd/Ronda Court and Arona Road.

**Figure 3-14** illustrates the improvements graphically. Although it was not included as part of the potential improvements that were modeled, North Huntingdon Township previously studied and developed plans (in 2012) to increase capacity on Arona Road by adding a second lane (left/shared right) at its intersection with US 30.


***Figure 3-14: Irwin Interchange Potential Improvements to Irwin Interchange***

The model results of the improvement scenario are provided in the tables on the next pages. From the results, it can be concluded that adding a slip ramp and retiming the signals at US 30/Rocky Road intersection would have the desired effect of improving level of service at the I-76 WB off ramp merge area with US 30 and at the US 30/Rocky Road intersection. The LOS improved from F to E during the PM peak and from D to B during the Saturday peak at the I-76 WB off ramp merge area with US 30. Also the LOS improved from D to C at the US 30/Rocky Road intersection during the PM peak. Queuing also improved at the US 30/Rocky Road intersection as the average queue decreased by approximately 100 feet and maximum queue decreased by approximately 450 feet with the improvement scenarios. The extension of the EB right turn lane at Arona Rd/US 30 intersection upstream to lane drop improves the

merge area at I-76 EB off ramp with US 30. The LOS at that merge area improved from D to B during the PM peak. The PTC is preliminarily investigating whether direct cashless ramp connections are feasible with SR 30. Concept plans were not completed or available during the course of this study.

***Table 3-57: Irwin Interchange Results between Cashless System vs. Cashless System with Improvements (WB to US 30/Ronda Ct)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to US 30/Ronda Ct | 132 | 114 | -18 | -14% | 104 | 106 | 2 | 2% |
| 2) From 2000 ft. Upstream on SR 30 to US 30/Ronda Ct | 83 | 65 | -18 | -21% | 58 | 58 | 0 | 0% |
| **Queuing (ft.)** | | | | | | | | |
| From US 30/Ronda Ct (Avg) | 340 | 234 | -106 | -31% | 151 | 105 | -46 | -31% |
| From US 30/Ronda Ct (Max) | 1372 | 914 | -458 | -33% | 529 | 514 | -15 | -3% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with US 30 (Density in pc/mi/ln) | F (77.3) | E (36.8) | -40.5 | -52% | C (21.5) | B (18.6) | -2.9 | -13% |
| 2) US 30/Ronda Ct (Average Delay/Veh in Seconds) | D (42.9) | C (34.1) | -8.8 | -21% | C (24.9) | C (24.7) | -0.2 | -1% |

***Table 3-58: Irwin Interchange Results between Cashless System vs. Cashless System with Improvements (EB to US 30/Arona Rd)***

| | PM Peak | | | | Saturday Peak | | | |
|---|---|---|---|---|---|---|---|---|
| **Performance Measures** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** | **Year 2022 Cashless System** | **Year 2022 Cashless System with Improvements** | **Difference** | **% Difference** |
| **Travel Time (Sec)** | | | | | | | | |
| 1) From Toll Plaza Area to US 30/Arona Rd | 100 | 90 | -10 | -10% | 84 | 82 | -2 | -2% |
| 2) From 2000 ft. Upstream on US 30 to US30/Arona Rd | 66 | 61 | -5 | -8% | 50 | 50 | 0 | 0% |
| **Queuing (ft.)** | | | | | | | | |
| From US 30/Arona Rd (Avg) | 224 | 315 | 91 | 41% | 100 | 149 | 49 | 49% |
| From US 30/Arona Rd (Max) | 1018 | 596 | -422 | -41% | 475 | 554 | 79 | 17% |
| **Level of Service** | | | | | | | | |
| 1) Merge Area with US 30 (Density in pc/mi/ln) | D (30.6) | B (19.2) | -11.4 | -37% | B (15.1) | B (14.5) | -0.6 | -4% |
| 2) US 30/Arona Rd (Average Delay/Veh in Seconds) | C (26.0) | C (24.9) | -1.1 | -4% | B (13.4) | B (15.3) | 1.9 | 14% |

### 3.3.6 Interchange 75-New Stanton

Converting from cash to a cashless system did not have an adverse impact on traffic at the New Stanton Interchange. Additionally, with the new I-79 New Stanton Interchange currently being constructed, there are no projected levels of service deficiencies in this area. Therefore, no additional improvement options were investigated for this interchange.

### 3.3.7 Interchange 91-Donegal

As previously mentioned, Interchange 91-Donegal was not modeled because this interchange was studied by the PTC and PennDOT District 12-0 and modifications to this interchange with SR 31 are currently in design and scheduled for construction in Year 2017. The following provides some background on previous studies completed at this intersection and provides a brief explanation of the improvements planned for SR 31.

In 2013, URS reviewed and studied congestion at the toll plaza for the PTC. Queuing was known to occur at the eastbound exit ramp off the Turnpike, especially during special events in the area, such as skiing and winter festivals at Seven Springs Mountain Resort. The objectives of the study were to analyze current conditions and look at potential modifications at the interchange. During this same timeframe, PennDOT District 12-0 had began an improvement study/project with SR 31 in the same area. One of the recommendations of the URS study, *Traffic Congestion Study Donegal*, was to share the results with the District and actively participate in their study. The District was reviewing several strategies in the area, including widening of SR 31 in the interchange area with intersection improvements.

The SR 31-X10 project, which will widen and realign the intersection of SR 31 with the Turnpike, is currently in Final Design with a scheduled let date of March 9, 2017. Figure 3-15 provides a schematic of the proposed improvements at the interchange. The intersection will be moved approximately 200’ to the south, which provides more distance from the existing toll plaza. The new intersection design is referred to as a Florida-T or Texas-T intersection. This configuration encourages safer operations by providing a dedicated auxiliary acceleration lane on the mainline separate from the free flow mainline through volumes. In this case , eastbound through traffic on SR 31 will be separated by concrete barrier from intersection movements. The new intersection will also be signalized with a simple two-phase operation for lefts in and out of the Turnpike entrance. Construction for this project will begin in 2017 and is anticipated to last two years.

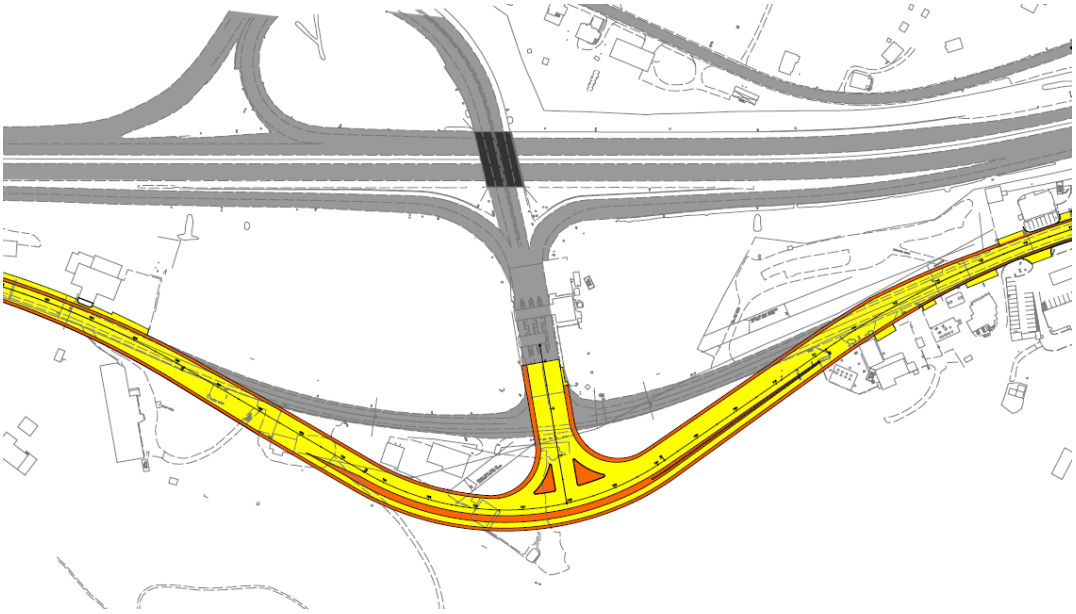


***Figure 3-15: Proposed Improvements to the Donegal Interchange***

# 4 Evaluation of Potential New Access Ramps with Cashless Tolling

Providing new access ramps along the Turnpike under a cashless system is potentially more cost effective than under the current ticketing system. Ramps and interchanges in a future cashless system will not require toll plazas; therefore, the capital, operational and right-of-way costs associated with plazas is eliminated.

The purpose of this task was to identify locations where it may be desirable to provide a full or partial access cashless tolling interchange where direct access to mainline I-76 does not currently exist. New access locations were evaluated for the potential to improve operational conditions for commuter, freight, and emergency vehicle traffic as well as their potential to facilitate economic development.

The new access evaluation was broken into two analysis levels. The first level involved developing a qualitative rating criteria for nine potential new access locations as seen in the figure on the next page:

- SR 551 (Little Beaver Township, Lawrence County)
- SR 65 (North Sewickley Township, Beaver County)
- SR 68 (New Sewickley Township, Beaver County)
- SR 910 (Richland Township, Allegheny County – between SR 19 and SR 8)
- SR 28 (Harmar Township, Allegheny County)
- SR 380 (Plum Borough, Allegheny County)
- SR 130 (Penn Township, Westmoreland County)
- SR 136 (Hempfield Township, Westmoreland County)
- SR 981 (Mount Pleasant Township, Westmoreland County)

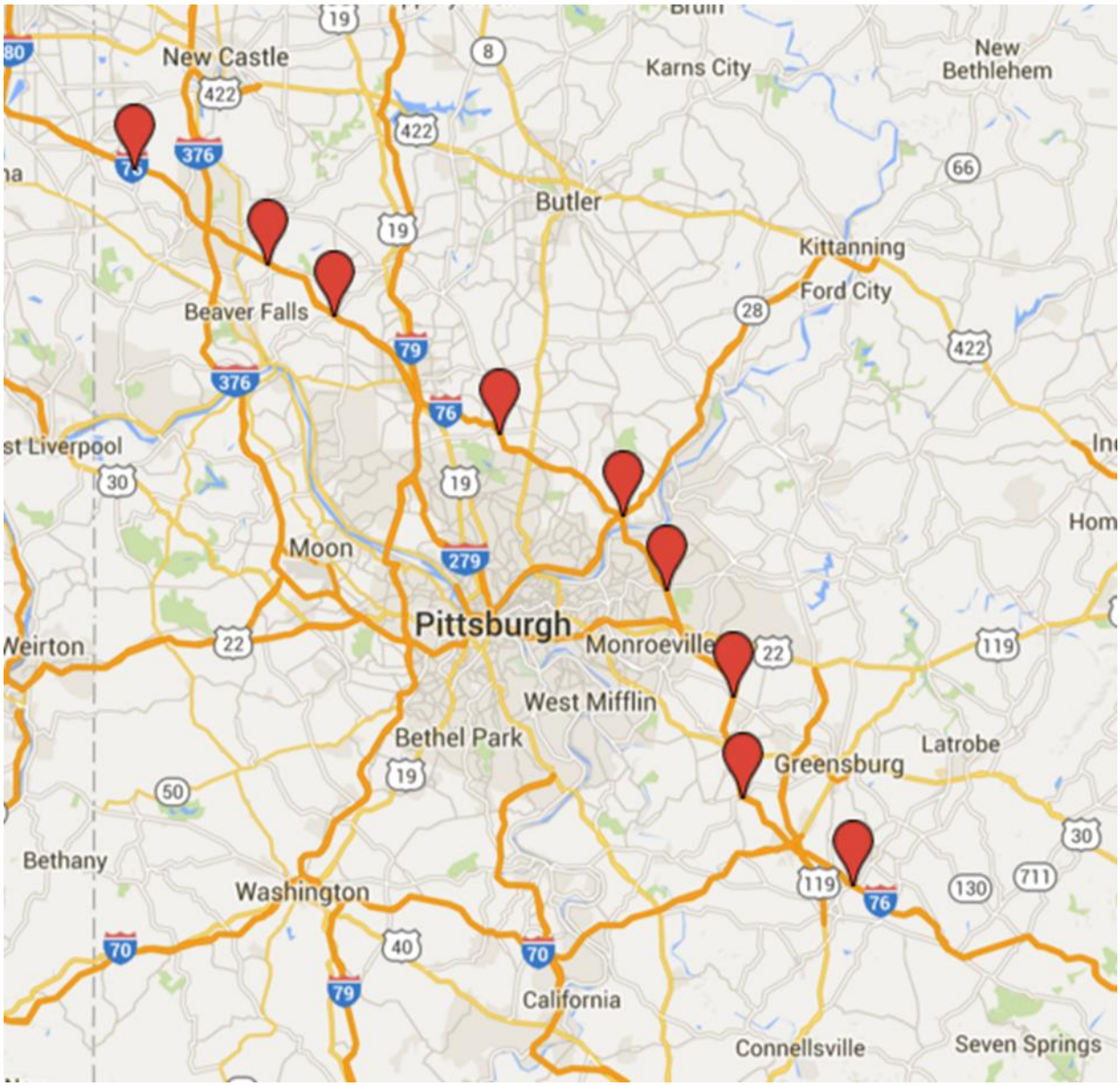



***Figure 4-1: Potential New Access Locations***

Based upon the results of the qualitative evaluation and the fiscal constraints of this study, four locations were chosen to do a detailed evaluation. This detail evaluation included developing conceptual interchange layouts. Along with the layouts, the detail evaluation included:

- Traffic information from the network modeling to estimate any additional traffic increases on both the Turnpike and the existing roadway network.

- Development of a planning level cost estimate for the potential new access points and related state roadway improvements based on estimated quantities and unit costs of right-of-way acquisitions, bridge and wall structures, earthwork, pavement and drainage structures, and major utility involvements with contingency budgets for each of the other elements associated with the construction of the new infrastructure.

- Identification of any preliminary environmental constraints related to the potential new interchange projects.

## 4.1 High Level Evaluation (9 Locations)

As previously stated, the study initially evaluated nine locations. These locations represent PennDOT maintained routes that currently pass over or under the mainline Turnpike in the SPC region.

**Evaluation Criteria**

Qualitative rating criteria were developed for these potential new access locations to help in identifying locations with favorable attributes. The purpose was to identify up to four locations to perform a more detailed evaluation.

The criteria developed included the following:

- Access Criteria (Interchange spacing) – identify locations that are not too close to existing interchanges Access Criteria (ADT of Crossroad) – identify locations with existing higher traffic relative to other locations
- Potential Congestion Reduction Impact – identify locations that may have an impact on congestion relief if new access was provided
- Potential to Attract New Turnpike Customers – identify locations that may provide more traffic/customers to the turnpike
- Land Use/Environmental – identify any known environmental features that could hinder the construction of a new access point
- Economic Revitalization – Based on SPC's Regional Development Scenario presented in the region's 2015-2040 Long Range Plan ("Mapping the Future"); Chapter 2 of this document presents a regional map that indicates levels of economic conduciveness to the preferred SPC policy scenario
- Private Property Impact – identifies the possible physical impact a new access may have on existing commercial and residential properties
- Standard Geometry for Interchange - evaluated the current terrain and curvature of the Turnpike and crossroads in terms of difficulty in designing the new access
- Construction Costs – a general measure indicating the relative construction costs based on the terrain and intersection roadway alignment
- Above Ground Utility Impacts - a general measure indicating the likelihood of major above ground utility impacts or transmission lines

For each criterion, a score was developed between 1 and 3, with 3 being the most favorable score. The evaluation then identified the attributes for each of the score levels for each criterion. The table on the next page illustrates the scoring thresholds.

***Table 4-1: Preliminary Thresholds for Scoring***

| Criteria | 1 | 2 | 3 |
|---|---|---|---|
| Access Criteria (Interchange Spacing) | Nearest Turnpike Interchange < 2 miles | Nearest Turnpike Interchange between 2 and 6 miles | Nearest Turnpike Interchange > 6 miles |
| Access Criteria (ADT of Crossroad) | Crossroad ADT < 5000 | Crossroad ADT between 5000 and 9000 | Crossroad ADT > 9000 |
| Potential Congestion Reduction Impact | No congestion on Crossroad or perceived impact on current congestion. Also, could create more congestion on Crossroad if constructed | Possible moderate congestion relief on Crossroad or local traffic | Possible high congestion relief on Crossroad or local traffic |
| Potential to Attract New Turnpike Customers | Low potential to attract new Turnpike customers based on intersection roadway ADT and spacing between interchanges | Some potential to attract new Turnpike customers based on intersection roadway ADT and spacing between interchanges | High potential to attract new Turnpike customers based on intersection roadway ADT and spacing between interchanges |
| Land Use / Environmental | Residential Area and/or high potential for impacts to environmental features identified by PennDOT's MPMS IQ | Non Residential/limited potential for impacts to environmental features identified by PennDOT's MPMS IQ | Non Residential/little or very unlikely for potential for impacts to environmental features identified by PennDOT's MPMS IQ |
| Economic Revitalization | Less conducive to development scenario of SPC Long Range Plan | Moderate conducive to development scenario of SPC Long Range Plan | Most conducive to development scenario of SPC Long Range Plan |
| Private Property Impact | Significant potential business/ residential private property impacts including building impacts | Limited potential private business/ residential property impacts unlikely to impact buildings | Little or no potential for business/ residential private property impacts |
| Standard Geometry for Interchange | Terrain or curvature of Turnpike or Crossroad make it difficult for Interchange | Either Turnpike or Crossroad in curve or skewed/terrain issue | Both Turnpike and Crossroads in tangent/ level terrain |
| Construction Costs | Relatively high perceived construction cost due to terrain and intersecting roadway alignment | Relatively moderate perceived construction cost due to terrain and intersecting roadway alignment | Relatively low construction cost based upon observations of terrain and intersection roadway alignment |
| Above Ground Utility Impacts | Major above ground utility impacts to transmission lines likely | Moderate above ground utility impacts to transmission lines likely | Limited above ground utility identified |

Each location was then evaluated using the criteria listed on the previous table. Section 4.1.1 below provides a general description of each location and how it relates to the above criteria.

### 4.1.1 Summary of Each Location Evaluated

#### 4.1.1.1 SR 551 (Little Beaver Township, Lawrence County)

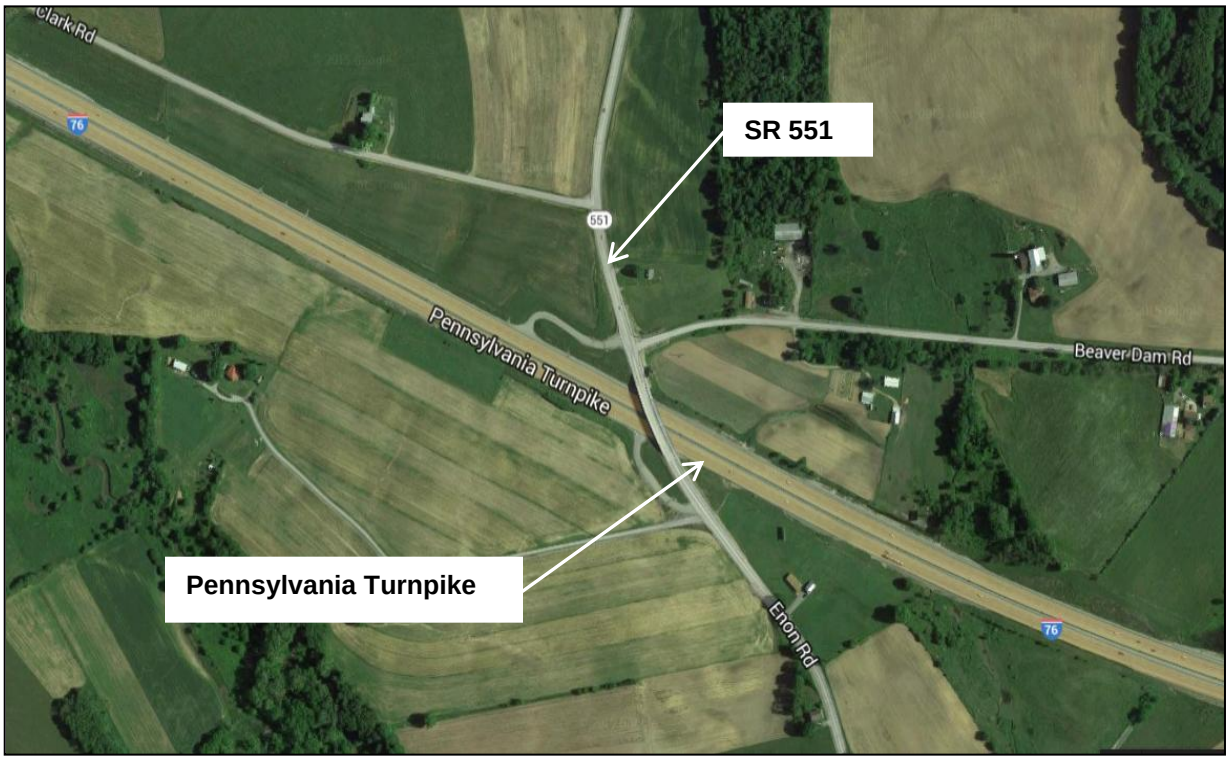



***Figure 4-2: SR 551 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are 10 miles to the west and 6 miles to the east

Access Criteria (ADT of Crossroad):

- SR 551 is a two-lane facility has an ADT of approximately 900 vehicles per day according to PennDOT ITMS.

Potential Congestion Reduction Impact:

- Based on 900 ADT, no impact to congestion is considered

Potential to Attract New Turnpike Customers:

- Could attract new customers, but the amount would be minimal

Land Use/Environmental:

- Agricultural / No documented environmental impacts in the immediate area

Economic Revitalization:

- Less conducive to development scenario of SPC Long Range Plan/No major economic generators in immediate area

Private Property Impact:

- No building impacts/some private property impacts

Standard Geometry for Interchange:

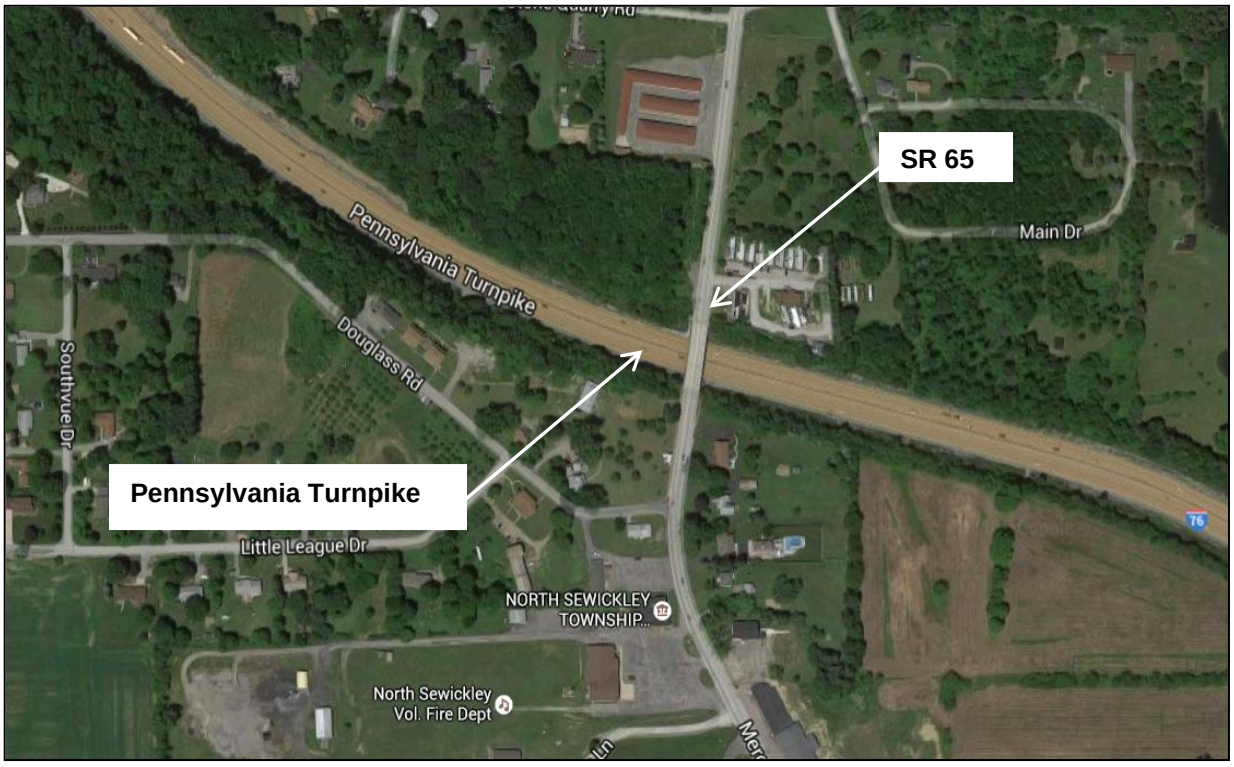
- Turnpike in tangent/skewed SR551/level terrain

Construction Costs:

- Low anticipated construction cost

Above Ground Utility Impacts:

- Minor aerial service lines east and west of SR551 – crossing the Turnpike




#### 4.1.1.2 SR 65 (North Sewickley Township, Beaver County)

***Figure 4-3: SR 65 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are 2 miles to the west and 13 miles to the east

Access Criteria (ADT of Crossroad):

- SR 65 is a two lane facility has an ADT of about 6400 vehicles per day according to PennDOT ITMS

Potential Congestion Reduction Impact:

- Because of the close proximity to the Turnpike's Beaver Valley Interchange and the lack of significant congestion on SR 65, no impact to congestion is considered

Potential to Attract New Turnpike Customers:

- Because of the close proximity to the Beaver Valley Interchange, not seen as attracting many new customers

Land Use/Environmental:

- Residential/Agricultural/no major environmental features

Economic Revitalization:

- Less conducive to development scenario of SPC Long Range Plan/No major economic generators in area

Private Property Impact:

- Building impacts/trailer park/some private property impacts

Standard Geometry for Interchange:

- Turnpike in tangent /perpendicular SR 65

Construction Costs:

- Medium anticipated construction cost due to displacements

Above Ground Utility Impacts:

- Minor aerial service lines east and west of SR 65 – crossing the Turnpike

#### 4.1.1.3 SR 68 (New Sewickley Township, Beaver County)


***Figure 4-4: SR 68 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are 8 miles to the west and 7 miles to the east

Access Criteria (ADT of Crossroad):

- SR 68 is two lane facility has an ADT of approximately 4900 vehicles per day according to PennDOT ITMS

Potential Congestion Reduction Impact:

- Could reduce truck traffic in Harmony/Zelienople

Potential to Attract New Turnpike Customers:

- Could attract new customers. SR 68 Truck traffic is currently 12%

Land Use/Environmental:
- Residential/mixed use/Brush Creek/Hydric Soils

Economic Revitalization:
- Less conducive to development scenario of SPC Long Range Plan/Midway between Rochester and Zelienople

Private Property Impact:
- Building impacts/American Legion/some private property impacts

Standard Geometry for Interchange:
- Turnpike in tangent/skewed with SR 68

Construction Costs:
- Medium anticipated construction cost due to Brush Creek

Above Ground Utility Impacts:
- Minor aerial service lines east and west of SR 68 – crossing the Turnpike

#### 4.1.1.4 SR 910 (Richland Township, Allegheny County)

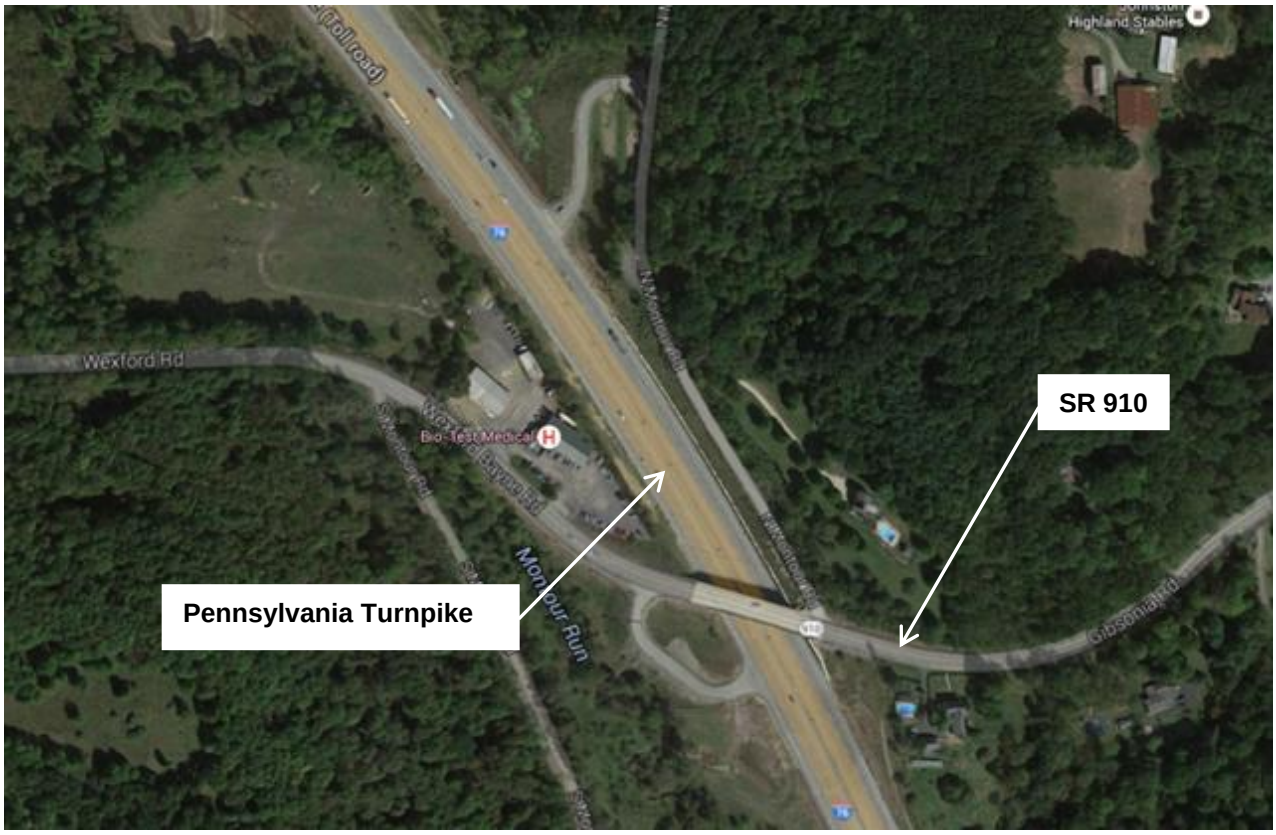



***Figure 4-5: SR 910 Location Map***

Access Criteria (Interchange Spacing):
- This location is west of State Route 8. The nearest Turnpike interchanges are 7 miles to the west (Cranberry) and 3 miles to the Butler Valley Interchange

Access Criteria (ADT of Crossroad):

- SR 910 has an ADT of approximately 9,200 vehicles per day according to PennDOT ITMS

Potential Congestion Reduction Impact:

- This location has the potential to alleviate traffic on the I-79 Wexford Interchange and US 19 traffic

Potential to Attract New Turnpike Customers:

- Could attract new customers.

Land Use/Environmental:

- Residential/mixed use/Montour Run/100 year floodplain and wetlands

Economic Revitalization:

- Less conducive to development scenario of SPC Long Range Plan/Located near SR 19 Wexford

Private Property Impact:

- Building impacts/some private property impacts

Standard Geometry for Interchange:

- Turnpike in curve/skewed with SR 910

Construction Costs:

- Medium anticipated construction cost

Above Ground Utility Impacts:

- Minor aerial service lines east and west of SR 910 – crossing the Turnpike

#### 4.1.1.5 SR 28 (Harmar Township, Allegheny County)

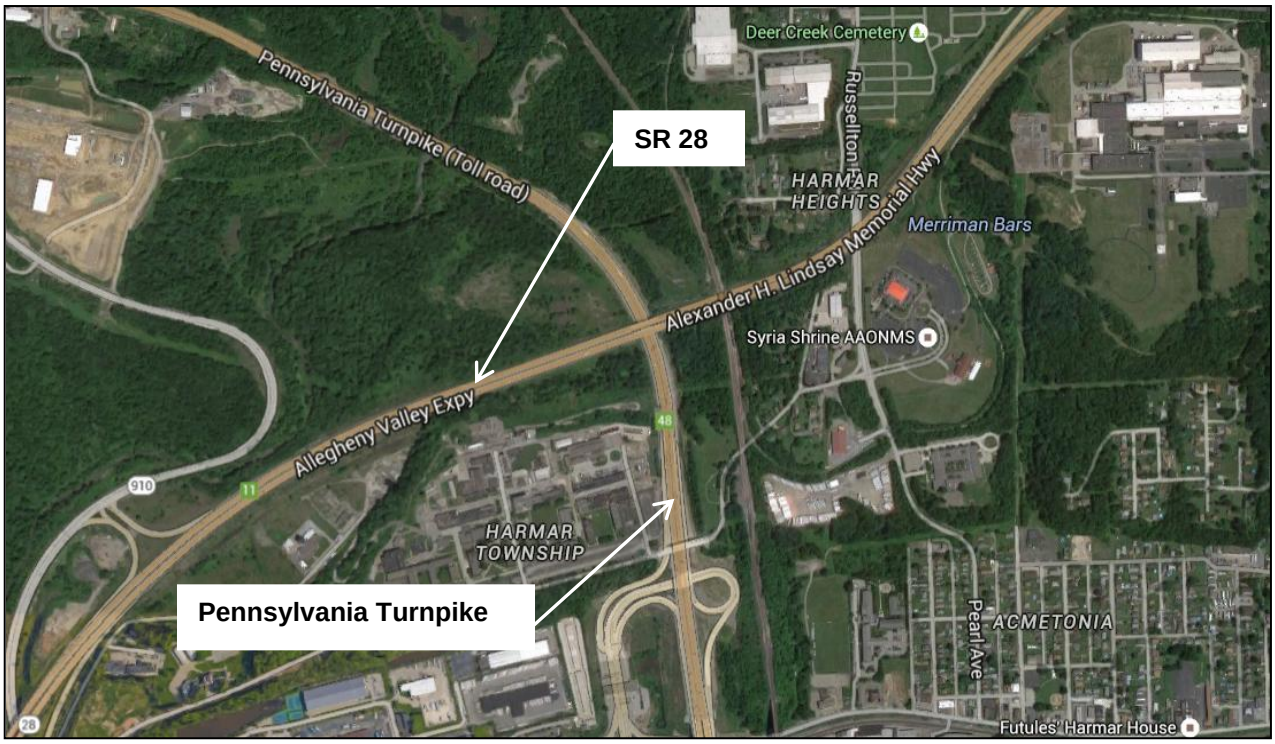



***Figure 4-6: SR 28 Location Map***

Access Criteria (Interchange Spacing):

- Allegheny Valley Interchange is less than 0.3 miles from Turnpike crossover of SR 28. When SR 28 is assumed as a replacement interchange, it is 9 miles from the Irwin Interchange and 9 miles from Butler Valley Interchanges

Access Criteria (ADT of Crossroad):

- SR 28 is four lane limited access facility that has an ADT of 40,000 per day in this location according to PennDOT ITMS

Potential Congestion Reduction Impact:

- A replacement interchange could relieve traffic on Freeport Road

Potential to Attract New Turnpike Customers:

- Could attract new customers because of direct connection with SR 28

Land Use/Environmental:

- Mixed use/Access issues for existing business along Freeport Road

Economic Revitalization:

- More conducive to development scenario of SPC Long Range Plan/Major Roadway Access. Numerous Activity Centers along SR 28

Private Property Impact:

- Building impacts/some private property impacts

Standard Geometry for Interchange:

- Turnpike in curve /railroad impact

Construction Costs:

- High anticipated construction cost

Above Ground Utility Impacts:

- Railroad location is a major constraint

#### 4.1.1.6 SR 380 (Plum Borough, Allegheny County)


***Figure 4-7: SR 380 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are approximately 6 miles to the west and 3 miles to the east.

Access Criteria (ADT of Crossroad):

- SR 380 is a two lane facility that has an ADT of approximately 7,500 vehicles per day according to PennDOT ITMS

Potential Congestion Reduction Impact:

- No impact to congestion is considered

Potential to Attract New Turnpike Customers:

- Since there currently is not a direct route to existing interchanges on SR 28 and SR 22, there is a potential to attract new customers from the current ADT of the roadway

Land Use/Environmental:

- Close proximity to potential historic resources, EPA Waste Site, and prime farmlands accordingly to PennDOT *MPMS IQ*. The current land use is developed near the Turnpike with a mix of commercial and private businesses

Economic Revitalization:

- Moderately conducive to development scenario of SPC Long Range Plan/Current development of Davidson Road and development potential at northeastern quadrant

Private Property Impact:

- Potential building/business displacement.

Standard Geometry for Interchange:

- Turnpike is in a horizontal tangent with a sizeable cut to the east. SR 380 has a fairly steep vertical grade, vertical crest curve to the west, and sharp horizontal curve to the east

Construction Costs:

- High anticipated construction cost based upon topography and SR 380 alignment

Above Ground Utility Impacts:

- Major transmission lines cross the Turnpike in close proximity of the bridge

#### 4.1.1.7 SR 130 (Penn Township, Westmoreland County)


***Figure 4-8: SR 130 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are approximately 6 miles to the west and 4 miles to the east

Access Criteria (ADT of Crossroad):

- SR 130 has a five-lane typical section at the eastern approach to the bridge over the Turnpike. SR 130 has an ADT of approximately 13,000 vehicles per day according to PennDOT ITMS

Potential Congestion Reduction Impact:

- Probability of increasing congestion to SR 130 and adjacent local roadways

Potential to Attract New Turnpike Customers:

- There is a good potential to attract new customers considering the fairly dense population and potential congestion experienced travelling to nearby existing interchange access points (Irwin to the East, Pittsburgh (Monroeville) to the west

Land Use/Environmental:

- Within the Turtle Creek Watershed - Act 167 according to PennDOT *MPMS IQ*. No other environmental resources appear to be present. Current land use is developed areas near the Turnpike with a mix of residential and commercial properties

Economic Revitalization:

- Moderately conducive to development scenario of SPC Long Range Plan/Potential for Economic Revitalization at northeastern quadrant and development along SR 130.

Private Property Impact:

- Potential private residents and business displacement. Turnpike Maintenance facility would likely need to be removed/ relocated to accommodate interchange

Standard Geometry for Interchange:

- Turnpike on tangent in sizeable cut to the west. SR 130 relatively flat, steep grades on Pleasant Valley Road Hill Roads

Construction Costs:

- High construction costs, likely, based upon accommodating traffic on SR 130 and ramp junction points

Above Ground Utility Impacts:

- Major transmission lines cross in the proximity of the bridge and along SR 130

#### 4.1.1.8 SR 136 (Hempfield Township, Westmoreland County)


***Figure 4-9: SR 136 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are approximately 3 miles to the west and 5 miles to the east

Access Criteria (ADT of Crossroad):

- SR 136 is a two-lane roadway with an average daily traffic volume of approximately 3,000 vehicles according to PennDOT ITMS. There are no adjacent side roads connecting to SR 136 in the vicinity of the Turnpike

Potential Congestion Reduction Impact:

- No impact to congestion is considered

Potential to Attract New Turnpike Customers:

- The potential to attract new customers is low based on lower ADT and relatively short distance to existing interchange locations. To the east of this location, SR 136 already has an interchange with PA-66 (Turnpike)

Land Use/Environmental:

- There are farmlands present near the intersection of SR 136 and the turnpike accordingly to PennDOT *MPMS IQ*. No other environmental resources appear to be present. Current land use is primarily undeveloped rural land

Economic Revitalization:

- Less conducive to development scenario of SPC Long Range Plan/Potential for new development within this area adjacent to the Turnpike with a new access point

Private Property Impact:

- Potential private property impact in the northwest quadrant. An impact to an active farm may result in the southwestern quadrant

Standard Geometry for Interchange:

- Turnpike is in a horizontal curve at the intersection of SR 136. SR 136 has a curve at each approach to the bridge over the Turnpike

Construction Costs:

- Construction costs would be low to moderate based upon location of the potential ramps on the Turnpike mainline curve

Above Ground Utility Impacts:

- Minor aerial lines cross in the proximity of the bridge adjacent to SR 136

#### 4.1.1.9 SR 981 (Mount Pleasant Township, Westmoreland County)

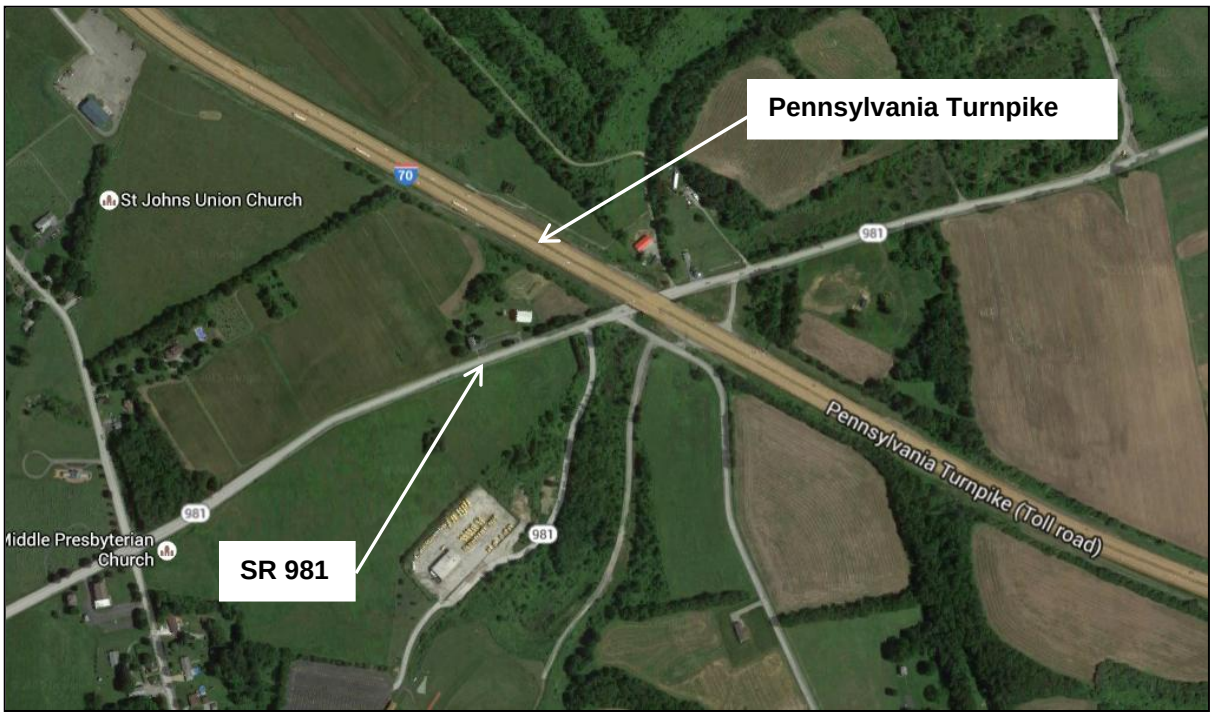



***Figure 4-10: SR 981 Location Map***

Access Criteria (Interchange Spacing):

- The nearest Turnpike interchanges are approximately 5 miles to the west and 10 miles to the east.

Access Criteria (ADT of Crossroad):

- SR 981 is a two-lane roadway with an average daily traffic volume of approximately 5,000 vehicles according to PennDOT ITMS. This is a local roadway Fiedors Grove Road located approximately 100 feet to the south with very low daily traffic volumes

Potential Congestion Reduction Impact:

- There should not be significant congestion on SR 981 as a result of a new interchange, however a new interchange here, along with the planned Laurel Valley Transportation Improvement Project could help reduce congestion on State Route 30

Potential to Attract New Turnpike Customers:

- The potential to attract new customers is relatively high. Due to the current lack of efficient north-south roadways in the area and SR 981 providing access to businesses located in Latrobe and the Airport Office Park

Land Use/Environmental:

- There are farmlands present at the intersection of SR 981 and the Turnpike accordingly to PennDOT *MPMS IQ*. The land is generally rural and not developed

Economic Revitalization:

- Moderately conducive to development scenario of SPC Long Range Plan/Potential for new development within this area with upgrades to SR 981 to Latrobe and towards Mount Pleasant

Private Property Impact:

- Potential private property impact in the northwest quadrant. Otherwise, partial property impacts would be likely required

Standard Geometry for Interchange:

- Turnpike is in a horizontal tangent at the intersection of SR 981. SR 981 is in a tangent at the intersection

Construction Costs:

- Construction costs would be low based upon the location of the potential ramps on the Turnpike being able to directly connect without major earthwork or structures required

Above Ground Utility Impacts:

- Minor aerial service lines are located along Fiedors Grove Road. There are no utility transmission lines that cross the Turnpike at this location

### 4.1.2 Results of High Level Evaluation

Preliminary scoring of each criterion was developed and presented to SPC's Technical Advisory Committee (TAC) for this study. Some general comments during this meeting included:

- SR 28 was identified as the most significant regional freight and traffic route without a direct connection to the Turnpike. Due to the proximity of the existing Allegheny Valley interchange, discussions centered around potential options to add access points that would complement the existing interchange or consideration of a direct connection to SR 28 as a potential future replacement of the existing Allegheny Valley Interchange.

- There are currently no tolls collected west of I-79, therefore, providing additional Turnpike access points west of I-79 would be unlikely to result in a noticeable gain in revenue at this time. However, PTC is still discussing and analyzing the financial aspects of the implementation of the Cashless Tolling system to the west of I-79. It has not been determined if this section of the Turnpike will be tolled in the future as part of the Cashless Tolling conversion process.

The TAC also decided to assign higher weighted value to the following criteria:

- Potential Congestion Reduction
- Potential to Attract New PTC customers
- Economic Revitalization

The table below represents the result of the scoring of each location and each criterion. For non-weighted criteria, each location was given a 1, 2, or 3 score. For the weighted criteria, each location was

given a score of 2, 4, or 6. The color coding represents the relative scoring difference for each criterion in relation to the locations (i.e., green represents higher scores, yellow represents middle scores and red represents lower scores.) One particular change in the evaluation process was to evaluate a SR 28 access point from both the "new" access perspective and a "replacement" (i.e., replace the existing Allegheny Valley Interchange) perspective – hence, this location is listed twice in the table.

***Table 4-2: Matrix Evaluation Results***

| Criteria | SR 551 | SR 65 | SR 68 | SR 910 | SR 28 (Replace) | SR 28 (New) | SR 380 | SR 130 | SR 136 | SR 981 |
|---|---|---|---|---|---|---|---|---|---|---|
| Access Criteria (Interchanges spacing) | 3 | 1 | 3 | 2 | 3 | 1 | 2 | 2 | 2 | 3 |
| Access Criteria (ADT of Crossroad) | 1 | 2 | 1 | 3 | 3 | 3 | 2 | 3 | 1 | 2 |
| Potential Congestion Reduction Impact | 2 | 2 | 4 | 4 | 6 | 6 | 4 | 2 | 2 | 2 |
| Potential to Attract New PTC Customers | 2 | 2 | 2 | 4 | 6 | 6 | 6 | 6 | 2 | 6 |
| | | | | | | | | | | |
| Land Use/Environmental | 3 | 2 | 1 | 1 | 2 | 3 | 1 | 2 | 2 | 2 |
| Economic Revitalization | 2 | 2 | 2 | 2 | 6 | 6 | 4 | 6 | 4 | 6 |
| Private Property Impact | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| | | | | | | | | | | |
| Standard Geometry for Interchange | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| Construction Costs | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 2 | 3 |
| Above Ground Utility Impacts | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 3 | 3 |
| | | | | | | | | | | |
| **Total** | 22 | 19 | 20 | 23 | 30 | 29 | 24 | 27 | 22 | 31 |

The results of the evaluation concluded the following:

- The relative difference in the total scoring of the criteria was not a large range – none of the locations gave a scoring that would indicate this area should never be pursued.
- A sensitivity analysis of the weighted vs. non-weighting of the criteria yielded no difference in the relative ranking of each location.
- The analysis and resulting consultation with the TAC resulted in the study moving forward with more in-depth analysis of the following four (4) locations:
    - SR 910
    - SR 28
    - SR 130
    - SR 981

## 4.2 Detailed Level Evaluation (4 Locations)

The Detailed Level Evaluation consisted of developing conceptual level plans, cost estimates and traffic demand information for the following locations:

- SR 910
- SR 28
- SR 130
- SR 981

Preliminary information on these access points was shared with the TAC at a meeting on June 23, 2016 and revised to reflect their input.

For the conceptual layouts, the latest imagery, Light Detection and Ranging (LIDAR) contour mapping and environmental features were utilized from the Pennsylvania Spatial Data Access (PASDA) site. Bentley Microstation and InRoads software was utilized to prepare the roadway design and excavation quantities, respectively.

General design criteria were followed for each ramp, using a 35 mph design speed for ramps and 55 mph for acceleration/deceleration sections with the Turnpike and SR 28. Travel lane widths ranged from 12-15 feet and ramp shoulders ranged from 8-12 feet widths.

**Cost Estimates**

All costs shown are presented in Year 2016 dollars. Unit costs for excavation, borrow, and pavement were taken from PennDOT's Engineering and Construction Management System (ECMS). New signal systems were estimated at either $200,000 for three way Intersections or $250,000 for four way intersections. Structure costs were estimated at $600/linear feet for culverts and $950/linear feet for structures. Right-of-way costs were estimated using low, median and high cost per square feet derived commercial and residential value ranges for the area as a whole. Existing roadway right-of-way was estimated for each area.

Certain percent estimates were also utilized in the cost estimates. Utility costs were generally estimated to be 10% of the construction cost. Design costs were considered to be 30% of the total construction and utility costs. Construction Inspection was considered to be 15% of the total construction and utility costs.

Lastly, as per PennDOT Publication 352, Estimating Manual, a 40% contingency factor was applied to the above costs due to the fact that this is a planning-level analysis.

At each of the four interchange locations, cost is presented for the interchange configuration shown. In addition, a breakdown of the total cost is presented for each associated component (individual ramps and impacted adjacent roadways).

**Travel Demand Modeling**

To determine the potential of a new access location to shift traffic patterns locally and on the Turnpike system, SPC's transportation demand model using the Cycle 10 Year 2035 forecast was utilized. Each location was modeled separately to determine high-level changes to the roadway network.

### 4.2.1 SR 910 (Allegheny County)

**Description**

SR 910 crosses the Turnpike in four locations. This first crossing is just west of the Butler Valley Interchange with SR 8 in Richland Township, Allegheny County. This location was of particular interest because it was initially thought that it may have the potential to alleviate traffic at the I-79 Wexford Interchange. The nearest Turnpike interchanges are 7 miles to the west (Cranberry) and 3 miles east to the Butler Valley Interchange.

The new access concept alternative is shown on the figure on the next page, along with mapping of the associated environmental constraints. The area consists of SR 910, along with North Montour Road intersecting SR 910 in the northeast quadrant of the proposed interchange. A retaining wall exists along the Turnpike along the westbound lane in the area of the SR 910 bridge.

The current surrounding land use in the area consists of low density housing, open space and one commercial property . Noticeable environmental features include Montour Run, which runs under the Turnpike, and associated 100-year floodplain and possible wetlands along the stream.

As can be seen in the new access concept alternative, the proposed interchange consists of three ramps directly connecting onto SR 910 and one ramp utilizing North Montour Road.

**Constraints and Design Considerations**

Constraints and design considerations associated with the development of the proposed SR 910 interchange with the Turnpike are as follows:

- Local North Montour Road would require upgrades to accommodate the increase in traffic associated with the westbound access to the Turnpike. This ramp would also require additional signing, since it is not a direct connection with SR 910.
- Culverts would be required for the two ramps traversing Montour Run.
- Ramp 2 would utilize the existing maintenance access roadways in the area.
- The existing bridge carrying SR 910 over the Turnpike is 44 feet wide (2 – 12’ lanes and 2 – 10’ shoulders). The possibility of additional turn lane would change the typical section across the bridge to 3 – 12’ lanes and 2 – 4’ shoulders. A design exception approval would be required to accommodate the additional turn lane without widening the bridge since the new shoulder width on the bridge (4 feet) would not match the shoulder width on the approach roadway (10 feet). If a design exception approval is not possible, the bridge would need to be widened by 12 feet (6 feet on either side) which would significantly increase costs.

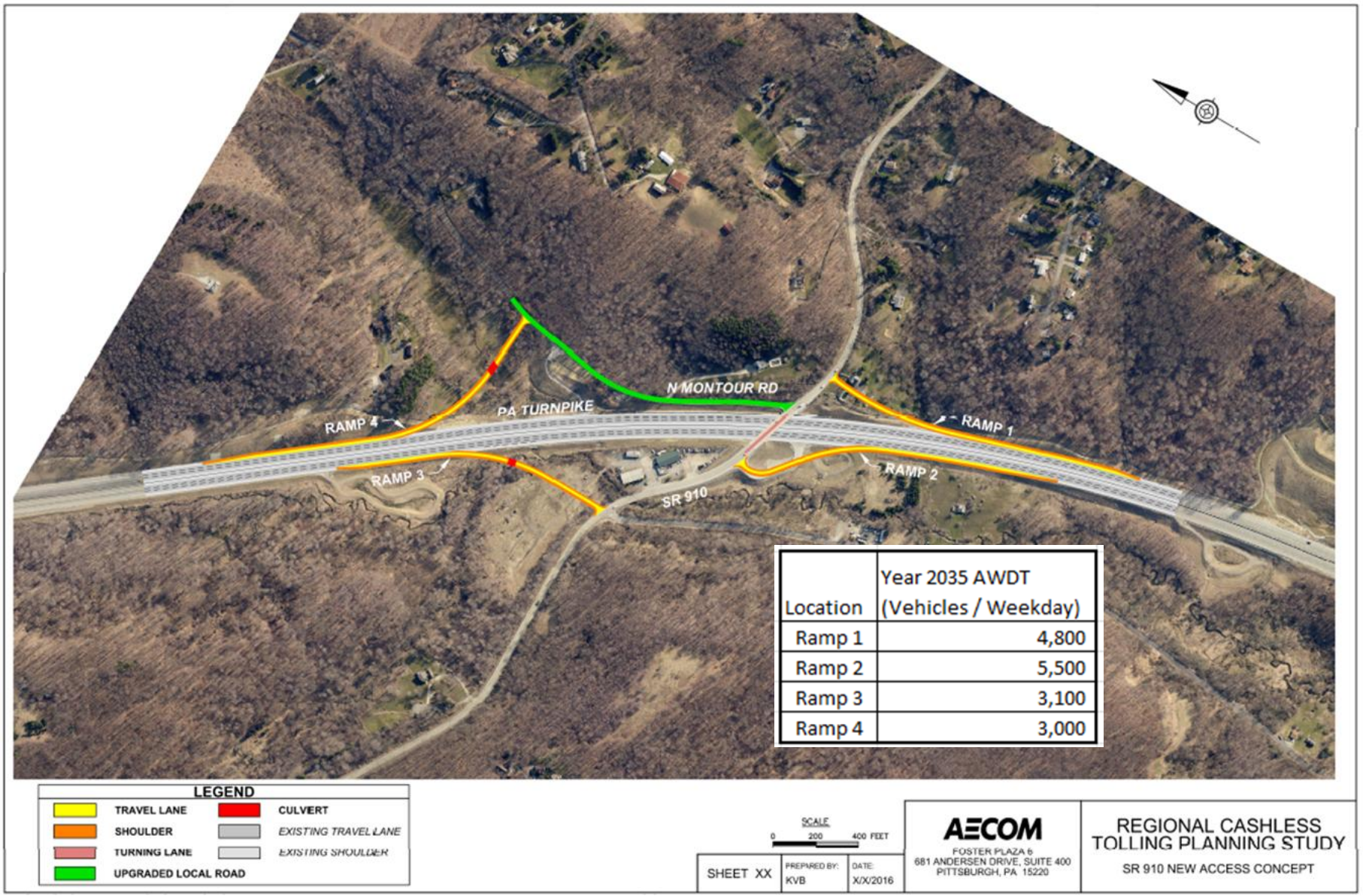



***Figure 4-11: SR 910 New Access Concept Alternative***

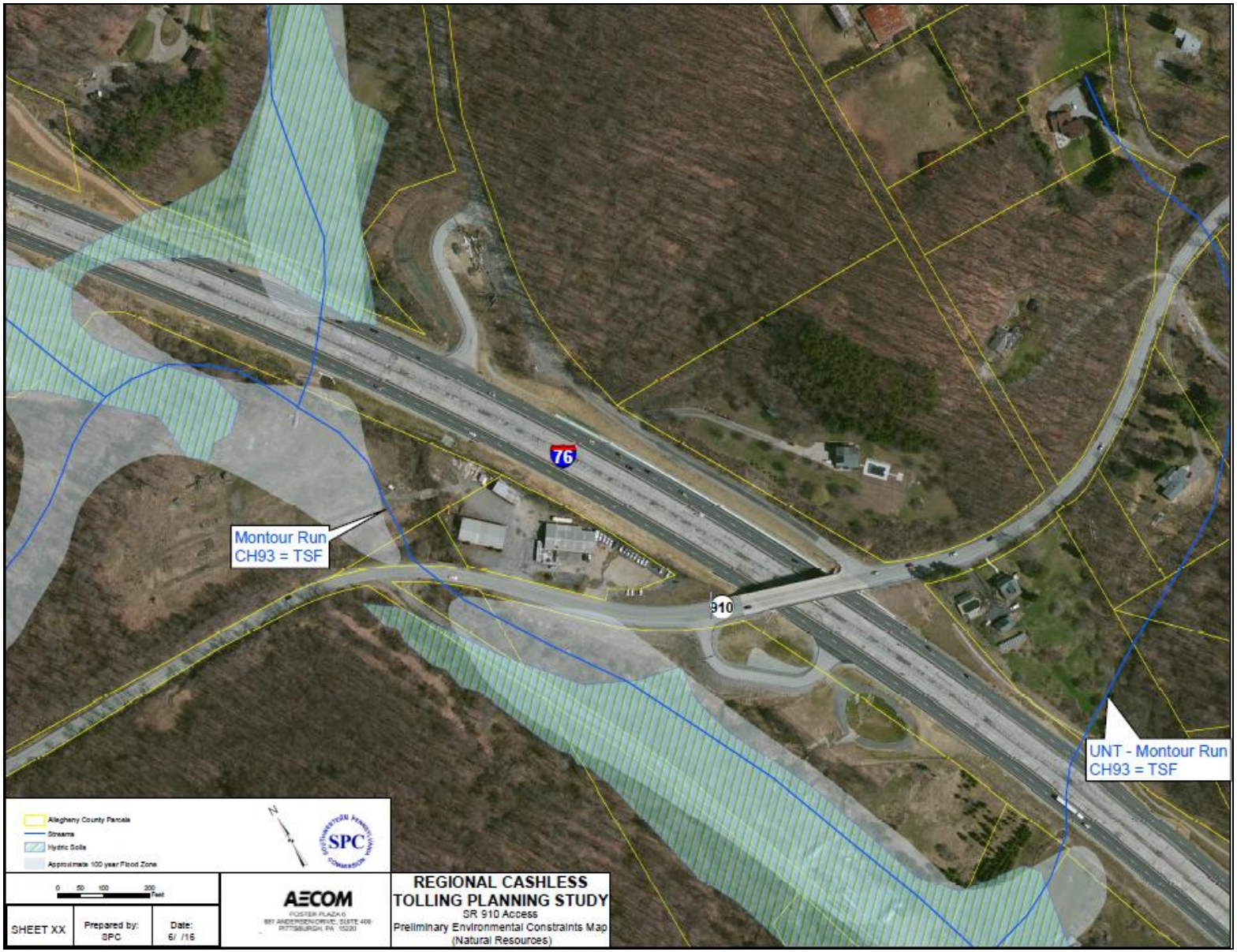



***Figure 4-12: SR 910 Environmental Constraints Map 1 of 2***

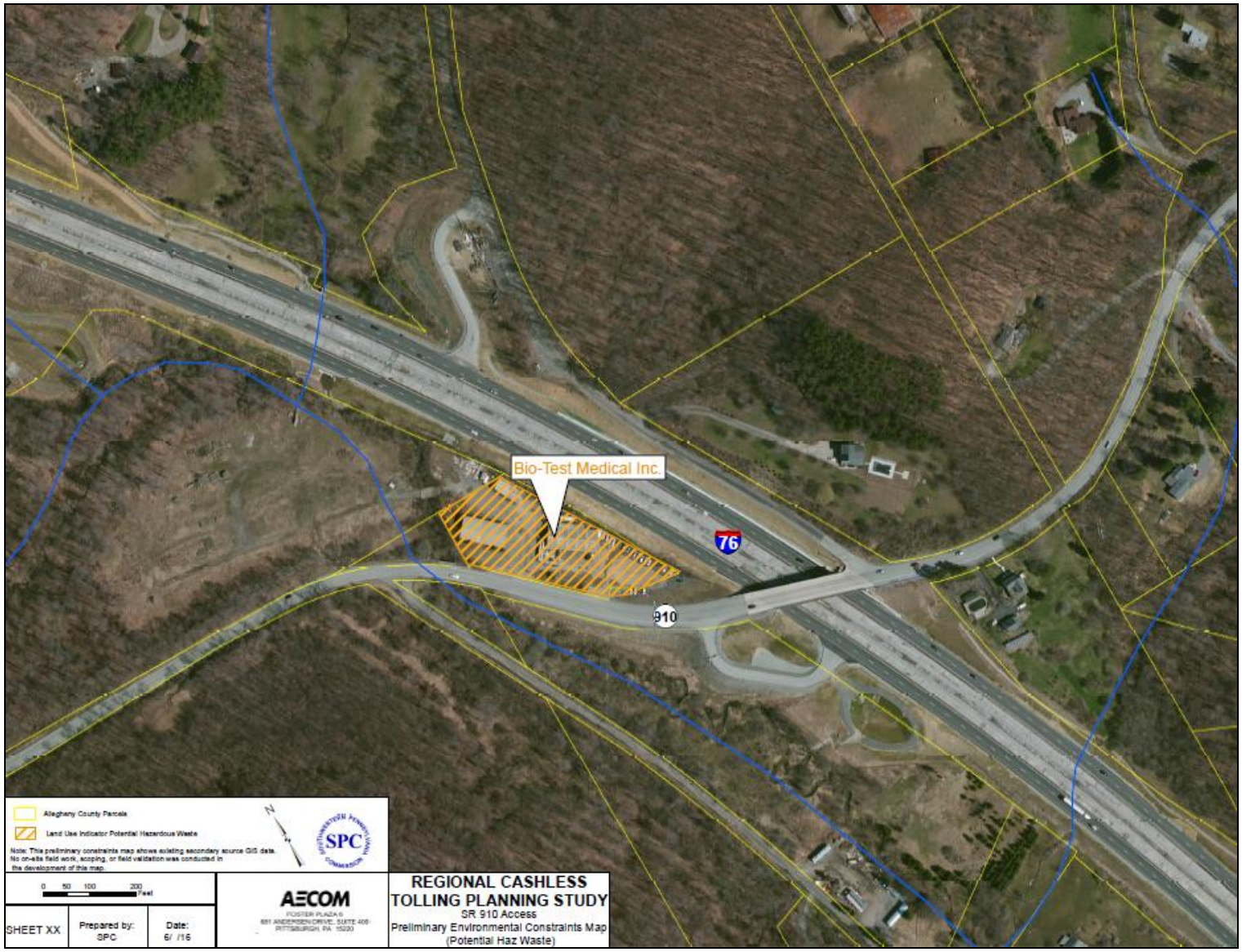
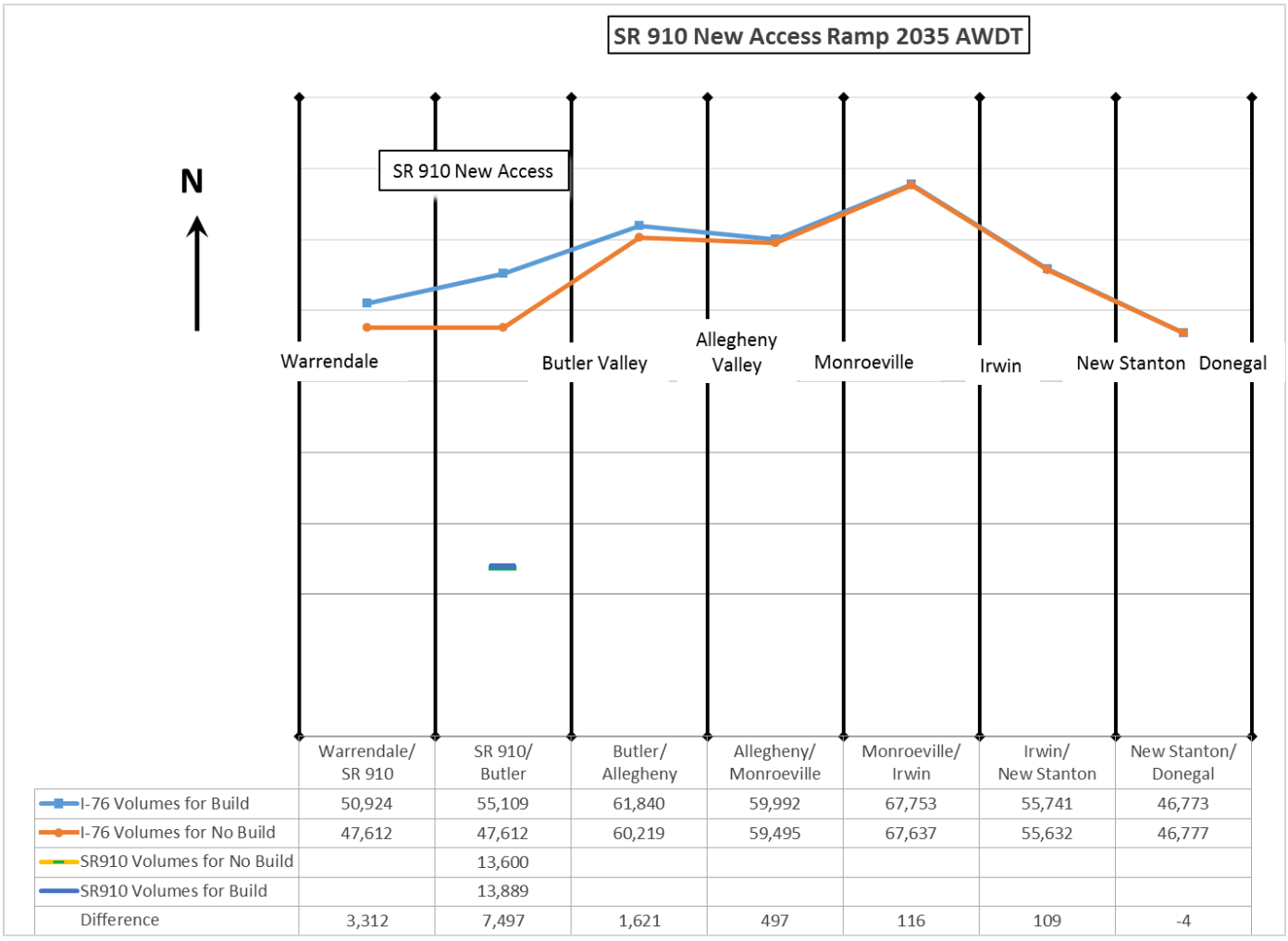



***Figure 4-13: SR 910 Environmental Constraints Map 2 of 2***

## Traffic

For this interchange, as shown in Figure 4-11, Ramps 1 and 2 had slightly higher projected daily traffic volumes than Ramps 3 and 4. The Average Weekday Daily Traffic (AWDT) for ramps 1, 2, 3 and 4 were 4,800, 5,500, 3,100 and 3,000 respectively. It has been noted that the traffic at the I-79 Wexford Interchange did reduce with this new access ramp - the reduction ranging from 0.8-5.5%. Also, the SR 910 traffic volumes west and east of the new interchange would increase approximately 3.2-14.2%, which may cause some traffic operational impacts on SR 910. These impacts would likely necessitate signalization of the new ramps. This is illustrated in the figure below.




| | Warrendale/ SR 910 | SR 910/ Butler | Butler/ Allegheny | Allegheny/ Monroeville | Monroeville/ Irwin | Irwin/ New Stanton | New Stanton/ Donegal |
|---|---|---|---|---|---|---|---|
| I-76 Volumes for Build | 50,924 | 55,109 | 61,840 | 59,992 | 67,753 | 55,741 | 46,773 |
| I-76 Volumes for No Build | 47,612 | 47,612 | 60,219 | 59,495 | 67,637 | 55,632 | 46,777 |
| SR910 Volumes for No Build | | 13,600 | | | | | |
| SR910 Volumes for Build | | 13,889 | | | | | |
| Difference | 3,312 | 7,497 | 1,621 | 497 | 116 | 109 | -4 |

***Figure 4-14: SR 910 New Access Year 2035 AWDT Traffic Effects on Mainline Turnpike***

## New Access Concept Cost Estimate

The estimated Year 2016 program cost for the SR 910 New Access Concept Alternative shown in Figure 4-11 is approximately $16.1 million. A summary breakdown of this cost estimate is shown in the following table and a detailed breakdown is included in Appendix A. Projected interchange costs are provided as well as costs associated with projected improvements to N. Montour Road.

### *Table 4-3: SR 910 Summary Cost Estimate*

| | Ramp 1 | Ramp 2 | Ramp 3 | Ramp 4 | SR 0910 | N Montour Road | Totals |
|---|---|---|---|---|---|---|---|
| **Design** [1] | $596,200 | $369,300 | $394,200 | $606,300 | $0 | $177,500 | **$2,143,500** |
| **Construction** [2] | $1,806,600 | $1,119,000 | $1,194,400 | $1,837,200 | $0 | $537,800 | **$6,495,000** |
| **Relocated Utilities** | $180,700 | $111,900 | $119,500 | $183,800 | $0 | $53,800 | **$649,700** |
| **Right-of-Way** | $400,000 | $0 | $261,000 | $454,100 | $0 | $49,500 | **$1,164,600** |
| **Construction Inspection** | $298,100 | $184,700 | $197,100 | $303,200 | $0 | $88,800 | **$1,071,900** |
| **Subtotals:** | $3,281,600 | $1,784,900 | $2,166,200 | $3,384,600 | $0 | $907,400 | **$11,524,700** |
| **40% Contingency:** | $1,312,700 | $714,000 | $866,500 | $1,353,900 | $0 | $363,000 | **$4,610,100** |
| **TOTALS:** | **$4,594,300** | **$2,498,900** | **$3,032,700** | **$4,738,500** | **$0** | **$1,270,400** | **$16,134,800** |

1 - Design cost was assumed to cover Preliminary Engineering tasks (i.e. required studies and environmental clearances).

2 - See construction breakdown below.

| SR 0910 Interchange Construction Breakdown | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Items** | **Ramp 1** | **Ramp 2** | **Ramp 3** | **Ramp 4** | **SR 0910** | **N Montour Road** | **Total** |
| **Excavation/Borrow** | $750,000 | $200,000 | $212,000 | $807,825 | $0 | $66,675 | **$2,036,500** |
| **Pavement** | $555,450 | $532,450 | $485,300 | $618,125 | $0 | $381,425 | **$2,572,750** |
| **Structures** | - | - | $48,000 | $105,000 | $0 | $0 | **$153,000** |
| **Signals** | $200,000 | $200,000 | $250,000 | - | $0 | $0 | **$650,000** |
| **Mobilization (5%)** | $75,273 | $46,623 | $49,765 | $76,548 | $0 | $22,405 | **$270,613** |
| **MPT (15%)** | $225,818 | $139,868 | $149,295 | $229,643 | $0 | $67,215 | **$811,838** |
| **TOTAL Construction Cost** | **$1,806,540** | **$1,118,940** | **$1,194,360** | **$1,837,140** | **$0** | **$537,720** | **$6,494,700** |

**Possible Options at SR 910**

In meeting with the Technical Advisory Committee for this location, a number of possible options were discussed. This included the following:

- Consider a partial interchange utilizing only Ramps 3 and 4 to aid in reducing congestion at the I-79 Wexford Interchange. This would lower the estimated overall cost shown above
- Consider moving Ramp 1 toward the east and relocating Ramp 4 as a "loop" ramp in the same quadrant as Ramp 1. This concept is illustrated in the figure below. This concept would have two advantages: (1) It would lead to less confusion for travelers from a signing perspective compared to the original concept of using North Montour Road, and (2) it would concentrate traffic utilizing Ramps 1 and 4 to one intersection along SR 910.


***Figure 4-15: SR 910 Alternative Concept Relocating Ramp 4***

This concept would have a relatively higher cost compared to the original concept because of the following changes:

  - Ramp 4 would require an additional property take
  - The inclusion of two additional culverts along Ramps 1 & 4
  - The eastern bridge abutment and retaining wall along the Turnpike mainline would need to be relocated 12 feet to accommodate the acceleration lane

- Relocating North Montour Road and Ramp 1 to create a four-way intersection. This concept is shown in the figure below. This concept would have a relatively higher cost than the original concept because of the following changes:
  - An additional property take
  - Large amount of excavation due to the relocated road cutting through a hillside

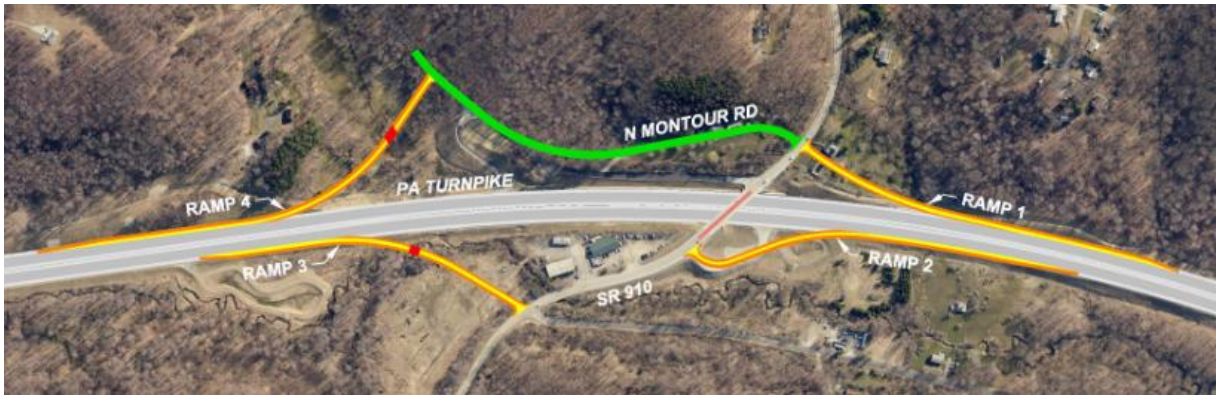



***Figure 4-16: SR 910 Alternative Concept Relocating N. Montour Rd and Ramp 1***

### 4.2.2 SR 28 (Allegheny County)

**Description**

The new access evaluated for SR 28 was unique relative to the other access locations in this study for three reasons. First, SR 28 has a higher design and functional classification than the other access points – requiring any new access with SR 28 to be at an Interstate design standard. Second, this location needs to take into consideration the proximity of three adjacent interchanges- namely - Exit 11 and 12 on SR 28 and Allegheny Valley Interchange on the Turnpike. Because of this, any new access will be constrained because of design controls associated with acceleration, deceleration and weaving movements.

Lastly, the Technical Advisory Committee was interested in the possibility of eventual replacement of the Allegheny Valley Interchange with a new SR 28 interchange. Historically, the Allegheny Valley Interchange was constructed prior to the construction of SR 28. At the time, the main roadway in this area was Freeport Road, which the interchange ties into. As the area between the interchange and SR 910 has grown, traffic congestion has increased along Freeport Road and SR 910 (Indianola Road). This has led to delays for trips connecting to/from the Turnpike and SR 28.

**Constraints and Design Considerations**

As stated above, there are a number of constraints and design considerations for accessing SR 28 to/from the Turnpike in this area.

- Adjacent Interchanges of Exit 11 and Exit 12 on SR 28 and the Allegheny Valley Interchange on the Turnpike. As stated above, the proximity of these interchanges restricts the acceleration, deceleration and weaving movements design controls.
- Railroad Bridge Overpass - the Canadian National/Bessemer & Lake Erie Railroad (CN/BLE) parallels the Turnpike in this area and passes over SR 28 approximately 550 feet northwest of the turnpike crossing with SR 28. The railroad is active and any relocation or widening of the railroad bridge is considered challenging and extremely costly. The abutments for this bridge are adjacent to the shoulders of SR 28, making any widening to accommodate access ramps connecting to SR 28 problematic unless modifications are done with the bridge. For the analysis, it was assumed this railroad bridge would not be modified.
- Land use - three of the four quadrants in the area of the SR 28 crossing of the turnpike are restricted by existing development or the railroad. In the southwest quadrant, the UPARC Business and Research Campus and other facilities along Gulf Lab Road, lies within 200 feet south of SR 28. In the southeast and northeast quadrant, the proximity of the CN/BLE railroad (distances range 450 to 1000 feet.) from the Turnpike restricts ramp alignments in these areas.
- Design speeds of the ramps ranged from 35 to 50 mph , as opposed to a lower criteria for the other access locations in this report.

***Figure 4-17: Railroad Overpass on SR 28 Northbound***

## New Access Concept

The new access concept alternative is shown on the following figure, along with mapping of the associated environmental constraints. This concept followed a number of iterations with SPC staff and the Technical Advisory Committee. Initially, a full access interchange was conceptually developed that consisted of full access between SR 28 and the Turnpike. For a full access interchange, eight ramp connections are required (four entrance/exit ramps for the Turnpike and four entrance/exit ramps for SR 28). The group then decided to illustrate and develop cost estimates for five of the access points - focusing on the least costly connections. The figure below and the following cost estimate reflect this concept. Although these ramps are shown together, any of these ramps could be pursued independent of the others, with some modification to the design. The new access concept provides five access ramps. These ramps are:

- Ramp 1: Turnpike Eastbound Off-Ramp to Southbound SR 28
- Ramp 3: Turnpike Eastbound On-Ramp from Southbound SR 28
- Ramp 6: Turnpike Westbound Off-Ramp to Northbound SR 28
- Ramp 7: Turnpike Westbound On-Ramp from Southbound (SR 28
- Ramp 8: Turnpike Westbound On-Ramp from Northbound SR 28

(Note: the numbering of the ramps was originally developed from the full access concept and the numbering was held throughout the study)

Although these ramps are shown together, any of these ramps could be pursued independent of the others, with some modification to the design.

**Ramp 1**

Ramp 1 is a Turnpike eastbound off-ramp connecting to southbound SR 28. Although there are no structures on this ramp, the length and amount of earthwork required is reflected in its cost. Additionally, a weave section on SR 28 between this ramp and the exit ramp for the SR 910 exit would be created and analysis of this could affect its design.

**Ramp 3 and Ramp 7**

Ramp 3 is a SR 28 southbound off-ramp connecting to the eastbound Turnpike. Ramp 3 also ties to Ramp 7 (Ramp 7 would provide SR 28 southbound drivers access to the westbound Turnpike). Ramp 7 would require a structure over both the mainline Turnpike and a portion of proposed Ramp 8.

**Ramp 6**

Ramp 6 is a Turnpike westbound off-ramp connecting to northbound SR 28. This is the least expensive of the connections presented. For the design presented, the connection to northbound 28 would require the utilization of the existing SR 28 northbound 3rd lane (which was originally designed to provide a truck climbing lane) to use for acceleration purposes. Using the third lane for this purpose would require terminating the third lane prior to this ramp merge. Although a traffic analysis of this merge area was not done as part of this study, the currently available capacity of the 3rd lane on SR 28 may allow for this merge movement.

**Ramp 8**

Ramp 8 is a SR 28 northbound off-ramp connecting to the westbound Turnpike. To accommodate Ramp 6, Ramp 8 would require a structure over the mainline Turnpike, Ramp 6, and SR 28.

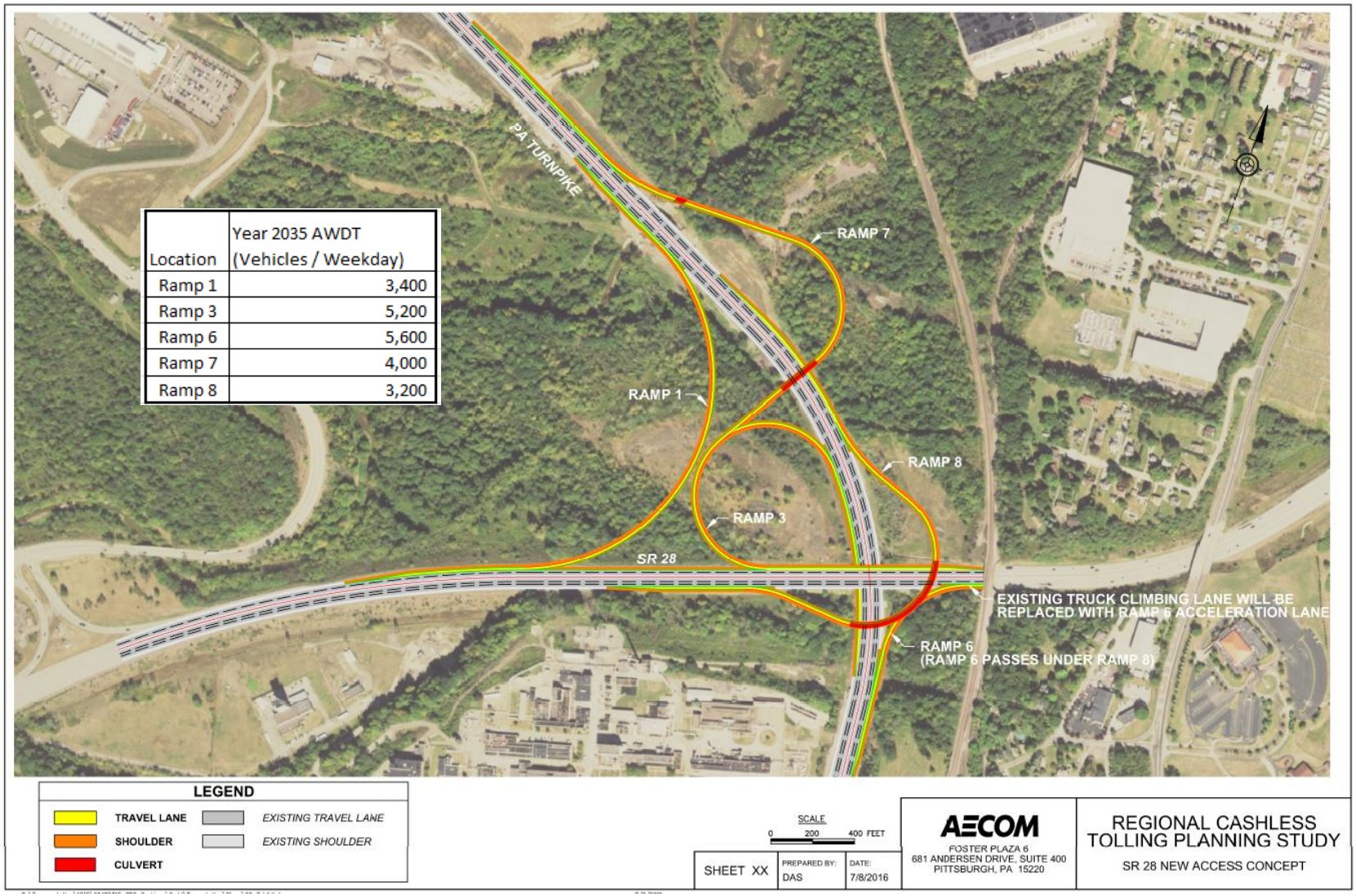



***Figure 4-18: SR 28 New Access Concept Alternative (Partial Access)***

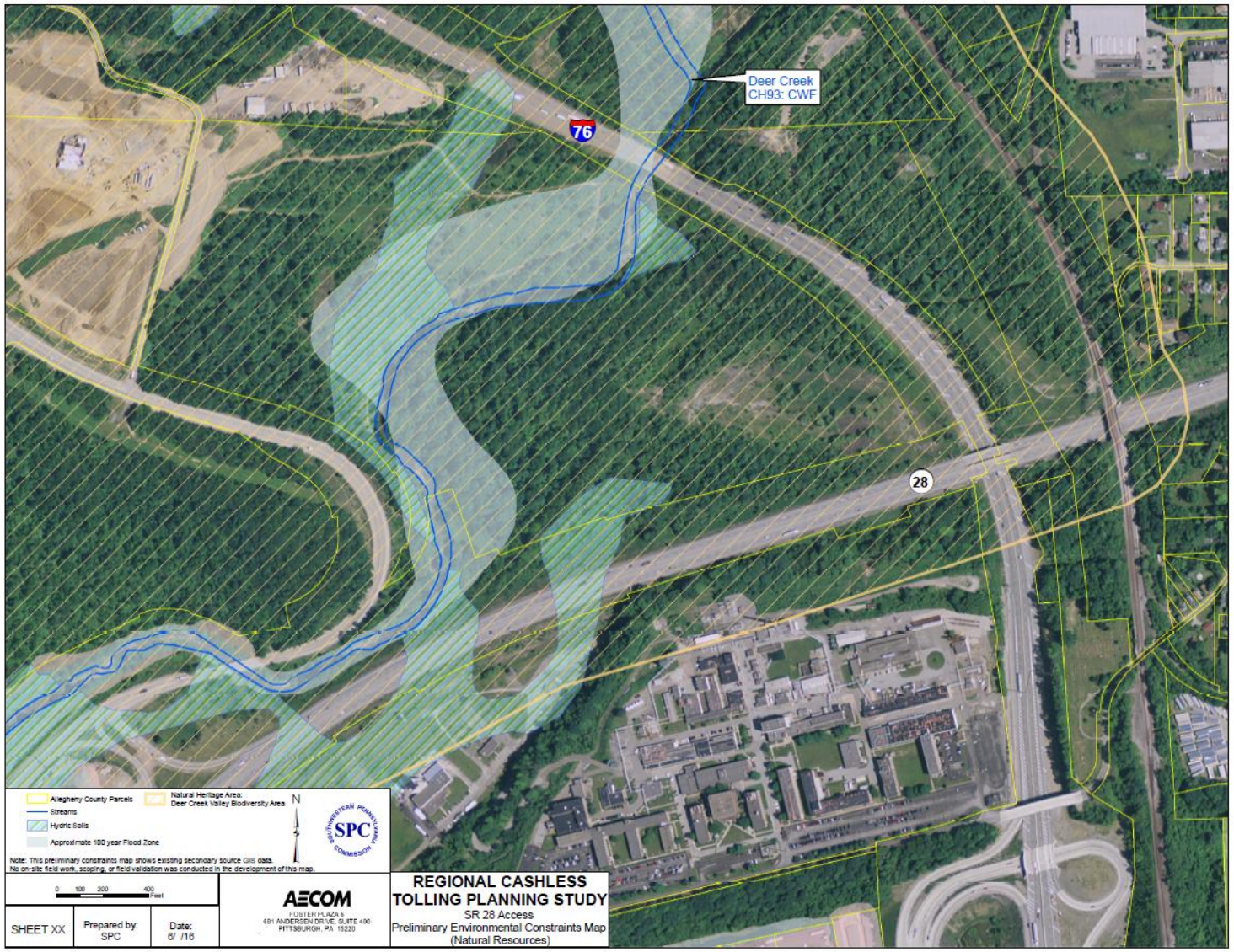



***Figure 4-19: SR 28 Environmental Constraints Map 1 of 2***

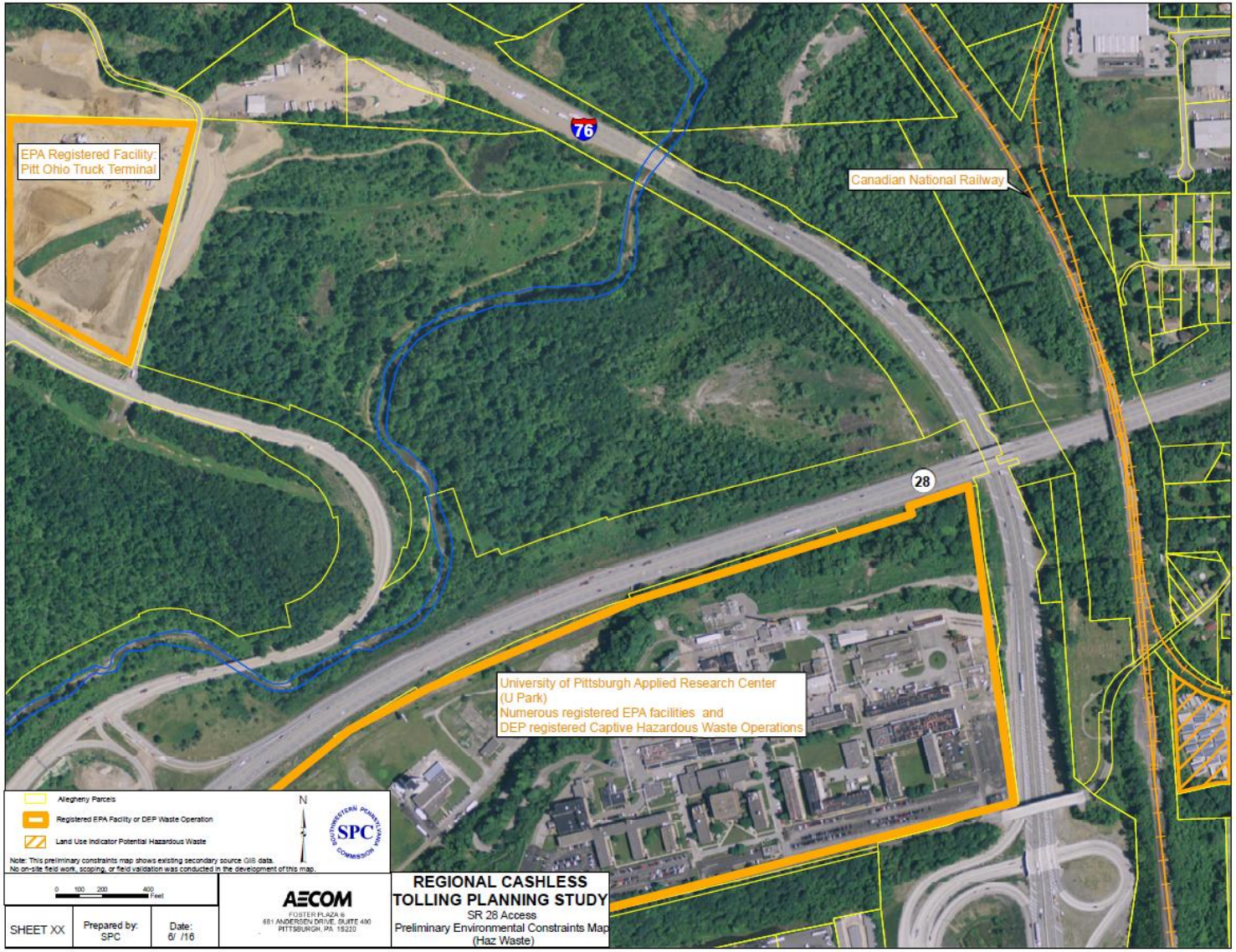



***Figure 4-20: SR 28 Environmental Constraints Map 2 of 2***

**Traffic**

For this interchange, all eight potential connections were added and modeled with the travel demand model and a number of conclusions from that modeling included:

1. A full SR 28 interchange would both increase the amount of Turnpike and SR 28 traffic and reduce traffic on Freeport Road by approximately 32-95%.
2. The ramp volumes on the new ramps ranged from 3,000 -5,500 vehicles/day. These volumes are shown on the Conceptual Layout Plan.
3. The higher volumes were associated with traffic to and from northern SR 28 (i.e.,to/from Kittanning Area-ramps 3, 6, and 7).

**New Access Concept Cost Estimate**

The estimated cost for the SR 28 New Access Concept Alternative (5 new ramp connections) is approximately $46.7 million. A summary breakdown of this cost estimate is shown in the following table and a detailed breakdown is included in Appendix A.

***Table 4-4: SR 28 Summary Cost Estimate (Partial Access)***

| | Ramp 1 | Ramp 3 | Ramp 6 | Ramp 7 | Ramp 8 | Totals |
|---|---|---|---|---|---|---|
| **Design** [1] | $727,100 | $353,900 | $312,800 | $1,087,800 | $982,800 | **$3,464,400** |
| **Construction** [2] | $3,304,600 | $1,608,200 | $1,421,500 | $4,944,200 | $4,467,000 | **$15,745,500** |
| **Relocated Utilities** | $330,500 | $160,900 | $142,200 | $494,500 | $446,700 | **$1,574,800** |
| **Right-of-Way** | $1,497,300 | $3,221,000 | $708,500 | $2,934,300 | $1,580,200 | **$9,941,300** |
| **Construction Inspection** | $545,300 | $265,400 | $234,600 | $815,900 | $737,100 | **$2,598,300** |
| **Subtotals:** | $6,404,800 | $5,609,400 | $2,819,600 | $10,276,700 | $8,213,800 | **$33,324,300** |
| **40% Contingency:** | $2,562,000 | $2,243,800 | $1,127,900 | $4,110,700 | $3,285,600 | **$13,330,000** |
| **TOTALS:** | **$8,966,800** | **$7,853,200** | **$3,947,500** | **$14,387,400** | **$11,499,400** | **$46,654,300** |

1 - Design cost was assumed to cover Preliminary Engineering tasks (i.e. required studies and environmental clearances).
2 - See construction breakdown below.

| SR 28 Interchange Construction Breakdown | | | | | | |
|---|---|---|---|---|---|---|
| **Items** | **Ramp 1** | **Ramp 3** | **Ramp 6** | **Ramp 7** | **Ramp 8** | **Total** |
| **Excavation** | $124,050 | $242,535 | $178,185 | $808,965 | $474,840 | **$1,828,575** |
| **Borrow** | $1,405,600 | $0 | $550,460 | $2,011,540 | $1,912,540 | **$5,880,140** |
| **Pavement** | $1,224,175 | $1,097,560 | $455,860 | $1,050,755 | $820,180 | **$4,648,530** |
| **Structures** | $0 | $0 | $0 | $248,900 | $514,900 | **$763,800** |
| **Mobilization (5%)** | $137,691 | $67,005 | $59,225 | $206,008 | $186,123 | **$656,052** |
| **MPT (15%)** | $413,074 | $201,014 | $177,676 | $618,024 | $558,369 | **$1,968,157** |
| **TOTAL Construction Cost** | **$3,304,600** | **$1,608,200** | **$1,421,500** | **$4,944,200** | **$4,467,000** | **$15,745,500** |

**Possible Option - Full SR 28 Interchange with Allegheny Valley Interchange Closure**

In meeting with the Technical Advisory Committee for this location, there was interest in what a possible interchange layout would entail if the Allegheny Valley Interchange were to be closed and replaced by an interchange on SR 28 in the long term. (It should be noted that the PTC currently has no plans for replacing the Allegheny Valley Interchange and has recently made a significant investment with reconstruction in the interchange area.) The replacement of Allegheny Valley Interchange with a full interchange with SR 28 could yield the following benefits:

- The travel time between SR 28 and the Turnpike could be reduced by approximately 5 minutes during the peak periods. The current delay is due to congestion on Freeport Road and SR 910.
- Congestion on Freeport Road and SR 910 during the peak periods would be reduced.
- A direct connection to SR 28 would increase overall Turnpike traffic and revenue.

It is assumed that a closure of the Allegheny Valley Interchange would remove some of the design impediments that were discussed in the previous section. Namely, without the Allegheny Valley Interchange, restrictions with regard to acceleration and deceleration lanes would no longer be a major issue in this section of the Turnpike.

The following figure provides a conceptual layout of a full SR 28 interchange with the Allegheny Valley Interchange closed. A cost estimate for this concept was not developed. However, the relative cost of this concept would be much higher than the cost estimate for the partial access concept and would also need to include the closure and possible removal costs of the Allegheny Valley Interchange.

This full access concept provides for eight access ramps. These ramps are:

- Ramp 1: Turnpike Eastbound Off-Ramp to Southbound SR 28
- Ramp 2: Turnpike Eastbound Off-Ramp to Northbound SR 28
- Ramp 3: Turnpike Eastbound On-Ramp from Southbound SR 28
- Ramp 4: Turnpike Eastbound On-Ramp from Northbound SR 28
- Ramp 5: Turnpike Westbound On-Ramp to Southbound SR 28
- Ramp 6: Turnpike Westbound Off-Ramp to Northbound SR 28
- Ramp 7: Turnpike Westbound On-Ramp from Southbound SR 28
- Ramp 8: Turnpike Westbound On-Ramp from Northbound SR 28

The goal of this layout was to provide a possible configuration to provide full access. There are other possible configurations that would provide partial access if further development of this concept were to yield design issues. If this concept was developed further, below are known design considerations that should be considered and investigated further:

- The merging of Ramps 1&2 with Ramps 5 & 6 in the northwest quadrant would require a weave section for the traffic. A detailed traffic analysis of this section would be required to determine if these movements are acceptable.
- The connection of Ramp 1&5 with SR 28 southbound would require a weave section for the traffic. A detailed traffic analysis of this section would be required to determine if these movements are acceptable.
- The section of northbound SR 28 between Ramps 2&6 and Ramp 4 would require a weave section for the traffic. A detailed traffic analysis of this section would be required to determine if these movements are acceptable.


***Figure 4-21: SR 28 Full Access Alternative with Allegheny Valley Interchange Closure***

### 4.2.3 SR 130 (Westmoreland County)

**Description**

The general project area of interest for a potential new cashless tolling interchange location is SR 130 crossing the Turnpike in Penn Township, Westmoreland County. Current surrounding land use adjacent to SR 130 and the Turnpike consists of a mix of residential and commercial properties. The Turnpike's Harrison City Maintenance Facility is located directly to the south of SR 130 and to the east of the Turnpike. Local roadways that parallel the Turnpike to the east are Sandy Hill and Pleasant Valley Roads and to the west Nike Site Road.

The PTC recently replaced the SR 130 Bridge over the Turnpike and widened the bridge to provide additional capacity on the SR 130 eastbound approach to the SR 130/ Pleasant Valley Road/Sandy Hill Road Intersection. Currently, PennDOT District 12-0 has a project to improve each approach to this intersection and match the widened template constructed with the SR 130 Bridge over the Turnpike. The PTC is currently completing the design to reconstruct this section of the Turnpike including widening the median to 20 feet and adding a third travel lane in each direction.

The new access concept alternative is shown on the figure on the next page, along with mapping of the associated environmental constraints. Access to and from SR 130 is provided from the eastbound direction of the Turnpike. Ramp 3 provides access to SR 130 for vehicles traveling eastbound along the Turnpike. Ramp 3 begins to the north of SR 130 and forms a new plus intersection with Nike Site Road to the south of the SR 130 Bridge. Ramp 2 provides access to the Turnpike for vehicles entering the Turnpike traveling in the eastbound direction. The Ramp 2 entrance is located approximately 250 feet to the south of the intersection with Nike Site Road and SR 130. Retaining walls will likely be required between Ramp 2 and the Turnpike and Ramp 2 and Nike Site Road to avoid impacts to the eastbound Turnpike travel lanes and to minimize the relocation of Nike Site Road.

Access to and from SR 130 is also provided from the westbound direction of the Turnpike. Ramp 1 provides access from the Turnpike to SR 130 for vehicles traveling westbound along the Turnpike. Ramp 1 begins to the south of SR 130 and connects at a new intersection with Sandy Hill Road, located approximately a quarter (1/4) mile to the south of the SR 130 intersection with Pleasant Valley and Sandy Hill Roads. This location along Sandy Hill Road was selected to provide appropriate intersection spacing with the SR 130 intersection to better manage the operation of traffic at each intersection. Further study and traffic analysis will be required to confirm the operation and location of this new ramp junction point along Sandy Hill Road. Ramp 4 provides access from SR 130 to the westbound Turnpike. Ramp 4 begins along Sandy Hill Road at a common point with Ramp 1 and ends along the Turnpike to the south of the existing SR 130 Bridge.

Upgrades would likely be needed to Sandy Hill Road and Nike Site Road to connect to SR 130, as indicated on the New Access Concept Plan, and reflected in the conceptual cost estimate. Due to the projected significant increase in traffic volumes on SR 130 using the new Turnpike interchange, it is anticipated upgrades would be required on SR 130. For the purpose of this study, it is assumed a three-lane template would be required along SR 130 to accommodate the increased volumes. From the west, improvements would start at the signalized intersection of Harrison City Road and end to the west of the SR 130 Bridge at Old Farm Road. Improvements would likely be required at the signalized intersections of SR 130 and SR 993 and Harrison City Road. A more detailed study of the traffic circulation considering the new interchange access points would need to be conducted to determine the extent of the upgrades to SR 130 and the local roadway network.

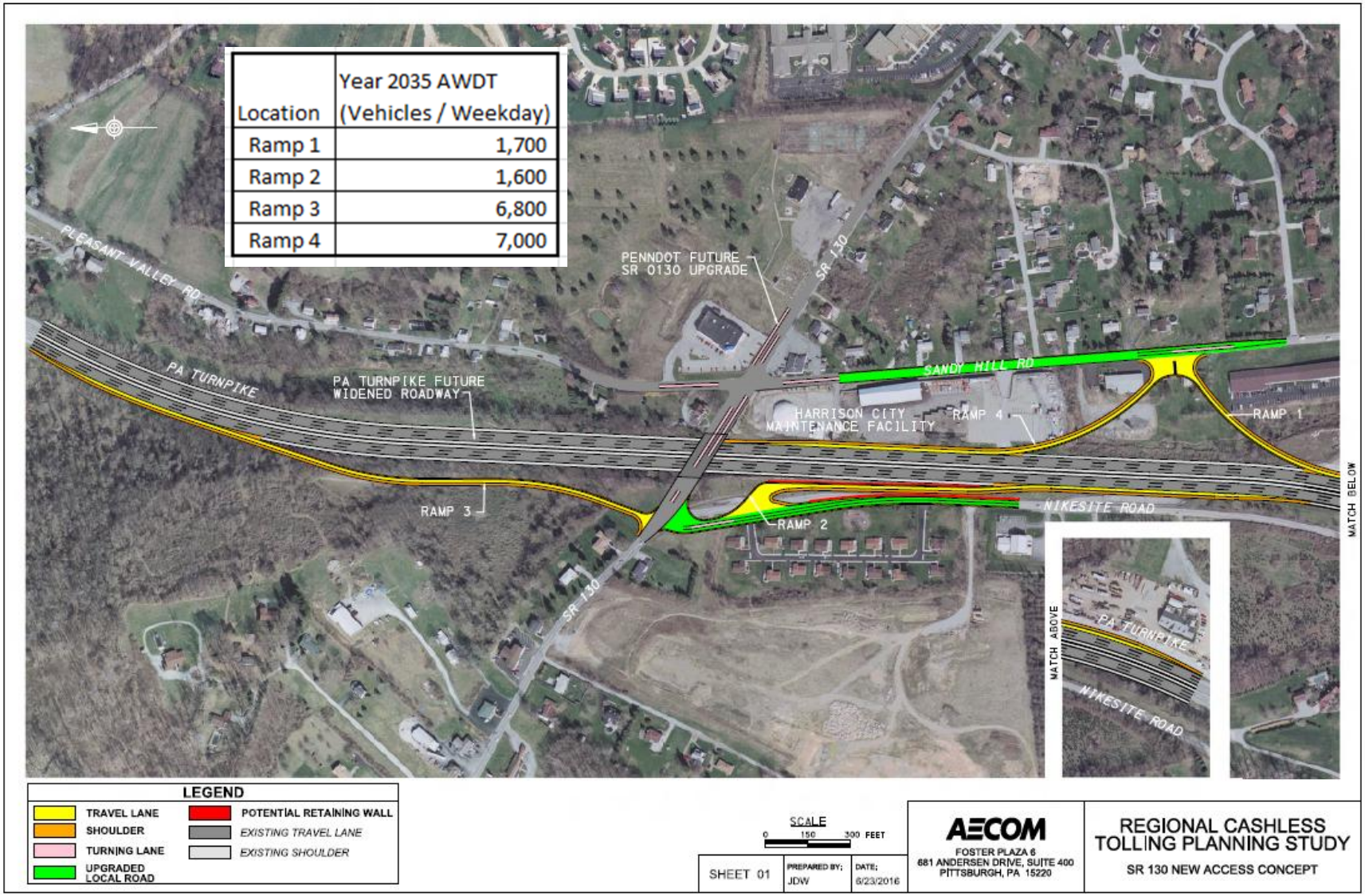



***Figure 4-22: SR 130 New Access Concept Alternative***


***Figure 4-23: SR 130 Environmental Constraints Map***

**Constraints and Design Considerations**

Constraints and design considerations associated with the development of the proposed SR 130 interchange with the Turnpike are as follows:

- As indicated previously, due to the projected significant increase in traffic volumes on SR 130 using the new Turnpike interchange, it is anticipated upgrades would be required on SR 130. For the purpose of this study, it is assumed a three lane template would be required along SR 130 to accommodate the increased volumes. From the west, improvements would start at the signalized intersection of Harrison City Road and end to the west of the SR 130 Bridge at Old Farm Road. Improvements would likely be required at the signalized intersections of SR 130 and SR 993 and Harrison City Road. A more detailed study of the traffic circulation considering the new interchange access points would need to be conducted to determine the extent of the upgrades to SR 130 and the local roadway network.

- High traffic volumes using the SR 130 and Pleasant Valley/Sandy Hill Road intersection to the east of the Turnpike with little available room for improvements to the intersection without business and residential displacements.

- The pending reconstruction and widening of the Turnpike does not provide additional room under the SR 130 Bridge to construct a ramp and limits potential configuration options.

- The Harrison City Maintenance Facility location, to the southeast of the Turnpike and SR 130, limits options to tie-in closer to SR 130.

- Close proximity and the elevation difference of Nike Site Road and the Turnpike located to the southwest of the SR 130 Bridge over the Turnpike. Construction of a connection to the Turnpike would require a slight realignment of Nike Site Road, construction of a retaining wall to bridge the elevation difference between Nike Site Road and the Turnpike, and presents potential difficultly for turning movements onto a proposed ramp without a wide ramp junction.

- Steep grades, sharp curves, and residential development along Pleasant Valley Road limit ramp connection options, unless major roadway upgrades and potential residential displacements are considered.

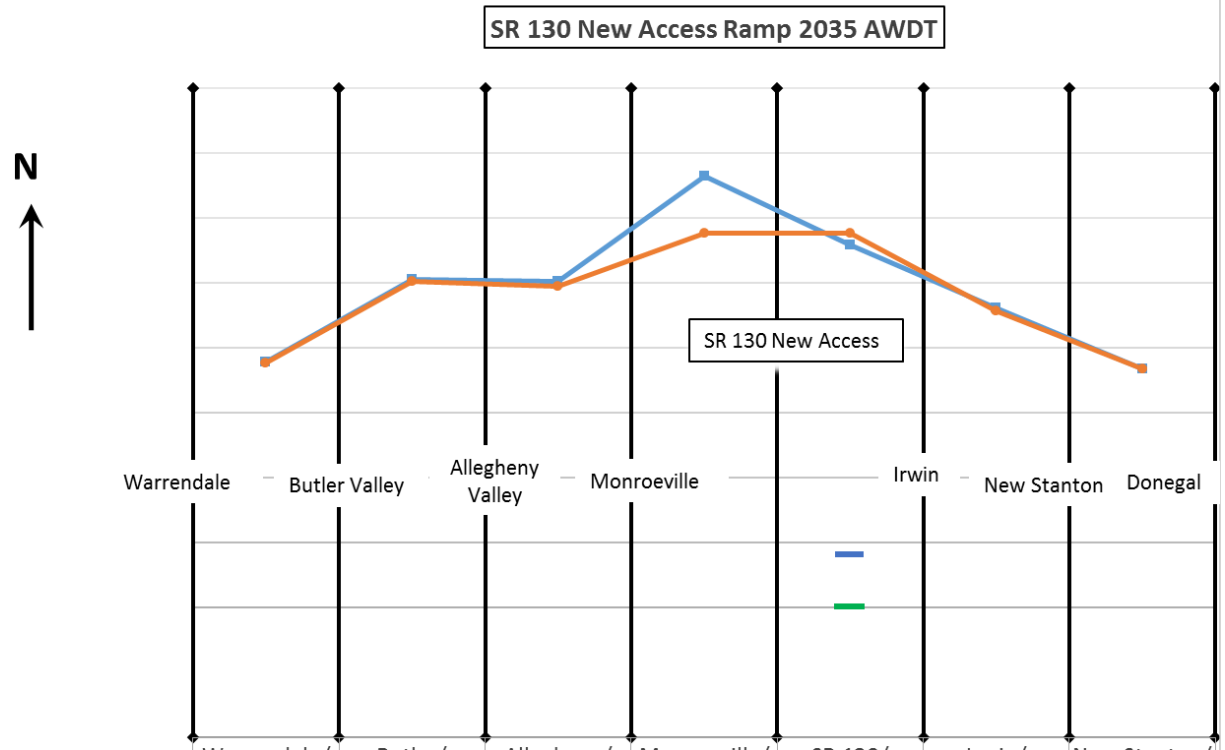
- Northwest of the SR 130 Bridge, a fairly sizeable cut slope exists along the Turnpike with evidence of rock outcrop, which may make excavation and construction at this location challenging.

**Traffic**

For the proposed SR 130 interchange, the new access modeling showed three important trends listed as following:

- Ramps 3 and 4 (to/from the Pittsburgh Area) had much stronger traffic demand than Ramps 1 and 2. Traffic volumes for Ramps 1, 2, 3 and 4 were 1,700, 1,600, 6,800 and 7,000 respectively.
- This interchange actually reduces traffic demand at the Irwin Interchange by approximately 8-16%.
- This interchange greatly increases the overall traffic on SR 130 by about 8,000 more vehicles/day.

The figure on the next page illustrates the effect the new access has on the mainline Turnpike Year 2035 Average Weekday Daily Traffic (AWDT).




| | Warrendale/ Butler | Butler/ Allegheny | Allegheny/ Monroeville | Monroeville/ SR 130 | SR 130/ Irwin | Irwin/ New Stanton | New Stanton/ Donegal |
|---|---|---|---|---|---|---|---|
| I-76 Volumes for Build | 47,755 | 60,464 | 60,271 | 76,442 | 65,825 | 56,100 | 46,688 |
| I-76 Volumes for No Build | 47,612 | 60,219 | 59,495 | 67,637 | 67,637 | 55,632 | 46,777 |
| SR 130 Volumes for No Build | | | | | 10,175 | | |
| SR 130 Volumes for Build | | | | | 18,073 | | |
| Difference | 143 | 245 | 776 | 8,805 | -1,812 | 468 | -89 |

***Figure 4-24: New Access Year 2035 AWDT Traffic Effects on Mainline Turnpike***

## SR 130 New Access Concept Cost Estimate

For the SR 130 new access concept alternative, a range of estimated Year 2016 program costs were developed and are shown in the table below. The range was developed to illustrate the cost for the interchange itself and for the possible upgrade/widening of 2.2 miles of SR 130 to accommodate the additional traffic on SR 130. The projected cost for the interchange itself is $29.6 million. The projected cost for the interchange and assumptions for a three-lane widening of SR 130 is $67.7 million.

The additional costs for upgrading SR 130 include the following assumptions:

- A thorough itemization of the widening costs for SR 130 was beyond the scope of this study. The main basis of this cost was a $5 million/mile construction cost estimate.

- Also included in this estimate was a right-of-way cost for SR 130 widening/upgrade that was estimated to be 40% of the estimated construction cost (other estimates in this study were based on estimated the right of way parcel take and applying cost/sq. ft. estimates).

A summary breakdown of this cost estimate is shown in the following table and a detailed breakdown is included in Appendix A.

Ramp 3 is projected to be the most costly access point to construct due to the topographic challenges, grades, and resulting ramp length. Ramps 1 and 4 were projected to be the least costly to construct primarily due to the relatively minimal excavation and grading, though right-of-way costs are higher and likely would result in displacements. Due to the potential need for retaining walls, Ramp 2's construction cost would be higher, though the right-of-way, assuming no displacement along Nike Site Road, would be lower relative to the other interchange ramps.

## *Table 4-5: SR 130 Summary Cost Estimate*

| | Ramp 1 | Ramp 2 | Ramp 3 | Ramp 4 | SR 130 | Nike Site Road | Sandy Hill Road | Totals (with SR 130) | Totals (without SR 130) |
|---|---|---|---|---|---|---|---|---|---|
| **Design** [1] | $317,100 | $1,332,100 | $1,289,700 | $278,300 | $4,653,000 | $397,900 | $180,200 | **$8,448,300** | **$3,795,300** |
| **Construction** [2] | $960,800 | $4,036,600 | $3,908,100 | $843,100 | $14,100,000 | $1,205,600 | $546,000 | **$25,600,200** | **$11,500,200** |
| **Relocated Utilities** | $96,100 | $403,700 | $390,900 | $84,400 | $1,410,000 | $120,600 | $54,600 | **$2,560,300** | **$1,150,300** |
| **Right-of-Way** | $802,200 | $0 | $704,300 | $868,600 | $4,700,000 | $278,700 | $180,000 | **$7,533,800** | **$2,833,800** |
| **Construction Inspection** | $158,600 | $666,100 | $644,900 | $139,200 | $2,326,500 | $199,000 | $90,100 | **$4,224,400** | **$1,897,900** |
| **Subtotals:** | $2,334,800 | $6,438,500 | $6,937,900 | $2,213,600 | $27,189,500 | $2,201,800 | $1,050,900 | **$48,367,000** | **$21,177,500** |
| **40% Contingency:** | $934,000 | $2,575,400 | $2,775,200 | $885,500 | $10,875,800 | $880,800 | $420,400 | **$19,347,100** | **$8,471,300** |
| **TOTALS:** | **$3,268,800** | **$9,013,900** | **$9,713,100** | **$3,099,100** | **$38,065,300** | **$3,082,600** | **$1,471,300** | **$67,714,100** | **$29,648,800** |

1 - Design cost was assumed to cover Preliminary Engineering tasks (i.e. required studies and environmental clearances).
2 - See construction breakdown below.

| SR 130 Interchange Construction Breakdown | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Items** | **Ramp 1** | **Ramp 2** | **Ramp 3** | **Ramp 4** | **SR 130** | **Nike Site Road** | **Sandy Hill Road** | **Total (with SR 130)** | **Total (without SR 130)** |
| **Excavation** | $23,790 | $210,015 | $2,276,445 | $139,575 | $0 | $172,350 | $4,170 | **$2,826,400** | **$2,826,400** |
| **Borrow** | $339,680 | $0 | $0 | $3,190 | $0 | $0 | $0 | **$342,900** | **$342,900** |
| **Pavement** | $437,128 | $693,693 | $730,161 | $559,692 | $0 | $542,228 | $250,707 | **$3,213,700** | **$3,213,700** |
| **Structures** | $0 | $2,460,000 | $0 | $0 | $0 | $290,000 | $0 | **$2,750,000** | **$2,750,000** |
| **Roadway Upgrade ($5M/ mi)** | $0 | $0 | $0 | $0 | $11,000,000 | $0 | $0 | **$11,000,000** | **$0** |
| **Signals** | $0 | $0 | $250,000 | $0 | $750,000 | $0 | $200,000 | **$1,200,000** | **$450,000** |
| **Mobilization (5%)** | $40,100 | $168,200 | $162,900 | $35,200 | $587,500 | $50,300 | $22,800 | **$1,067,000** | **$479,500** |
| **MPT (15%)** | $120,100 | $504,600 | $488,500 | $105,400 | $1,762,500 | $150,700 | $68,300 | **$3,200,100** | **$1,437,600** |
| **TOTAL Construction Cost** | $960,798 | $4,036,508 | $3,908,006 | $843,057 | $14,100,000 | $1,205,578 | $545,977 | **$25,600,000** | **$11,500,000** |

**Summary**

The projected traffic volumes are showing traffic over four times higher on Ramps 3 and 4, which are vehicles travelling to/from the Pittsburgh/Cranberry areas compared to ramps 1 and 2.. Based upon this volume and the relatively lesser volumes of vehicles traveling towards the east, consideration should be given to a partial cashless tolling interchange configuration. This option would eliminate Ramps 1 (westbound off-ramp) and Ramp 2 (eastbound on-ramp). The relocation and improvements to Nike Site Road would likely be able to be minimized and retaining walls to support the construction of Ramp 2 could also be eliminated. Eliminating Ramp 1, at the same location as Ramp 4, would provide more design flexibility to adjust Ramp 4 to further minimize impacts to the adjacent properties and Sandy Hill Road. Improvements to SR 130 would still need to be evaluated, though with less traffic entering and existing the local roadway network from the Turnpike, updates would likely not need to be as extensive.

### 4.2.4 SR 981 (Westmoreland County)

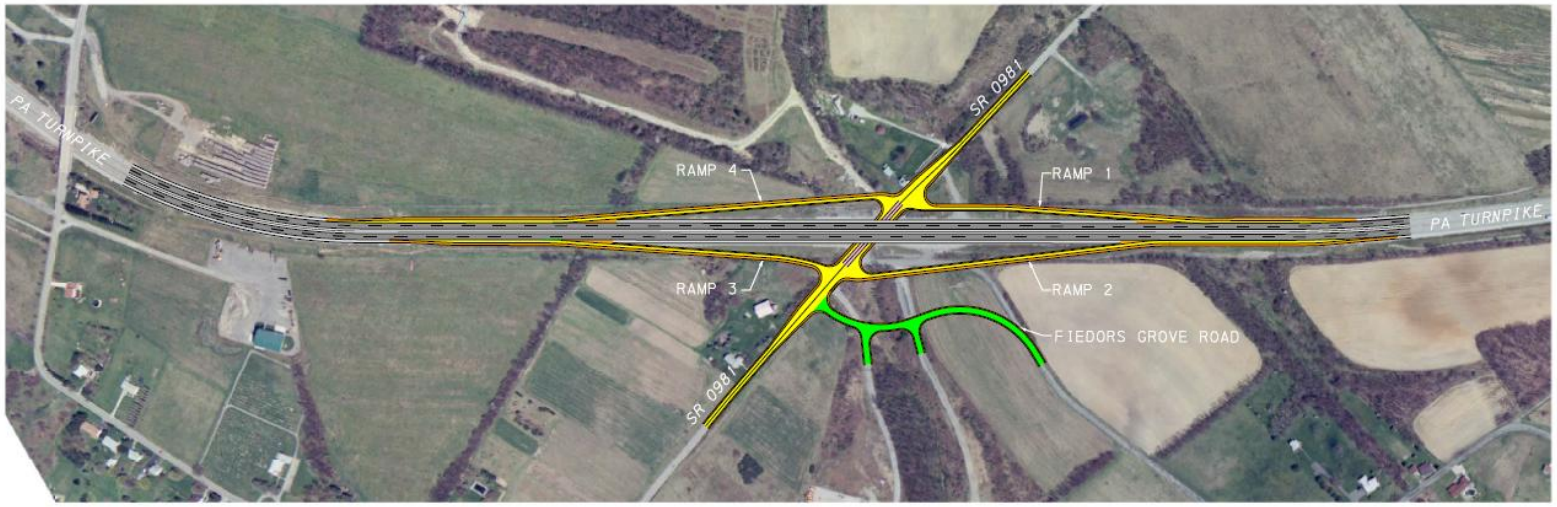
**Description**

The general study area of interest for a potential new cashless tolling interchange location is the SR 981 crossing of the Turnpike in Mount Pleasant Township, Westmoreland County. Current surrounding land use adjacent to SR 981 and the Turnpike consists of primarily agricultural land and a sparse mix of residential properties to the west of SR 981. Fiedors Grove Road is a local roadway that parallels the Turnpike to the east.

The Turnpike roadway and bridge over SR 981 was reconstructed within the last ten years. PennDOT District 12-0 is conducting a study as part of the Laurel Valley Transportation Improvement Project (LVTIP) to evaluate improvements to the SR 981 Corridor from SR 119 to SR 30 for approximately 14 miles. SR 981 is a critical regional north/south corridor within Westmoreland County and the PennDOT study will focus on improving safety and regional access within the SR 981 Corridor. PennDOT's study will consider improvements to the SR 981 Corridor, which will include consideration of additional traffic volumes on SR 981 resulting from the potential construction of the interchange at this location.

The interchange concept was developed assuming a full diamond interchange configuration, which is represented on the concept plan seen on the next page. A layout of this concept is seen on the next page, along with the environmental constraints in this area.

| Location | Year 2035 AWDT (Vehicles / Weekday) |
|---|---|
| Ramp 1 | 1,500 |
| Ramp 2 | 1,400 |
| Ramp 3 | 4,500 |
| Ramp 4 | 5,800 |




LEGEND

| | |
|---|---|
| TRAVEL LANE | RELOCATED LOCAL ROAD |
| SHOULDER | EXISTING TRAVEL LANE |
| TURNING LANES | EXISTING SHOULDER |

SCALE 0 200 400 FEET

SHEET 01 | PREPARED BY: AJR | DATE: 06/23/2016

AECOM
FOSTER PLAZA 6
681 ANDERSEN DRIVE, SUITE 400
PITTSBURGH, PA 15220

REGIONAL CASHLESS TOLLING PLANNING STUDY
SR 981 NEW ACCESS CONCEPT

***Figure 4-25: SR 981 New Access Concept Alternative***


***Figure 4-26: SR 981 Environmental Constraint Map***

Access to and from SR 981 from the eastbound direction of the Turnpike is via Ramps 2 and 3. Ramp 3 provides access to SR 981 for vehicles traveling eastbound along the Turnpike. Ramp 3 begins to the west of SR 981 along the Turnpike and forms a new plus intersection with Ramp 2 to the south of the Turnpike Bridge over SR 981. Ramp 2 provides access to the eastbound Turnpike for vehicles from SR 981. Ramp 2 ends on the Turnpike to the east of the Turnpike Bridge. The construction of Ramp 2 would result in a relocation of approximately 1000 feet of local Fiedors Grove Road to the south of its current location. Currently, there are no businesses or residents located along this section of Fiedors Grove Road. There does appear to be productive farmland that would likely be impacted by the realignment.

Access to and from SR 981 to/from the westbound direction of the Turnpike is via Ramps 1 and 4. Ramp 1 provides access from the Turnpike to SR 981 for vehicles traveling westbound along the Turnpike. Ramp 1 begins to the east of SR 981 and forms a new plus intersection with Ramp 4 to the north of the Turnpike Bridge. Ramp 4 provides access to the westbound Turnpike for vehicles entering from SR 981. The construction of Ramp 4 would impact a dual-purpose driveway providing access to a business, resident and a billboard. While the construction of this ramp would be relatively low cost, the potential right-of-way impacts could be costly and result in relocations. The evaluation of a half trumpet configuration with access to Ramp 1 and 4 located to the east of SR 981 and north of the Turnpike should be considered to minimize these right-of-way impacts. The trumpet configuration would consist of a loop ramp for Ramp 4 to the northeast of SR 981/Turnpike Bridge near the current Turnpike maintenance access location. Ramp 1 would be located to the outside of the loop ramp configuration to the north. This option should be evaluated against the diamond configuration to determine more detailed costs and impacts associated with each configuration prior to moving forward with a westbound on-and off-ramp option.

SR 981 would need to be widened and would be likely require turning lanes to provide access to the eastbound and westbound on-ramps (Ramps 2 and 4), which are shown as part of this improvement concept and costs. Additionally, the relocation of Fiedors Grove Road would be required to construct the Ramp 2, which is shown as part of this improvement concept and costs. Improvements would likely be needed to SR 981 to accommodate future traffic and truck volumes generated at the new interchange location. These improvements and associated costs are being evaluated as part of the Laurel Valley Transportation Improvement Project (LVTIP) Feasibility Study conducted by PennDOT District 12-0. Working with District 12-0, the 12 Year funding program projects a budget need of approximately $80 million for the LVTIP. The SR 981 corridor extends from the intersection with Hecla Road in Mount Pleasant Township to the intersection with US 30 in Unity Township. The scope of work for the LVTIP Feasibility Study will identify deficiencies for existing and future conditions along the corridor and identify improvements to address these deficiencies as well as determine the overall costs/benefits of the program. The final step of the study will prioritize the improvements along the SR 981 with suggested phasing of critical improvements that would need to be in place with the opening of a full or partial Turnpike interchange at SR 981.

**Constraints and Design Considerations**

Constraints and design considerations associated with the development of the proposed SR 981 interchange with the Turnpike are as follows:

- The location of productive agricultural land adjacent to SR 981 and the Turnpike.
- Local Fiedors Grove Road would need to be relocated to accommodate a diamond configuration to provide eastbound access to the Turnpike.
- A residential and business driveway to the northwest of the Turnpike and SR 981 would likely need to be removed or relocated. Also, a billboard may need to be relocated to accommodate a diamond configuration to provide westbound access to the Turnpike.

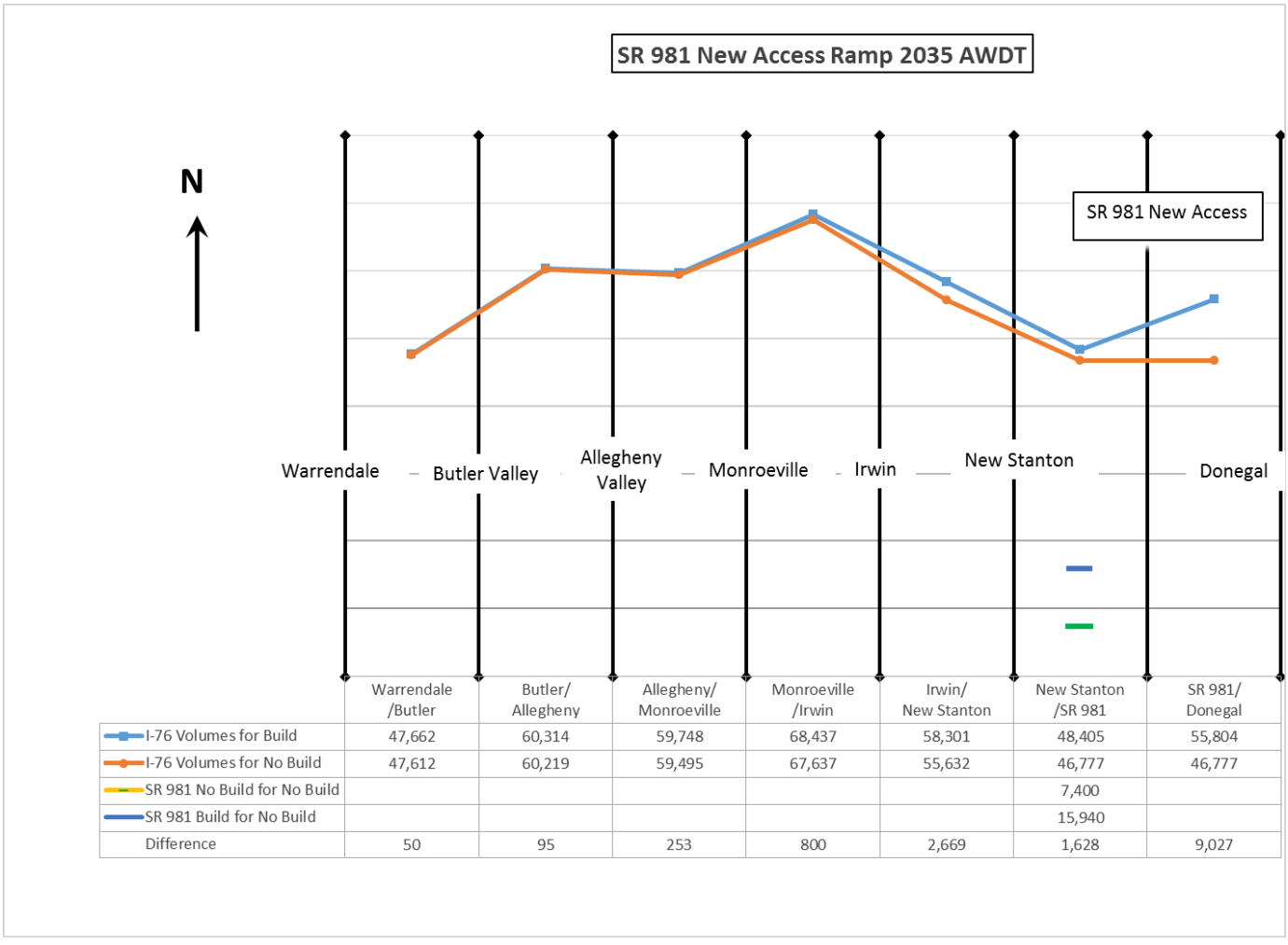
## Traffic

This interchange is being considered in PennDOT District 12-0- Laurel Valley Transportation Improvement Project (LVTIP). As part of that study, improvements to SR 981 as a whole is considered with the inclusion of this new access interchange, but those improvements are not included in the cost estimate presented.

The majority of traffic demand for this interchange was for the ramps coming from/going to the west (New Stanton Interchange direction). The SR 981 traffic volumes west and east of the new interchange are projected to increase approximately between 50-125%, which will cause significant traffic operational impacts on SR 981.

Additionally, the adjacent Turnpike Donegal Interchange to the east does not provide efficient access to SR 30 via SR 711; therefore, more traffic may choose SR 981 for access to SR 30 should an interchange be provided.

The figure on the next page illustrates the effect the new access has on the mainline Turnpike Year 2035 Average Weekday Daily Traffic (AWDT).




| | Warrendale /Butler | Butler/ Allegheny | Allegheny/ Monroeville | Monroeville /Irwin | Irwin/ New Stanton | New Stanton /SR 981 | SR 981/ Donegal |
|---|---|---|---|---|---|---|---|
| I-76 Volumes for Build | 47,662 | 60,314 | 59,748 | 68,437 | 58,301 | 48,405 | 55,804 |
| I-76 Volumes for No Build | 47,612 | 60,219 | 59,495 | 67,637 | 55,632 | 46,777 | 46,777 |
| SR 981 No Build for No Build | | | | | | 7,400 | |
| SR 981 Build for No Build | | | | | | 15,940 | |
| Difference | 50 | 95 | 253 | 800 | 2,669 | 1,628 | 9,027 |

***Figure 4-27: SR 981 New Access Year 2035 AWDT Traffic Effects on Mainline Turnpike***

## SR 981 New Access Concept Cost Estimate

A conceptual cost estimate was developed to better determine planning level costs associated with the construction of a new cashless tolling location at SR 981. The estimated Year 2016 program cost for the SR 980 New Access Concept Alternative is approximately $19.6 million. The cost estimate includes planning level design, construction, utility, and right-of-way costs. A total cost to provide full access was developed and the estimated cost of each access ramp was developed individually to allow consideration of each access point separately (see table on the next page). Costs were also developed for the relocation of Fiedors Grove Road. In addition, improvements to SR 981 to add turning lanes (only) were included with the estimate.

## *Table 4-6: SR 981 Summary Cost Estimate*

**SR 981**
**New Access Cost Estimate**

| | Ramp 1 | Ramp 2 | Ramp 3 | Ramp 4 | SR 0981 | Fiedors Grove Road | Totals |
|---|---|---|---|---|---|---|---|
| **Design** [1] | $524,600 | $598,400 | $252,700 | $354,600 | $244,900 | $544,900 | **$2,520,100** |
| **Construction** [2] | $1,665,100 | $1,899,600 | $802,100 | $1,125,400 | $777,400 | $1,729,600 | **$7,999,200** |
| **Relocated Utilities** | $83,300 | $95,000 | $40,200 | $56,300 | $38,900 | $86,500 | **$400,200** |
| **Right-of-Way** | $188,700 | $250,000 | $157,200 | $946,200 | $0 | $271,700 | **$1,813,800** |
| **Construction Inspection** | $262,300 | $299,200 | $126,400 | $177,300 | $122,500 | $272,500 | **$1,260,200** |
| **Subtotals:** | $2,724,000 | $3,142,200 | $1,378,600 | $2,659,800 | $1,183,700 | $2,905,200 | **$13,993,500** |
| **40% Contingency:** | $1,089,600 | $1,256,900 | $551,500 | $1,064,000 | $473,500 | $1,162,100 | **$5,597,600** |
| **TOTALS:** | **$3,813,600** | **$4,399,100** | **$1,930,100** | **$3,723,800** | **$1,657,200** | **$4,067,300** | **$19,591,100** |

1 - Design cost was assumed to cover Preliminary Engineering tasks (i.e. required studies and environmental clearances).
2 - See construction breakdown below.

**SR 981 Interchange Construction Breakdown**

| Items | Ramp 1 | Ramp 2 | Ramp 3 | Ramp 4 | *SR 0981 | Fiedors Grove Road | Total |
|---|---|---|---|---|---|---|---|
| **Excavation** | $797,745 | $911,430 | $138,345 | $256,335 | $0 | $13,710 | **$2,117,600** |
| **Borrow** | $0 | $0 | $0 | $0 | $0 | $976,000 | **$976,000** |
| **Pavement** | $589,669 | $671,408 | $529,907 | $681,464 | $647,710 | $451,577 | **$3,571,800** |
| **Structures** | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Signals** | $0 | $0 | $0 | $0 | $0 | $0 | **$0** |
| **Mobilization (5%)** | $69,400 | $79,200 | $33,500 | $46,900 | $32,400 | $72,100 | **$333,500** |
| **MPT (15%)** | $208,200 | $237,500 | $100,300 | $140,700 | $97,200 | $216,200 | **$1,000,100** |
| **TOTAL Construction Cost** | **$1,665,014** | **$1,899,538** | **$802,052** | **$1,125,399** | **$777,310** | **$1,729,587** | **$7,999,000** |

Due to the minimal presence of utilities within the study limits, an estimated 5% of the construction cost was utilized to determine the utility cost for SR 981. Due the presence of multiple utilities and potential conflict points within the SR 130 study limits, an estimated 10% of the construction cost was utilized to determine the utility cost for SR 130.

* SR 981 does not include a cost associated with an upgrade to the SR 981 Corridor beyond the interchange turning lanes and the relocation of Fiedors Grove Road. The required upgrade to the SR 981 Corridor will be determined as part of the Laurel Valley Transportation Improvement Project.

**Summary**

The projected ramp traffic volumes on Ramps 3 and 4 are showing over double the traffic compared to Ramps 1 and 2. Ramps 3 and 4 carry vehicles travelling to or from the New Stanton (I-70)/Pittsburgh areas. The projected volumes based on the SPC's Travel Demand Model may be understating the traffic volumes from/to the east as the location of this proposed interchange is near the geographic extent of SPC's model. For similar reasons with regard to model limits, the projected volume changes at the Donegal interchange may be overstated. Additionally, the adjacent Turnpike Donegal Interchange to the east does not provide efficient access to SR 30 via SR 711; therefore, more traffic may choose SR 981 for access to SR 30 should an interchange be provided. An interchange at SR 981 and improved SR 981 Corridor would provide improved access to Turnpike customers traveling from the east with destinations to the City of Latrobe and Mount Pleasant Borough. Overall, cashless tolling interchange options considered at this location should be in concert and planned with PennDOT's proposed improvements to the SR 981 Corridor. Improved access on SR 981 for trucks and passengers cars would provide a critical link and direct connection to the north and south of the Turnpike corridor within Westmoreland County.

# 5 Recommendations/Conclusions on Existing Toll Interchanges

In general, the typical user of the existing Turnpike interchanges will see no increase in delay or travel time once a cashless tolling system will take effect. The main reason for this is the current high rate at which E-ZPassis already used, particularly during the peak periods. This represents a significant change from what was experienced with all-cash transactions many years ago.

On average, travel times for traffic exiting the Turnpike during peak hours would decrease between 8 and 34 seconds (decrease between 5 - 25%).

Several possible improvements were identified that could help alleviate congestion and travel delays currently experienced by motorists at certain locations. These possible improvements are listed below under each interchange.

## 5.1 Butler Valley Interchange

Potential improvements in this area included a southbound left turn lane and a northbound right turn lane at the intersection of East Bardonner Road.

## 5.2 Allegheny Valley Interchange

Potential improvements include installing adaptive signals at SR 910, Alpha Drive East and Alpha Drive West intersections on Freeport Road. The simulation showed a definite improvement in the delay at these intersections with an adaptive system applied to the different peak hour demands at these intersections.

## 5.3 Pittsburgh/Monroeville Interchange

The primary improvements considered a widening of the I-376 off-ramp to Haymaker Road to two lanes, and providing an exclusive right turn lane along Haymaker Road. to the US Business 22/SR 48 intersection. This would relieve congestion at the US Business 22/SR 48 intersection.

Another improvement that could be considered with the rehabilitation of the Pittsburgh/Monroeville Interchange is the consideration of an additional access point south of US Business 22 in either the Holiday Lane or Northern Pike area. The Holiday Lane access may be problematic with the developed businesses and their own access. . The Northern Pike access concept could include slip ramps from Circle Way Drive to eastbound Turnpike and/or a slip ramp from westbound Turnpike to Northern Pike. These access points have the possibility of drawing traffic off of US Business 22 from the west and east of the current Turnpike access points on US Business 22. A thorough analysis of this concept was beyond the scope of this study.

## 5.4 Irwin Interchange

The possible improvements for this area include providing a slip ramp for exiting Turnpike traffic from the SR 30 overpass to Pennsylvania Avenue, extending the exclusive right turn lane on SR 30 to the Arona Road intersection back to the Turnpike eastbound Exit Ramp, and retiming the signals at Ronda Court and Arona Road The combinations of these projects is projected to improve the level of service at both intersections.

## 5.5 Donegal Interchange

As discussed in Section 3.3.8, the SR 31-X10 project will widen and realign the intersection of SR 31 with the Turnpike. This project is currently in Final Design with a scheduled let date of March 9, 2017. The new intersection design is referred to as a Florida-T or Texas-T intersection. Construction for this project will begin in 2017 and is anticipated to last two years.

# 6 Recommendations/Conclusions on Potential New Access Ramps with Cashless Tolling

A total of nine locations for potential new access were evaluated . Based on this evaluation, all the locations had specific merits and nothing indicated that any should be eliminated from future consideration. The PTC did indicate that there are no current plans to change tolling operations between the Ohio state line and I-79 at the Cranberry Interchange.

Below are specific conclusions on the four new access locations that were studied in greater detail.

## 6.1 SR 910 Access

New cashless tolling access appears to be feasible. The estimated cost for the SR 910 New Access Concept Alternative shown in this report is $16.1 million. Estimated Year 2035 AWDT ramp volumes are in the range of 3,100 to 5,500 vehicles/weekday. Traffic demand estimates also show this project decreases? traffic on the I-79 Wexford Interchange in the range of 0.8-5.5%. A number of configuration options were also presented, including the possibility of a partial interchange, which could, be explored if this were to progress to an Alternative Analysis study.

## 6.2 SR 28 Access

New cashless tolling access appears to be feasible. The estimated cost for the SR 28 New Access Concept Alternative is approximately $46.7 million. This concept is a partial access interchange that includes the five access points that provide the least costly connections, However, the development of any access in this area is hindered by the proximity of adjacent interchanges on SR 28 and the Turnpike, as well as the proximity to existing development in the area and a railroad.

An option also presented for this location included a conceptual alternative assuming the closure of the Allegheny Valley Interchange. (It should be noted that there currently are no plans for replacing the Allegheny Valley Interchange.) The replacement of Allegheny Valley Interchange with a full interchange at I-76 and SR 28 could yield the following benefits at some point:

- The travel time between SR 28 and the Turnpike could be reduced by approximately 5 minutes during the peak periods. The current delay is due to congestion on Freeport Road and SR 910.
- Congestion on Freeport Road and SR 910 during the peak periods would be reduced.
- A direct connection to SR 28 would increase overall Turnpike traffic and revenue.

## 6.3 SR 130 Access

New cashless tolling access appears to be feasible. The estimated cost for the SR 130 New Access Concept Alternative shown in this report is provided as a range. The projected cost for the interchange itself is $29.6 million. The projected cost for the interchange and assumptions for a three-lane widening

of SR 130 is $67.6 million. The higher range and projected widening of SR 130 is due to the projected significant increase in traffic volumes on SR 130 using the new Turnpike interchange. A more detailed study of the necessary upgrades to SR 130 would be needed to determine a more precise scope and cost.

Estimated Year 2035 AWDT ramp volumes are in the range of 1,700 to 7,000 vehicles/weekday. The highest demand ramps are those accessing the western part of the Turnpike. This proposed interchange could lower the demand at the Irwin Interchange.

## 6.4 SR 981 Access

New cashless tolling access appears to be feasible. The estimated cost for the SR 981 New Access Concept Alternative shown in this report is $19.6 million. Estimated Year 2035 AWDT ramp volumes are in the range of 1,500 to 5,800 vehicles/day.

Improvements to SR 981 in conjunction with this interchange have not been included for this study. PennDOT District 12-0 is conducting a study as part of the Laurel Valley Transportation Improvement Project (LVTIP) to evaluate improvements to the SR 981 Corridor from SR 119, southwest of the Turnpike, north to SR 30 for approximately 14 miles. The PennDOT study will consider improvements to the SR 981 Corridor, which will include consideration of additional traffic volumes on SR 981 resulting from the potential construction of a cashless tolling interchange at SR 981. . Working with District 12-0, the 12 Year funding program projects a budget need of approximately $80 million for the LVTIP.