ROUTE 28 CORRIDOR STUDY

FROM KITTANNING TO I-80

# TECHNICAL APPENDICES

*November 2020*

Prepared by: McCORMICK TAYLOR

Prepared for: SOUTHWESTERN PENNSYLVANIA COMMISSION SPC

# Appendices

A. Steering Committee Meeting Minutes

B. Public Comments Received

C. Online Mapping Survey Questions

D. Public Concern Map

E. Stakeholder Meeting Minutes

F. Existing Conditions Report

G. Intersection Level of Service 2019 AM/PM and 2045 AM/PM

H. Route 28 Design Criteria

I. SPC Funding Program

# APPENDIX A
## Steering Committee Meeting Minutes

| | | | |
|---|---|---|---|
| ***Meeting:*** | Steering Committee Kickoff Meeting | ***Date:*** | December 5, 2019 |
| ***Location:*** | Armstrong County Planning and Development Office | ***Time:*** | 12:30pm to 2:30pm |
| ***Attendees:*** | See attached sign-in sheet | | |
| ***Purpose:*** | The purpose of the meeting was to kick-off the Route 28 Corridor Study Project. | | |

***Discussion:*** The project kick-off meeting was held to discuss the Route 28 Corridor Study development, community outreach, initial goals and concern areas, and project schedule. John Petulla, consultant Project Manager began the meeting by welcoming the meeting attendees. Each Steering Committee member introduced themselves and provided the organization they represent. Each member was provided a packet with project related materials.

1) Mr. Petulla continued the presentation by reviewing the study area map. The study area includes Route 28 from Kittanning to Interstate 80 near Brookville. An overall study area map was provided in the packet and shown on a large format board at the front of the room for review. The attendees were asked to provide feedback or comments on the map. The map will be used throughout the study as the basis for displaying technical and non-technical information and the results displayed within the final report. Amy Kessler commented that the insets should be labeled, and the orange leader lines blend in with the yellow background. McCormick Taylor will adjust the map for subsequent versions. Additional feedback regarding the study area map was encouraged to be provided after the meeting via email.

   The meeting continued with a small group exercise to discuss the draft project goals. Based upon initial study observations by the project team, the study team developed and presented the following draft goals:

   - Increase Safety
   - Support Economic Development
   - Accommodate Mulitimodal Use
   - Reduce Congestion
   - Facilitate Freight Movement
   - Improve Quality of Life

   The attendees were split into the following three groups:

   Group 1: Josh Spano, Lillian Gabreski, Kristi Amato, Dave Tomaswick, John Petulla

   Group 2: Tim Jablunovsky, Domenic D'Andrea, Jamie Lefever, Travis Siegel, Melissa Thomas

   Group 3: Ryan Gordon, Darren Alviano, Amy Kessler, Ashley Tracy

   The Steering Committee was asked to provide input on the draft goals and/or add to the list as needed. Discussion related to the draft goals included the following:

   - **Improve Safety** – for all modes of transportation (trucks, cars, trail, pedestrians and cyclists). General safety and specific safety improvements related to the roadway is a high priority throughout the corridor.
   - **Support Regional Economic Development** – freight and trade along the Route 28 corridor is likely a key part of economic importance of the corridor. The value of the cargo moving along the Route 28 Corridor should be compared to the overall gross domestic product (GDP) for Pennsylvania as a potential economic performance measure of cargo moving through the corridor. Wayfinding signage for Route 28 from I-80 and from Pittsburgh is limited, and that affects tourism as well. Consider the larger businesses currently in the corridor and how improvements may impact them.
   - **Accommodate Multimodal Use** – there are needs at existing trail crossings. There are potential pedestrian improvements needed in New Bethlehem. Consider potential new trail opportunities along the corridor.

- **Reduce Congestion / Improve Operations –** congestion is a lower priority as the corridor is not traditionally congested. Recommendations may include climbing lanes, passing lanes, signals, which would improve general operation of the corridor. Crashes on I-80 resulting in traffic using Route 28 as a detour route can result in secondary roads being gridlocked for hours as traffic diverts around I-80. Due to the frequency of crashes on I-80, consideration should be given to better notify drivers of congested secondary routes and potential choices before roadways become over saturated with vehicles. During an incident on I-80 resulting in a detour on Route 28, common congestion points and temporary or permanent solutions to reduce bottlenecks and improve emergency response times should be considered. In addition, the potential impact along the Route 28 corridor if I-80 becomes a toll road in the future was discussed. Providing reliable travel times for current businesses and residents, regional travel, and emergency response times was noted as being an important consideration.
- **Facilitate Freight Movement / Regional Connectivity –** it was noted freight movement is directly correlated to economic development. Consideration should be given to inadequate turning radii and making the first and last mile connections for delivery of freight. For instance, in New Bethlehem trucks park along Route 28 and block lanes of traffic to service the businesses. There are also areas where trucks park on the corridor overnight, which points to a need for truck parking in the corridor.
- **Environmental / Quality of Life –** the term "quality of life" needs to be better qualified. Environmental considerations may include improved stormwater infrastructure, identifying food deserts, and improving access for trail connections and access to public resources. Quality of life will be influenced by the ability to achieve the other goals such as safety, reliability, and supporting accessibility for all modes.
- **Resiliency / Reliability –** the corridor needs to consistently support roadway users to provide reliable travel times for typical traffic and to better accommodate road closures and emergency detour routes.
- **Tourism –** this was added as it is a federal planning factor. Route 28 corridor serves traffic to the south to Pittsburgh, as well as traffic to the north to Allegheny National Forest, Punxsutawney, trails and rivers outside the study area, and the Oil Heritage region. Armstrong County and Kittanning have a lot of historical sites, which could be better marketed.
- **Security –** this was added as it is a federal planning factor. This may include emergency vehicle travel times, and the status of critical assets such as bridges and highways. The hospital location on the corridor and service area access should be considered. There are not many appropriate helicopter landing spots on the corridor. The Pennsylvania State Police Barracks is in Kittanning and coverage area expands into several communities along the corridor. It was noted Volunteer Fire Departments are struggling to recruit members and keep up their funding, and reluctant to combine services with other departments. The fire department coverage along the corridor is not ideal.
- **Asset Preservation –** we need to consider asset management of key roadway features along the corridor and planning to maintain a good state of repair.
- **Community Buy-in/Satisfaction –** community support of the study and proposed improvements is important. We need to balance community needs with regional needs. This may include reducing impacts to communities during construction. Communities may not want to attract additional regional traffic, though some may not want traffic diverted away from the corridor that potentially could take away business. The study should consider the community support behind each project. Community outreach will also be key for the public to understand and be able to provide input on the study as well as proposed future projects along the corridor.

2) Melissa Thomas, consultant Assistant Project Manager reviewed the project team's approach to public involvement. A project logo was developed for the corridor study with SPC's input and presented to the Steering Committee. The proposed website address is www.Route28CorridorStudy.com. The official project email address to send out correspondence and provide responses to feedback and questions is Route28CorridorStudy@mccormicktaylor.com.

The website is anticipated to include 4 main pages consisting of:

- About the Study
- Corridor Details
- Public Outreach
- Study Outcomes

The Route 28 Corridor Study website will host the Wiki-Map under the Public Outreach section. The Public Outreach section will allow users to comment on the study as well as pinpoint areas of concern along the corridor. Website display options are currently in the development process. Similar to the Route 28 Corridor Study logo, the draft website options will be sent to the Steering Committee for comment prior to implementation. The draft questions for the public on the Wiki-Map will be customized to the corridor. A sample of the draft user questions are attached to this summary for review and comments. It was discussed to make the website more public friendly, the project team may want to consider a story map imbedded on the website to better display study results.

McCormick Taylor anticipates collaborating with the Stakeholders to help inform the public of the Route 28 Study and ask for public input on the Wiki-Map section of the website. Members of the Steering committee suggested contacting the various active Chambers of Commerce located along the corridor including but not limited to Armstrong County, New Bethlehem, and Brookville. It was advised that the Chambers of Commerce could provide specific input on the website and the help distribute information obtain additional public input from their communities. McCormick Taylor will provide hard copies of the final questions for users who may not wish to complete the survey online. McCormick Taylor will discuss this option with the stakeholders further after the website is developed.

Domenic D'Andrea asked if McCormick Taylor has a social media plan for the study like Twitter, Facebook, etc. Ms. Tracy stated it was not scoped as part of the outreach, but that a social media platform could be considered for public outreach. Mr. D'Andrea mentioned they successfully used Streetlight data for the Second Avenue Study to get a list of zip codes of people who traverse the corridor, and sent targeted advertisements to those people on Facebook. Ms. Tracy asked if Mr. D'Andrea knew what the cost of the targeted ads was, and Mr. D'Andrea said that it was about $50. Mr. Petulla agreed the application this collection of information may work well to gain information and target users to gain input on the Route 28 Corridor.

Interviews of key stakeholders along the corridor to obtain a better understanding of the corridor needs and potential areas of improvements were discussed. The project team requested the Steering Committee provide feedback on potential stakeholders to be interviewed. A request will be made via email by the project team for this information after the meeting.

Ms. Kessler stated that the North Central's Public Participation Plan (PPP) does not allow meetings past 5pm as there is no transit available to the public after that time. McCormick Taylor will review the PPP for each MPO/ RPO to determine the required outreach time frames and tailor the outreach to fit that. Ms. Lefever suggested that we should look at when the Chambers of Commerce have their meetings and try to do this as part of a regularly scheduled meeting, or back-to-back with one.

3) Ashley Tracy, consultant Traffic Lead, discussed traffic data collected to date. Data collection includes turning movement counts (TMC) and twenty-four hour automated traffic recorder (ATR) counts at key locations provided by SPC in the scope of services. Mr. Spano and Mr. Gordon mentioned that it would be possible to supplement the count data with Streetlight data. A comparison will be made between the TMC data obtained and the Streetlight data to verify the reliability of Streetlight count information before being incorporated into the study. Mr. D'Andrea mentioned the study team should review the Regional Operations Plans (ROP) to ensure the analysis is consistent with the respective plans.

INRIX data has been transferred from SPC to McCormick Taylor, which should give us a sense of travel times during the off-peak and peak directions. McCormick Taylor performed a preliminary crash history analysis and showed how the fatal and hit fixed object crash analysis may highlight areas for further consideration during field views. There was discussion of whether these crash maps would be shown on the study website. PennDOT indicated that have to be careful about the specifics of crash data and the language we use that will be displayed on the Route 28 website. Mr. D'Andrea stated it should be permitted to show a general crash area map with the specific crash information removed.

Signal permit plans were provided from PennDOT District 10 to McCormick Taylor to be used in the Synchro analysis of the existing and future conditions which will be completed in the next few months. Upcoming work on the data collection includes developing the data collection plan, analyzing the Streetlight data, and performing existing and future traffic analyses. SPC and Western PA Regional Operations Plans will be incorporated as well.

4) Mr. Petulla directed the Steering Committee back into their working groups for the second group activity of the meeting. This activity asked the participants to mark up the provided corridor map with initial areas of concern. The initial areas of concern discussed during the meeting were not prioritized:

- **Route 422 at Rt 28 –** interchange upgrade for additional capacity, potential for economic development.
- **Route 85 at Rt 28 –** economic development opportunity nearby, there is a 60-acre site for sale by the county.
- **Route 66 and Route 28 -** turning radii difficult to navigate.
- **Route 28 and SR 1018 –** intersection with sight distance issues.
- **Selker Curve –** sharp horizontal curve that may be a safety concern.
- **Mayport Curve -** sharp horizontal curve that may be a safety concern.
- **Baxter Curve -** sharp horizontal curve that may be a safety concern.
- **Fish Basket –** trail crossing, pedestrian & bicycle safety area that improvement options should be considered.
- **Hays Run –** structure replacement and widening project currently programmed. May need additional upgrades adjacent to the project area in the future.
- **Sight Distance –** potential for coordination with utilities through the corridor for tree trimming where warranted to improve sight distance.
- **General –** truck climbing lanes and passing lanes where warranted. Slow trucks can delay travel time through the corridor by at least 30 minutes.
- **General -** guiderail applications, centerline and shoulder rumble strip applications, and shoulder width should be applied consistently per PennDOT design criteria through the corridor.
- **General –** deer crossings or accidents involving deer through the corridor.
- **General –** intermittent roadway flooding. Mr. Gordon and Ms. Kessler have dates of flooding events when Route 28 has been closed. Ms. Lefever mentioned a few flooded locations between New Bethlehem and Brookville. McCormick Taylor will attempt to obtain photos of the mentioned locations and consult PennDOT Maintenance for additional information on areas of flooding concern.
- **General –** emergency access and service times, especially related to the various volunteer fire department access along the corridor.
- **General –** applications of Streetlight data to support analysis and decisions for the Route 28 Corridor Study. Streetlight data may provide an avenue for innovative uses – i.e. target Facebook ads to the survey and public meetings, gain insight on travel patterns on specific days of incidents when I-80 is detoured, or if Route 28 is detoured. Streetlight has the potential to capture car and truck travel times, travel time reliability, limited multimodal travel, the estimated value of commercial goods traveling on the road. SPC expanded their license to have access to obtain Streetlight data along the Route 28 Corridor within Clarion and Jefferson Counties within the study area. This will enable the study team to be able to provide a consistent analysis of Streetlight data throughout the study area.
- **General –** potential to evaluate practicality of high friction pavement along sharp curves, microsurfacing, shoulder width in the corridor.

Additionally, Mr. Tomaswick provided a list of potential improvement recommendation locations from District 10 Safety Coordinator William Rankin, PennDOT District 10 (see attached list).

5) The following is a list of next steps discussed during the meeting:

| **Follow-Ups** | | | |
|---|---|---|---|
| **Follow-up item** | **Responsible party** | **Anticipated completion** | **Actual Completion** |
| Provide Draft Wiki-Map survey questions for Steering Committee review. | McCormick Taylor | December 2019 | |
| Develop pilot webpages | McCormick Taylor | January 2020 | |
| Streetlight Data provided to McCormick Taylor | SPC | January 2020 | |
| Analyze collected Traffic Data obtained from French Engineering | McCormick Taylor | January 2020 | |
| Obtain Public Participation Plan (PPP) for each MPO/RPO involved to determine required outreach. Determine active Chambers of Commerce along the corridor and dates of next upcoming meetings. | McCormick Taylor. | January 2020 | |
| Provide list of Stakeholder to be interviewed. | Steering Committee | January 2020 | |
| Conference Call to discuss Pilot Website and Stakeholder Interviews to be scheduled. | McCormick Taylor/ Steering Committee | January 2020 | |

The meeting was adjourned at approximately 2:25 p.m. by thanking the committee for their feedback during this meeting and throughout the study.

Prepared by:

***McCORMICK TAYLOR, INC.***

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

PennDOT District 10 - Corridor Safety Concerns List

Draft Wiki Map Survey Questions

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

# Steering Committee Meeting #1

December 5, 2019

| Name | Organization | Address | Phone | E-Mail |
|---|---|---|---|---|
| 1. Josh Spano | SPC | Two Chatham Center | 412-391-5590 | jspano@spcregion.org |
| 2. Dom D'Andrea | SPC | Two Chatham Ctr 112 Washington Pl., Suite 500, Pgh 15219-3451 | 412-391-5590 x-341 | ddandrea@spcregion.org |
| 3. Ryan Gordon | SPC | " | // x333 | rgordon@spcregion.org |
| 4. Kristi Amato | Clarion County | 330 Main St; Room 12 Clarion, PA 16214 | 814-226-4000 ext. 2800 | Kamato@co.clarion.pa.us |
| 5. Jamie Lefever | Jefferson Cd | 155 MAIN ST Brookville PA 15825 | 814 849 1517 | Jlefever@jeffersoncountypa.com |
| 6. Darin Alviano | Armstrong County | 402 market Street Kittanning | 724-548-3223 | ddalviano@co.armstrong.pa.us |
| 7. Lillian Gabreski | SPC | Two Chatham Center | 412-391-5590 x327 | lgabreski@spcregion.org |
| 8. Travis Siegel | NW RPO | 395 Seneca Street Oil City, PA 16301 | 814.677.4800 x123 | traviss@northwestpa.org |
| 9. Amy Kessler | NC RPO | 49 Ridgmont Dr Ridgway, PA 15853 | 814 773.3162 | Amy@ncentral.com |
| 10. Dave Tomaswick | PENNDOT TRAFFIC | 2550 OAKLAND AVENUE INDIANA PA | 724 357 2845 | DTOMASWICK@PA.GOV |
| 11. Tim Jablunovsky | PENNDOT DESIGN | 2550 OAKLAND AVE INDIANA PA 15701 | 724-357-2874 | TJABLUNOVS@PA.GOV |
| 12. | | | | |

## Tomaswick, David P

**From:** Rankin, William
**Sent:** Wednesday, December 4, 2019 10:02 AM
**To:** Tomaswick, David P
**Subject:** SR28

Sight distance at:

- 10-1 Sloan Hill Rd.
- 10-1 Oscar Rd. (SR1035)
- 10-1 Calhoun School Rd. (SR1016)
- 10-1 Tipple Rd.
- 10-3 Oak Ridge Rd. (SR2019)
- 10-5 Mendenhall Rd. (SR3035

The approach off of:

- 10-1 Oscar Rd. (SR1035)
- 10-1 Putneyville Rd. (SR839)
- 10-5 Seldom Seen Rd.
- 10-5 Snyder Rd.

Turning lane needed at:

- 10-1 SR1018 SB

The curves at:

- 10-1 SR1018
- 10-1 hogback area
- 10-1 South Bethlehem – (kohlersburg Rd)
- 10-3 Alcola – (TR-921)
- 10-5 Snyder Rd.

Speeding areas:

- Shannondale

**Route 28 Corridor Study**
**Wiki-map Survey Questions**
*Draft 12.30.19*

ADD A POINT

1. Select a point type* and then place on map.
   - Travelling via a car
   - Travelling via bike
   - Travelling via walking
   - Travelling via truck/freight vehicle

2. I use this area for: (Select all that apply)
   - Local commuting (Less than 40 miles each way)
   - Regional commuting (More than 40 miles each way)
   - Business travel (Deliveries, moving freight, etc.)
   - Accessing government services
   - Accessing Redbank Valley Trail
   - Accessing local schools
   - Accessing stores, services, goods, healthcare
   - Accessing recreational opportunities

3. How frequently do you use this facility?
   - Daily
   - Weekly
   - Monthly

4. What about this location causes you concerns? [CARS]
   - Pedestrians in the roadway
   - Cyclists in the roadway
   - Excessive vehicle speed
   - Slow trucks cause delays
   - General congestion
   - Stopping or turning vehicles
   - Lack of connectivity
   - Other (open-ended)

5. What about this location causes you concerns? [BIKES]
   - No shoulder
   - Shoulder is too narrow
   - Poor shoulder condition
   - Travel lanes need to be swept
   - Lack of bike lane
   - Lack of protected bike lane
   - Travel lanes are too narrow
   - Drainage grates make facility unusable or hazardous

*Each point type receives a different list of concerns (#4-7)

- Vehicles are going too fast
- Too many large trucks
- Lack of enforcement
- Lack of connectivity to transit facilities
- Other (open-ended)

6. What about this location causes you concerns? [FREIGHT]
    - Pedestrians in the roadway
    - Cyclists in the roadway
    - Excessive vehicle speed
    - Grades are too steep
    - No climbing lane on steep grade
    - Travel lanes are too narrow
    - Intersection too narrow to safely turn
    - General congestion
    - Stopping or turning vehicles
    - Lack of connectivity
    - Other (open-ended)

7. What about this location causes you concerns? [WALKING]
    - Sidewalk ends/no sidewalk
    - Sidewalk condition
    - No shoulder
    - Shoulder is too narrow
    - Poor shoulder condition
    - Drainage grates make facility unusable or hazardous
    - Excessive vehicle speed
    - No crosswalk
    - Vehicles don’t stop for pedestrians in crosswalks
    - Sidewalk not Americans with Disabilities Act (ADA) compliant
    - Lack of enforcement
    - Other (open-ended)

8. What improvements would you suggest for this location? (open-ended)

9. Do you have a photo of this area of concern for us to consider? Please upload it here.

10. Is there any other information you would like us to know about the Route 28 corridor? (open-ended)

*Each point type receives a different list of concerns (#4-7)

**Subject**: Steering Committee Coordination Call

**Date**: Friday 1/24/2020; 1:00 pm to 2 pm

**Location**: Conference Call

John Petulla, McCormick Taylor, began the meeting by welcoming all those who called in and asking for each to introduce themselves. The list of all in attendance can be found at the end of this summary.

**Study Goal Review & Discussion**
Mr. Petulla then reviewed the Study Goals which were refined after the Steering Committee Kick-off Meeting held in December 2019. No additional changes or additions were discussed, and the refined Study Goals and associated guiding principles are:

- ✓ **Improve Safety -** Improve safety for all modes of transportation
  - Improve Security – Improve security by maintaining critical assets like bridges and reducing emergency response times
- ✓ **Support Regional Economic Development** – Improve access to existing business and attract new businesses with an improved and efficient regional trade route between I-80 and Pittsburgh
  - Promote Tourism – Facilitate access to historic locations, trails, and outdoors activities
- ✓ **Facilitate Regional Connectivity** – Facilitate connections to other regional transportation facilities and systems
  - Accommodate Multimodal Use – Improve existing and plan for new multimodal connections to non-motorized facilities
  - Accommodate Freight Movement – Facilitate and improve access for freight and trucks
- ✓ **Improve Operations** – Improve operations and reduce congestion
  - Improve Resiliency/Reliability – Provide reliable travel times for all users
  - Focus on Asset Preservation – Maintain a good state of repair of bridges, guide rail, signs, drainage, slopes, lighting, and pavement
- ✓ **Minimize Impacts** – Minimize impacts to the environment and community
  - Improve Quality of Life – Improve quality of life by providing access to a safe and efficient transportation system and public resources
  - Gain Community Buy-in/Satisfaction – promote projects that have broad community support and meet the study's goals, and minimize impacts to the traveling public during construction

**Website and Wikimap Survey Draft**
Jennifer Threats, McCormick Taylor, then discussed the public outreach efforts that will be used to promote the Study in the region.

The McCormick Taylor team developed a Wikimap online mapping survey to collect input from the general public about specific areas of concern along the corridor. The team anticipates that the mapping survey will be ready to launch during the week of February 3 and remain open through the week of March 2. The survey is available for review at:
https://wikimapping.com/Route-28-Corridor-Study-Kittanning-to-I-80.html

A few comments and suggestions for the Wikimap survey were discussed:

- The map is mobile friendly and the survey feature is also functional on mobile devices.
- The current draft of the survey only allows for comments within the study boundary, but all in attendance agreed that viewers should be able to place points on all areas of the map. This will be adjusted before the map is circulated for further Steering Committee review.
- There is no character limit in the paragraph survey fields, so there should not be a risk of cutting off a response due to lack of space.

The other web-based public outreach tool is a study website, currently in development. The website will be launched at the same time as the Wikimap survey and will be available at: www.Route28CorridorStudy.com. The link to the test website will be shared with the Steering Committee members on January 27 or 28 for testing and review.

A press release and email blast will announce the launch of the website and Wikimap survey. The McCormick Taylor team will distribute the email blast to the Steering Committee who are encouraged to share it with their own connections. Social media graphics and text will also be developed for use by Steering Committee members on their organizations' social media accounts. Mr. Petulla asked the representatives from PennDOT District 10 if they would ask the Community Relations Coordinator to distribute the press release to their usual media contacts as well. He will send the draft press release to Tim Jablunovsky and Dave Tomaswick who will discuss with the Community Relations Coordinator.

**Stakeholder Outreach**

The study team will also conduct interviews with key stakeholders along the corridor. The Steering Committee provided names and contact information for several organizations and individuals who will be invited to participate. The current list of stakeholders will be shared with the committee to fill in any missing information or add additional contacts. Jamie Lefever, Jefferson County, mentioned that she will also reach out to any stakeholders within her contact network to encourage them to participate in the interviews. All agreed that this was a good approach for others on the committee to take.

Ms. Threats reviewed the draft Stakeholder Interview Plan with the committee, including potential locations for the interviews. The committee suggested additional locations, and the team will investigate the availability. The interviews will be tentatively held during the week of February 17 or 24, pending availability of the locations and the team members and committee members who will be attending.

A draft interview form was drafted to guide the discussion at the interviews. Ryan Gordon, Southwestern Pennsylvania Commission (SPC), suggested beginning with a short discussion of the locations with known safety or similar concerns to spark the discussion.

**Other Study Updates**

The McCormick Taylor team is continuing to review previous studies and plans related to the Route 28 Corridor for consideration during the study.

Traffic data collection is complete, including Synchro software analysis at all of the intersections. Highway Capacity Software (HCS) analysis will be completed next, and it may show more congestion that the Synchro analysis has so far. The McCormick Taylor team is coordinating with SPC to secure data from the Streetlight transportation analytics platform. All field work is also completed.

The next steps in traffic data analysis will include Synchro and HCS data for the future year, and the study team will need additional information from the Steering Committee regarding known planned development to come to an estimated growth rate to make those projections.

**Next Steps**
The Study Team will work toward the following milestones in the coming months:

- Public survey and website launch – early February – early March 2020
- Stakeholder interviews – late February 2020
- Existing conditions memo – March 2020
- Steering Committee call/meeting – mid-March 2020

**Resulting Action Items**

- John Petulla will send the draft press release to Dave Tomaswick and Tim Jablunovsky to share with the Community Relations Coordinator.
- Ryan Gordon, SPC, will distribute all materials discussed at the meeting for review and feedback from the committee:
    - Draft press release
    - Draft announcement email blast
    - Draft Stakeholder Interview plan
    - Draft Stakeholder Interview form
    - Potential Stakeholder Interview invitation list
    - Website
    - Wikimap survey

**Attendee List:**

| | |
|---|---|
| Darin Alviano | Armstrong County |
| Kristi Amato | Clarion County |
| Jamie Lefever | Jefferson County |
| Amy Kessler | North Central PA Regional Planning and Development Commission |
| Tim Jablunovsky | PennDOT District 10 |
| Dave Tomaswick | PennDOT District 10 |
| Dom D'Andrea | SPC |
| Ryan Gordon | SPC |
| Josh Spano | SPC |
| Andy Waple | SPC |
| Carrie Machuga | McCormick Taylor |
| John Petulla | McCormick Taylor |
| Melissa Thomas | McCormick Taylor |
| Jennifer Threats | McCormick Taylor |
| Ashley Tracy | McCormick Taylor |

*Meeting:* Steering Committee Meeting #3 — *Date:* April 28, 2020

*Location:* Conference Call — *Time:* 10:00am – 12:00pm

*Attendees:*

*Steering Committee:*

| | |
|---|---|
| Darin Alviano | Armstrong County |
| Kristi Amato | Clarion County |
| Jamie Lefever | Jefferson County |
| Amy Kessler | Northcentral RPO |
| Travis Siegel | Northwest RPO |
| Dave Tomaswick | PennDOT District 10 |
| Tim Jablunovsky | PennDOT District 10 |
| Lillian Gabreski | Southwestern Pennsylvania Commission |
| Josh Spano | Southwestern Pennsylvania Commission |
| Domenic D'Andrea | Southwestern Pennsylvania Commission |
| Ryan Gordon | Southwestern Pennsylvania Commission |

*McCormick Taylor Study Team:*

John Petulla
Ashley Tracy
Melissa Thomas
Jennifer Threats
Carrie Machuga

*Purpose:*
The purpose of the meeting was to review the initial draft Existing Conditions Report and related findings.

*Discussion:*
The third Steering Committee meeting was held to discuss the Route 28 Corridor Study work completed to date and related findings which are documented in the draft Existing Conditions Report. John Petulla, consultant Study Project Manager began the meeting by welcoming the meeting attendees. Each Steering Committee member introduced themselves and provided the organization they represent. In advance of the meeting, the Committee received the meeting agenda, the draft Existing Conditions Report and the draft Concerns Evaluation Matrix.

*Progress to Date – Existing Conditions Report Overview*
Ashley Tracy, Study Traffic Lead, reviewed the Existing Conditions Report and related data collection. She reviewed the conditions identified in the field analysis, which was conducted in January 2020. The examined areas were identified by the Steering Committee or through desktop research prior to field work, including locations with limited sight distance due to the horizontal and vertical curvature of the roadway or locations of tight geometry that are difficult for large vehicles to navigate. Speed differentials were noticeable, with a spectrum ranging from speeding in excess of the 55mph posted speed limit, aggressive passing behavior, and vehicles traveling 10-15mph below the speed limit.

Ms. Tracy also reviewed the information collected during Stakeholder Interviews in late February. The Steering Committee identified key stakeholders including county commissioners, municipal leaders, business owners, freight haulers, school district staff, emergency service providers, and state police. Seventeen (17) organizations participated in the interviews and provided valuable local insight and input to the study.

She then reviewed the data received from the Streetlight "big-data" platform. Streetlight provides roadway analytics from anonymized Bluetooth and cellular device information which can be analyzed to examine travel behavior and traveler demographics. Access to the Streetlight data service was provided by the Southwestern Pennsylvania Commission's subscription in support of the Route 28 Corridor Study.

The data was analyzed to understand existing travel conditions on the Route 28 corridor, such as the lengths of trips. More than half of the trips on the corridor are over 60 minutes in duration, with a large number of trips over 150 minutes. This trip duration includes commercial vehicle traffic, which may have hauling routes along the corridor or destined northward to Forest, Elk or

Venango counties. Trip lengths correspond with the trip duration, with a majority of trips longer than 30 miles. More than half of the travel speeds are between 30 and 50mph, with approximately 15% traveling 50 to 70mph.

The study team reviewed the distribution of trips passing a point near the intersection of Route 28 and South Main Street in Brookville. It showed traffic coming from approximately Williamsport and Brookville in the east, from areas slightly north of the I-80 interchange such as Sigel and Brockway south through Kittanning and Pittsburgh. Approximately 15% of trips passing this point are destined to Kittanning, and approximately 4% of trips passing this intersection are destined to Pittsburgh. This finding shows that the corridor primarily serves demand to Kittanning and communities along the Route 28 corridor, rather than functioning currently as a regional through route.

Examining a Top Route from Pittsburgh to a point east of Brookville, Streetlight highlighted two main routes: the Route 28 corridor, and the I-79 to I-80 corridor. The Streetlight Index is a proportional approximation of traffic along the route. The Streetlight Index for the Route 28 corridor (80.6 miles, 1h 31m) is 65 versus an index of 26 for I-79 to I-80 (118 miles, 1h 50m). This means that Route 28 is approximately three times more popular than I-79 to I-80 for this trip. However, the team did not observe a significant amount of through traffic on this route because there is not significant demand between these two points (as outlined above).

Streetlight data was also used to identify additional characteristics of the corridor users:

- *Who does the Route 28 corridor serve?* Travelers on this 40-mile section of the Route 28 corridor primarily live and work in areas adjacent to the corridor to the east and west. The cluster of home locations stretches as far southwest as Pittsburgh, with a few isolated clusters focused primarily in places that are accessible via Route 28, I-80, I-79, US 422, and US 322 such as Youngstown, Erie, Altoona, and State College.
- *Where are people going on the Route 28 corridor, and at what levels of frequency?* The team used a point in the middle of the corridor to show all personal trips passing through this point on a weekday and their origins and destinations. The data showed a distinct diagonal pattern of trips that follows the corridor, with a large geographic catchment area in the northeast counties (Forest, Elk, Warren, McKean, Clearfield, Cameron) for Route 28 traffic destined to Kittanning and Pittsburgh, as well as hauling or tourist-related traffic for outdoors activities to the northeast counties.
- *How are people using the multimodal facilities on the corridor?* The Open Street Map alignment data for the Redbank Valley Trail and Armstrong County Trail were imported to understand bicycle and pedestrian usage of the trail system, including trail user demographics and trip characteristics. The largest proportion of trips on the corridor are 45-60 minutes in length, which reveals a tremendous benefit to public health in the communities that it serves.

Ms. Tracy also reviewed the information gleaned from INRIX data. INRIX is a data repository for historical congested travel speeds and travel times. SPC provided observed speed and travel time data for the corridor from INRIX. Speeding is a noted concern throughout the corridor. In areas like New Bethlehem, maximum speeds range from 35 to 40 mph in the posted 25 mph zone. Most segments in the corridor have maximum observed speeds trending above 55 mph, and on average, the maximum speeds for cars on the corridor is 57 mph. The average maximum speed for trucks on the corridor is 51 mph. This 6 mph speed differential is exacerbated on areas where there are significant grades. The longest segment of speed differential between cars and trucks is from approximately Goheenville to Distant (5 to 10 mph difference) over the area known locally as Hogback Hill. Field observations and GIS data noted areas of significant grade change in this area. Another segment with a high-speed differential between cars and trucks is coming into South Bethlehem around the 15 mph curve through New Bethlehem (10 to 15 mph difference).

INRIX historical speed data was also used to understand the range of influence and operational impact of I-80 detour traffic on the corridor. The team studied data related to an incident on August 8th, 2016 where I-80 was closed from around 2pm through the afternoon peak hours. Average observed speeds dropped at various points along the corridor during the closure, first and most noticeably at the intersection with Route 322 close to the interchange and later and to a lesser extent as far south as Kittanning. This analysis supports that interstate closures can have widespread impacts on the corridor traffic operations. This in conjunction with detour route choice and signage, and travelers using personal devices to navigate off of I-80 create bottleneck conditions that are challenging for emergency responders, residents, and the traveling public.

Melissa Thomas, Study Highway Lead, discussed the team's review of previous and related studies. Seven (7) related documents were reviewed, including the most recent corridor feasibility study, State Route 28 Feasibility Study Kittanning to I-80 Armstrong, Clarion & Jefferson Counties, Pennsylvania, conducted by Michael Baker, International in June 1994.
This feasibility study examined Route 28 between Kittanning, PA and Interstate 80. The initial recommendation based on a Preliminary Location Study for State Route 28 completed by The Pennsylvania Department of Transportation in the 1960's was to

extend a 4 lane, limited access facility from Aspinwall to I-80. A portion of this was built in the 1970s and 1980s terminating in Kittanning, PA. This study examined the feasibility of continuing the 4-lane template from Kittanning to I-80. Ms. Thomas discussed the review of Michael Baker's cost estimate and how the estimate was escalated to 2020 dollars. While this estimate accounts for the construction cost, it does not take into account more stringent modern environmental regulations. In particular, regulations related to stormwater management, water quality treatment and the mitigation of protected environmental features. Accounting of this design, permitting, environmental and community impacts, construction, and future maintenance, presents potentially hidden costs which would place a further strain on initial design and construction costs and future PennDOT maintenance of the permitted stormwater and mitigation features.

Tim Jablunovsky, PennDOT District 10, asked about the construction engineering cost comparison. The team used the same 5% construction engineering cost that was cited in the 1994 study for the 2020 estimate. Mr. Jablunovsky requested the estimate to be updated using the current standard of 10%.

County and regional comprehensive plans were also reviewed for recommendations and future goals. Amy Kessler, Northcentral RPO, noted that the Northcentral and Northwest RPO Long Range Transportation Plans were not listed with the other related studies. The team will review both of those documents and add any findings to the Existing Conditions Report.

Ms. Thomas also reviewed the corridor geometric conditions. The team developed Design Criteria charts considering new construction following guidance found in PennDOT Publication 13M Design Manual Part 2 Highway Design. The design criteria data was used as a basis for comparison to the existing Route 28 Study Corridor roadway geometry and widths.

Existing horizontal radii through the corridor were weighted against the current design criteria. In examining the corridor, there are currently 18 notable areas with horizontal radii less than that current recommended design values. Speeds up to 40 MPH were limited to a maximum super elevation rate of 6%. For the higher speed limits 45 MPH & 55 MPH a slightly higher maximum super elevation rate of 8% is permitted with shoulder rounding.

Existing vertical grades vary throughout the corridor. Many sections have grades exceeding the desired current design maximum vertical grades of 5% (55 MPH) or 6% (up to 45 MPH). Excessive vertical grades not only make maintaining speeds difficult for larger truck traffic but also can limit sight distance for passing or entering roadways at intersections. In examining the corridor, there are 10 notable areas with vertical grades exceeding the current maximum design grade.

Jennifer Threats and Carrie Machuga, Study Public Involvement staff, reviewed the outreach conducted to collect feedback from the general public. In order to collect broad public input on the current conditions of the Route 28 Corridor from Kittanning to I-80, the study team utilized an online WikiMap survey. The survey was available at https://wikimapping.com/Route-28-Corridor-Study-Kittanning-to-I-80.html from Friday, February 7 through Friday, March 6, 2020. The Steering Committee member organizations promoted the survey through a press release, emails, and social media. Direct links to the mapping survey were also available on the study website (www.Route28CorridorStudy.com).

The interactive map allowed users to place points on a map of the corridor to identify areas of concern or opportunities for improvement related to vehicular, freight, bicycle, and pedestrian traffic. Each mode included targeted survey questions to collect specific details about the concern or opportunity.

During the course of the survey period, 305 total points were placed by 151 unique users. A majority (269) of points were related to vehicular traffic. Nineteen (19) were related to freight; ten (10) related to pedestrians; and seven (7) related to bicycles.

The survey points revealed common areas of concern, some of which were corridor-wide. Areas of concern were summarized into 31 unique locations. In each survey by travel mode, the public was prompted to select from several options for "What about this location causes you concern?" While each mode varied slightly in the options, the most common concerns were roadway safety; vehicle speeds, slow moving vehicles, intersection sight distance, and visibility of pedestrians and bicycles on the roadway.

Mr. Petulla then reviewed the Study Concern Matrix, which collected the concern locations that were documented in all aspects of data collection and studies. Thirty-eight (38) locations were listed in the matrix, and the Study Team indicated in columns across the matrix how the location was identified as a concern. These included previous studies, stakeholder interviews, public surveys, field observations, horizontal curvature, vertical grade, crash history, and existing operations. The team then noted the number of times the location was found to prioritize these concern areas. Locations that were found in five or more data collection points were listed as High Priority. All others were listed as Moderate.

The team requested feedback from the Steering Committee within two weeks regarding the methodology for identifying these locations, whether they agree with the draft prioritization as presented, or if there are additional locations that should be considered higher priority.

Mr. Petulla then opened the meeting for discussion. The following questions or comments were discussed:

- The Committee requested a map of all locations on the Study Concern Matrix to provide a more visual context of each concern location.
- The Committee asked whether public input from other surveys and studies had been included. To this point, that input had not been considered, but the team will review the following for public concerns related to the corridor:
  - State Transportation Commission Twelve Year Program Updates in 2017 and 2019
  - North Central and Northwest RPOs' recent Long Range Transportation Plan updates
  - North Central RPO Safety Plan
- The Committee also noted that PennDOT Central Office has recently updated the Highway Safety Manual and associated Highway Safety Network Screening which provides predicted crash data (not only observed) for various roadway types. This information may be helpful to identify potential or predicted safety concern locations in addition to the observed safety concern locations. SPC offered to provide access to this tool and data.
- The Committee asked what methodology was used to warrant a check in the crash % column of the matrix. Ashley indicated that anything that was higher than the statewide average was included.
- Dominic D'Andrea asked if the team reviewed the Highway Safety Predictive Model. Ashley indicated the model had not been considered, but the team will review moving forward.
- Amy Kessler mentioned the Freight Plan Survey noted a comment related to potential truck turning issues at the intersection of Main Street and Route 28 in Brookville and a curve on Route 28 between Seldom Seen Road and Coder Road that is very dangerous.

The following is a list of next steps discussed during the meeting:

| Follow-Ups | | | |
|---|---|---|---|
| Follow-up item | Responsible Party | Anticipated Completion | Actual Completion |
| Map all concern locations listed in matrix and provide to the Steering Committee | McCormick Taylor | 4/28 | 4/28 |
| Review additional public input from previous surveys/studies | McCormick Taylor | 5/1 | 4/29 |
| Review relevant corridor information from Northwest and Northcentral RPO LRTPs, Northcentral Safety Plan | McCormick Taylor | 5/8 | |
| Review Highway Safety Predictive Model | McCormick Taylor | 5/11 | 5/11 |
| Update the construction engineering cost assumption from 5% to 10% per Tim Jablunovsky | McCormick Taylor | 5/11 | 5/11 |
| Provide feedback on methodology and prioritization of concern areas | Steering Committee | 5/12 | |

The meeting was adjourned at approximately 12:00 p.m. by thanking the committee for their feedback during this meeting and throughout the study.

Prepared by:
*McCORMICK TAYLOR, INC.*

<u>Copies:</u>
Attendees
MT Project File

<u>Attachments:</u>
Study Concern Matrix
Draft Existing Conditions Report

*Meeting:* Steering Committee Meeting #4 *Date:* June 10, 2020

*Location:* Conference Call *Time:* 1:00pm – 2:30pm

*Attendees:*

| *Steering Committee:* | | *McCormick Taylor Study Team:* |
|---|---|---|
| Darin Alviano | Armstrong County | John Petulla |
| Kristi Amato | Clarion County | Melissa Thomas |
| Amy Kessler | Northcentral RPO | Jennifer Threats |
| Travis Siegel | Northwest RPO | Carrie Machuga |
| Dave Tomaswick | PennDOT District 10 | |
| Tim Jablunovsky | PennDOT District 10 | |
| Lillian Gabreski | Southwestern Pennsylvania Commission | |
| Josh Spano | Southwestern Pennsylvania Commission | |
| Domenic D'Andrea | Southwestern Pennsylvania Commission | |
| Ryan Gordon | Southwestern Pennsylvania Commission | |

*Purpose:*

The purpose of the meeting was to discuss the results of the Future Conditions Analysis, review the potential Improvement Concepts, and outline the next steps to draft and finalize the Study Report.

*Discussion:*

John Petulla, consultant Study Project Manager, began the meeting by welcoming all attendees and asking all Steering Committee members to introduce themselves. In advance of the meeting, the Steering Committee received the meeting agenda, draft final study report outline, draft improvement concept mapping, and the concern area matrix and mapping.

Mr. Petulla briefly reviewed the work done since the previous Steering Committee meeting, including updates to the concern area matrix. The team also reviewed additional studies as suggested by the committee and updated the matrix with some additional concerns found there. The matrix was updated to show the locations with higher occurrence across the various data collection and analysis sources.

The team mapped the concern areas from the matrix. Clusters of related improvements were found at the north and south ends of the corridor, with potential intersection improvements in the middle portions of the corridor. Mapping of crash data along the corridor in relation to these locations was also reviewed. High occurrences of hit-fixed-object crashes are consistent with narrow lanes along the corridor, and there was a high occurrence of head-on crashes at many horizontal curves throughout the study area.

Mr. Petulla also mentioned the Future Conditions analysis which the team has been developing. Historic growth trends were reviewed and revealed that more growth has been happening along the portions of Route 28 that have been upgraded to four lanes (1% growth rates) than in portions that are two lanes (¼– ½%). Working with SPC, the Study Team determined a ½% growth rate would be utilized to consider future traffic projections. Mr. Petulla concluded that, based on the overall future conditions analysis, the existing corridor does not appear to have any major capacity or congestion issues. Only one area showed a degraded level of service in the future projections – the area between Routes 1028 and 1035, just north of Kittanning. Most concerns identified were related to corridor operations and safety.

Melissa Thomas, Study Highway Lead, reviewed the draft improvement concepts developed to address the concerns identified along the corridor.

- Concern ID #6: Sloan Hill Road – Sloan Hill Road intersects Route 28 at a skew, which causes sight distance concerns. The draft improvement concept improves the turning radius and realigns the intersection to be more perpendicular to Route 28. The concept would also include wider shoulders and a grade adjustment.

- Concern ID #8: Near Oscar Road – This improvement concept would adjust the vertical grade over ¾ mile, which includes three crest curves and three sag curves. The concept includes several cuts and fills to achieve a smoother profile. This area has a high occurrence of hit-fixed-object crashes.
    - Tim Jablunovsky, PennDOT District 10, requested a profile be added for this concept.

- Concern ID #14: Madison and Kohlersburg Roads – This draft concept would reconfigure and better define this intersection where the two side roads approach Route 28. The concept would channelize the intersection to direct traffic through the intersection. This improvement would better define the intersection, remove pavement and add green space. Improving this intersection could also help with access management along the corridor. The study team also considered a roundabout design at this location; however, after a high-level benefit/cost analysis it was determined not feasible.

- Concern ID #25: Redbank Valley Trail Crossing – The trail currently crosses Route 28 at a steep diagonal in an area with vertical and horizontal curves. The improvement concept would realign the trail to run parallel to Route 28 between the roadway and the river to a perpendicular crossing at the intersection with Middle Run Road. Route 28 would be shifted slightly away from the river using roughly the same footprint of the current roadway and trail. Other countermeasures such as rectangular rapid flashing beacons, could also be used to alert drivers of the trail crossing and give trail users more visibility.

- Concern ID #29: Mayport Road – Mayport Road intersects Route 28 at a severe skew, causing sight distance concerns. The improvement concept would relocate the intersection south to a more perpendicular intersection with Route 28. The remainder of Mayport Road would end in a cul-de-sac. The relocated roadway would require a cut in order for Mayport Road to meet Route 28 with an eight-percent grade.

- Concern ID #33: Near Moore Road – The curve in this area is substandard, and the conceptual improvement would flatten the curve and reduce the grade.

- Concern ID #35: Seldom Seen Road and Seneca Trail (T396) – This improvement concept would flatten the curve near this intersection.

Following the discussion of the draft improvement concepts, the Steering Committee offered the following comments and/or questions:

- Dave Tomaswick, PennDOT District 10, requested that the current posted speed limits be added to each of the draft improvement concept displays.
- Josh Spano, SPC, requested that the team be as specific as possible when listing additional low-cost improvements in the final report documents.

- Darin Alviano, Armstrong County, asked whether the speed limits would be made consistent throughout the corridor. The improvements would help make the roadway meet design criteria which will improve safety, but speed limits will still vary throughout the corridor.

Mr. Petulla then reviewed the draft outline for the final study report. The report will conclude with a mini-Transportation Improvement Program, or mini-TIP. Mr. Petulla and the committee discussed how the mini-TIP will be organized and what will be included. Improvement concepts will be included in the mini-TIP, including those that have not been developed in detail as those discussed in the meeting today. As suggested by Amy Kessler, Northcentral RPO, all possible funding sources will be listed, as appropriate in the mini-TIP. For example, the trail improvement may qualify for funding through the Department of Conservation and Natural Resources. She also suggested organizing the mini-TIP according to planning district.

Ms. Kessler also asked whether the report can show the cost estimate for continuing the four-lane template for the length of the corridor and why incremental improvements were determined more effective. Mr. Petulla noted that the Existing Conditions Report included the cost estimate for the four-lane improvement, both from the 1994 study and updated with 2020 costs, and the final report can give details about why that improvement would not be cost-effective.

Domenic D'Andrea (SPC) asked that the team provide some basic cost-benefit information on the conceptual improvements, and Mr. Alviano agreed that it would help show that these improvements provide the best 'bang for the buck'. The team will work to incorporate any safety improvement, crash reduction and travel time benefits as the concepts are further developed.

Mr. Jablunovsky asked whether the website will be updated when the report is complete. The Study Team agreed to share the final report on the website and with an email to the individuals who have subscribed to the study email update list. A press release will also be drafted to announce the completion of the study.

The Study Team and Steering Committee members agreed that each MPO/RPO will need to determine the best way to present the findings to their boards of directors, due to the lack of in-person meetings at this time. SPC and Study Team members will be available to attend meetings (virtual or in-person) as needed to discuss the final report.

Ryan Gordan, SPC, closed the discussion by noting that the report should focus on three inter-related pieces: the concern matrix, concern area mapping, and the mini-TIP. These items should be stylized to connect and summarize the study visually.

The meeting was adjourned at approximately 2:30 p.m. by thanking the committee for their input and discussion during the meeting and throughout the study. This will be the final Steering Committee meeting.

The following is a list of next steps discussed during the meeting:

| Follow-up item | Responsible party | Anticipated completion | Actual Completion |
|---|---|---|---|
| Add current posted speed limits to all concept maps | McCormick Taylor | 6/26 | |
| Provide a profile for Concept #8 | McCormick Taylor | 6/26 | |
| Organize mini-TIP by county | McCormick Taylor | 6/26 | |
| Create matrix (or similar) of funding sources to show which improvements may qualify for each | McCormick Taylor | 6/26 | |
| Provide benefit-cost analysis for concepts | McCormick Taylor | 6/26 | |
| Stylize/coordinate the matrix, concerns/concept mapping, and Mini-TIP | McCormick Taylor | 6/26 | |
| Update website with final report findings | McCormick Taylor | 7/17 | |

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Updated Concerns Matrix

Concerns Area Map

Crash Location Maps

Draft Improvement Concept Displays

Draft Final Report Outline

# APPENDIX B
## Public Comments Received

| lat | lng | Additional Comments | Feature ID | Feature Type | Feature Description | Created(DD/MM/YYYY) | Inputter ID | Inputter | Please describe the area of your opportunity/concern: | I use this area for: (Check all that apply) - | | | | | | | | | | How frequently do you use this facility? (Select one) | | | What about this location causes you concerns? (Check all that apply) - | | | | | | | | | | | | | | Do you have a photo of this area of concern for us to consider? Please upload it here. | Is there any other information you would like us to know about the Route 28 corridor? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Local commuting (Less than 10 miles each way) | Regional commuting (More than 10 miles each way) | Business Travel (Deliveries, moving freight, etc.) | Accessing government services | Accessing Redbank Valley Trail | Accessing local schools | Accessing stores, services, goods, healthcare | Accessing recreational opportunities | Other | If Other, please explain | Daily | Weekly | Monthly | Sidewalk ends/no sidewalk | Sidewalk condition | No shoulder | Pedestrian safety/visibility | Roadway safety | Shoulder condition | Drainage | Vehicle speeds | Proximity to large trucks/ vehicles | Crosswalk | Sidewalk not Americans with Disabilities Act (ADA) compliant | Connectivity | Aesthetics | Please explain your concern. | | |
| 41.004511 | -79.318246 | | 374402 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town and right in front of a school. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.00425 | -79.325312 | | 374423 | point | | 2/10/2020 | 273109 | | | X | | | | | | | | | | X | | | | | | X | | | | | | | | | | | | |
| 41.164685 | -79.097557 | | 374570 | point | | 2/10/2020 | 273163 | | heavy foot traffic along allegheny blvd. no sidewalks | X | | | | | | | | | | X | | | X | | | | | | | | | | | X | | | | |
| 41.166954 | -79.097581 | | 374578 | point | | 2/10/2020 | 273163 | | no sidewalks | X | | | | | | | | | | X | | | X | | | X | | | | | | X | | | | heavy foot traffic for people commuting to work or walking to businesses from truck stops. no sidewalks | | |
| 41.143364 | -79.146506 | | 380371 | point | | 2/15/2020 | 273780 | | | X | X | | | X | X | X | | | | | X | | | | | X | X | | | X | X | | | X | | ATV's cross roadway NO signage and is very unsafe. Safe crossing to be installed for proper line of sight. | | |
| 41.00425 | -79.325312 | | 374423 | point | | 2/19/2020 | 274174 | | The cross walks are there but vehicles almost never stop. I walk around new Bethlehem a lot in the summer months with my young children. The amount of times we wait for several cars before someone is kind enough to let us cross is unreal. | X | | | | X | X | X | X | | | | X | | | | | X | | | | X | | X | | | | | | |
| 41.003869 | -79.318113 | | 380537 | point | | 2/23/2020 | 273737 | | | | | | | | X | | | | | X | | | | | | X | | | | | | | | | | This is a school and yet route 28 is a MAIN ROUTE! | | Route 28 is the main road of this area. |
| 40.968999 | -79.35684 | | 380686 | point | | 2/26/2020 | 274730 | Guest | There is an icecream stand RIGHT along 28 there. People are constantly slowing down, pulling in and pulling out. A big truck coming either north or south on that road and there could be very bad accidents. Also, not even 200 yards North from the ice cream store is the entrance/exit to the new Dollar General. Cars, again, are slowing down for turning cars and crossing traffic. They say it was surveyed and there is enough viewing room to see oncoming southward cars. Yes, maybe if you are in a 'tall' vehicle but not a car. I can't tell you how many 'near misses' I've seen at both places. And there have also been accidents at both. DANGEROUS!!!!! Why wait till a life is lost to do something about it. | | | | | | | | X | | | X | | | | | | X | | | | X | X | | | | | I've explained it all on the first screen. | | There is the sharp turn in South Bethlehem that some large vehicles, trucks, aren't familiar with and it's very difficult to maneuver. The roads in South Bethlehem are narrow and aren't always accomodating or safe for all vehicles. |
| 40.820727 | -79.48808 | | 380690 | point | | 2/26/2020 | 274739 | | Two people killed in recent years crossing the highway from the motel to the Bench Racers store. | | | | | | | X | | | | X | | | X | | | X | | X | | X | | | | | | | | |
| 40.970179 | -79.35303 | | 380822 | point | | 2/29/2020 | 275059 | | Ice cream stand | | X | | | | | | | | | | | X | | | | | X | | | X | X | | | | | In summer there is lots of activity around this business,it's hard to get in and out of parking lot,almost got hit. | | |

| lat | lng | Additional Comments | Feature ID | Feature Type | Feature Description | Created (DD/MM/YYYY) | Inputter ID | Inputter | Please describe the area of your opportunity/concern: | I use this area for: (Check all that apply) - | | | | | | | | | | How frequently do you use this facility? (Select one) | | | What about this location causes you concerns? (Check all that apply) | | | | | | | | | | | | | | Do you have a photo of this area of concern for us to consider? Please upload it here. | Is there any other information you would like us to know about the Route 28 corridor? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Local commuting (Less than 40 miles each way) | Regional commuting (More than 40 miles each way) | Business Travel (Deliveries, moving freight, etc.) | Accessing government services | Accessing Redbank Valley Trail | Accessing local schools | Accessing stores, services, goods, healthcare | Accessing recreational opportunities | Other | If Other, please explain | Daily | Weekly | Monthly | No shoulder | Shoulder is too narrow | Poor shoulder condition | Debris | Lack of bike lane | Lack of protected bike lane | Travel lanes are too narrow | Drainage | Vehicle speeds | Proximity to large truck/ vehicles | Roadway safety | Connectivity to regional trail system | Aesthetics | Please explain your concern. | | |
| 40.98956 | -79.3447 | | 374401 | point | | 2/8/2020 | 272976 | Guest | Add a bike trailhead in this location. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.01324 | -79.3045 | | 374573 | point | | 2/10/2020 | 273163 | | bicycle crossing for rails to trails | X | | | | | | | | | | X | | | | | | | | | | | X | | X | | | crossing for rails to trails | | |
| 41.00043 | -79.3342 | | 380523 | | | 2/22/2020 | 274433 | | Needs safe way for bicycles to cross 28 at fish basket crossing on Redbank valley trail. | | | | | X | | | | | | | | X | | | | | | X | | | | | | X | | | | |
| 41.0146 | -79.3009 | | 380709 | | | 2/26/2020 | 274763 | | | | | | | X | | | | | | | | X | | | | | X | X | | | X | | X | X | | Danger to trail users and motorists due to dangerous curve, the hill, and the short sight distance. Signage is very inadequate. | | |
| 41.15247 | -79.0866 | | 380713 | | | 2/26/2020 | 274763 | | Opportunity to provide a continuous 90+ mile trail for bikes, hikers, pedestrians and alternate transportation from East Brady to Ridgway,, Elk County. Connection needed from Brookville Park to Allens Mills, including a crossing over I-80 which PA DOT removed. From there it can connect to Five Bridges Trail, Trail Town Brockway and Clarion River-Little Toby Trail. | X | X | | | | | | X | | | | | X | X | X | X | | X | X | X | X | X | X | X | X | | | PA Wilds Loop concept January 2019 meeting agenda.docx | |
| 41.01325 | -79.3045 | | 380718 | | | 2/26/2020 | 231922 | | The Redbank Valley Trail crosses Rt. 28 at this point. Motorist-facing signage is in place, but roadway markings would help alert drivers of the trail crossing. | X | | | | X | | | X | | | | X | | | | | | X | X | | | | | X | | | Roadway markings to alert drivers of the trail crossing would increase the safety of crossing trail users. | | |
| 41.17077 | -79.0953 | | 380719 | | | 2/26/2020 | 231922 | | Ideally, this study would extend to include Rt. 28 as it continues under I-80 on the east side of Brookville. This site has the potential to connect the existing Redbank Valley Trail to the Tricounty Rails to Trails system further north. | X | | | | X | | | X | | | | | X | | | | | X | X | | | | | | X | | The Redbank Valley Trail could continue through Brookville towards the existing but unimproved Five Bridges Trail. The Five Bridges Trail is part of the Tricounty Rails to Trails system and includes the Clarion-Little Toby Trail. Finding a way under or over I-80 is going to be a key in connecting these two trails and should be explored as part of this study. | | |

| lat | lng | Additional Comments | Feature ID | Feature Type | Feature Description | Created(DD/MM/YYYY) | Inputter ID | Inputter | Please describe the area of your opportunity/concern: | I use this area for: (Check all that apply) - | | | | | | | | | | How frequently do you use this facility? (Select one) | | | What about this location causes you concerns? (Check all that apply) - | | | | | | | | | | | | | | | Do you have a photo of this area of concern for us to consider? Please upload it here. | Is there any other information you would like us to know about the Route 28 corridor? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Local commuting (Less than 10 miles each way) | Regional commuting (More than 10 miles each way) | Business Travel (Deliveries, moving freight, etc.) | Accessing government services | Accessing Redbank Valley Trail | Accessing local schools | Accessing stores, services, goods, healthcare | Accessing recreational opportunities | Other | If Other, please explain. | Daily | Weekly | Monthly | Pedestrian safety | Cyclist safety | Roadway safety | Vehicle speeds | Roadway incline/grade | No climbing lane on steep grade | Travel lanes are too narrow | Intersection too narrow | Congestion | Drainage | Stopping or turning vehicles | Connectivity | Loading zones | Height or weight restrictions | Please explain your concern. | | |
| 40.99809 | -79.3423 | | 374439 | point | | 2/10/2020 | 273141 | | 90 degree right hand turn going North bound, slows the flow of traffic for tractor trailers and tri axles | X | X | X | | | | X | X | | | | X | | | | | | | | X | | X | | X | | | | High roll over points, sharp turns and small lane width are a recipe for disaster. The lane needs widened. | | |
| 40.99914 | -79.3429 | | 374572 | point | | 2/10/2020 | 273163 | | | X | | | | | | | | | | | | X | | | X | | | | X | X | X | | X | | | | sharp curve hard for truck multiple accidents | | |
| 40.96455 | -79.3609 | | 380274 | point | | 2/13/2020 | 273472 | | I believe the area of 28 from the hill, known in the area as 'Hog Back'to Distant could benefit from dedicated lanes for commercial trucks. | | X | | | | | | | | | | | X | | | X | X | X | X | | | | | | | | | This entire stretch of 28 has always been hazardous, in my opinion. I've always heard that 28 was constructed the way it was for the scenic views in the past. The road design isn't safe for the way people drove today. | | I really hope this study has positive results. I fear the roadway will continue to deteriorate and become even less safe in the coming years. With the precipitation our region has been taking on, there could potentially be more road washouts like we experienced recently. |
| 41.12774 | -79.1705 | | 380286 | point | | 2/13/2020 | 273526 | | The rt 28 follows the river and in many places the road is squeezed onto a very tight river bank. There is a lot of rock to be removed. | | | | | | | | | X | Narrow road access up thru the mountains and the RedBank Creek | | X | | | | X | X | | | X | X | X | | | X | | | | | It is a narrow roadway in many places. |
| 41.15242 | -79.1014 | | 380373 | point | | 2/15/2020 | 273780 | | | X | X | X | X | X | X | X | X | X | | X | X | X | X | X | X | X | X | | X | X | X | X | X | X | X | X | CONSTRUCT ALLEGHENY VALLEY EXPRESSWAY PENNDOT HAS PLANS! | | |
| 40.83901 | -79.3689 | | 380389 | point | | 2/17/2020 | 273893 | | | | | | | | | | | | | | X | | | | X | X | X | | | | X | | X | | | | | | |
| 40.96455 | -79.3609 | | 380274 | point | | 2/18/2020 | 273998 | | | | X | X | | | | | | | | | | X | | | X | X | X | X | X | | X | | X | | | X | | | |
| 40.96455 | -79.3609 | | 380274 | point | | 2/19/2020 | 274174 | | | X | | | | X | X | X | X | | | X | | | | | X | | | | | | | X | | | | | | Local fire departments in New Bethlehem cause a great deal of traffic with book drives on weekends where traffic is already greater than normal. I think this should be a huge concern for pedestrian safety, vehicle safety and congestion. | |
| 40.99568 | -79.3421 | | 380460 | point | | 2/19/2020 | 274183 | | Towns and hills are ridiculous to get through for almost all traffic from Brookville to Kittanning. Speed traps, intersections, hills, and curves make this route a pain in the butt to drive with most vehicles, even a car. It needs a bypass around most of it. | | X | | | | | | | | | X | | X | X | X | X | X | | X | X | X | | X | | | | | | | |
| 40.93406 | -79.3621 | | 380464 | point | | 2/19/2020 | 274189 | | lots of hills with no passing lanes to get around all these loaded freight trucks. No trucks, I can get home in 22 minutes from Kittanning. With trucks it takes upwards of 45 minutes because you can't get around them. It's 14 miles from Kittanning to my house. | | X | | | | | X | X | | | X | | | | X | X | X | X | | | | X | X | | | | | Roadway safety is bad, I've seen cars pass trucks in a no passing zone (passing while going up a hill when the trucks are at their slowest). If every hill offered a passing zone, it would be safer. Coming out of Goheenville, it's a free for all speeding to get past the trucks. | the roads are rough, they need fixed and not just the taring in of the holes. That's ridiculous how it makes a thud noise every time you drive over those lines. | |
| 40.99568 | -79.3421 | | 380460 | point | | 2/21/2020 | 274335 | | | | X | | | | | | | | | | X | | | | | | | X | | | | | | | | | | | |
| 40.99526 | -79.3299 | | 380514 | point | | 2/21/2020 | 274364 | | In New Bethlehem, we have the Smuckers plant. I would like to see new access for truck traffic going to/from Smuckers directly off route 28 without going to the plant via Penn Street. | | | | | | | | | | | | | | | X | | | | | | | | X | | | | | | | |
| 40.96191 | -79.3639 | | 380545 | point | | 2/23/2020 | 273737 | | Passing lane too short | X | X | X | X | X | X | | | | | X | | | | | | X | | | | | | | | | | | Passing lane too short. | | |
| 40.90677 | -79.3713 | | 380546 | point | | 2/23/2020 | 273737 | | Bend too sharp | X | X | X | | | | | | | | | X | | | | | | | | | | | | | | | | | | |
| 40.99361 | -79.339 | | 380563 | point | | 2/23/2020 | 274504 | Guest | I think this would be a good opportunity to bypass this area because there is a lot of trucks that have trouble with the turns in town and sometimes cause many backups from them getting wedged on the turn | | X | | | | | | | | X | | | | | | | | | | X | X | | X | | | | | | I think this project would be a great idea. The road from Kittanning to New Bethlehem is horrible with a lot of vehicle fatalities and would be a upgrade for this area | |
| 40.96191 | -79.3639 | | 380545 | point | | 2/25/2020 | 274617 | | A combination of steep hills and sharp turns make it dangerous for trucks especially if the roads are slick | | | X | | | | | | | | | X | | | X | | X | | X | | | | X | | | | | There are alot of steep hills with sharp turns at the bottom and many places have narrow lanes | | |
| 40.86153 | -79.4451 | | 380819 | point | | 2/29/2020 | 275054 | | Need 4 lanes in this area from kittanning to New Bethlehem then new reroute north of New Bethlehem to make for more activities and recreation along North Fork. | | X | X | | | | X | X | | X | X | X | X | X | X | X | X | X | X | X | | | X | | | | | Need to make this route easier to travel to attract more revenue and safety! | Not much level land north of New bethlehem within present route 28 now, and to attract more revenue for recreation, college, and freight, I feel a better solution to avoid heavy construction such as exploding mountain ranges to level or to avoid to many bridges and the upkeep of them is to reroute onto 66N at New Bethlehem and forward traffic to I-80 at the Clarion exit/Easy travels for college students at CUP! | |
| 40.99995 | -79.3418 | | 380823 | point | | 2/29/2020 | 275059 | | Bend coming into town | | X | | | | | | | | | | X | | | | | | | X | | X | | | | | | | This turn is a bottleneck,slows trucks and traffic down too much. | | |
| 40.99548 | -79.341 | | 380998 | point | | 3/4/2020 | 275390 | | Tight turn into congested area. This area would benefit by bypass or other handling of CMV traffic. Dangerous curve. | | | X | | | | | | | X | | | X | | X | X | X | | X | | X | | X | | | | | The area generally around and through New Bethlehem is tight, dangerous with many stopped or slow moving vehicles. CMV and bypass traffic would benefit greatly if a bypass route (straighter with better lanes) could be designed and implimented. | | |

| lat | lng | Additional Comments | Feature ID | Feature Type | Feature Description | Created(DD/MM/YYYY) | Inputter ID | Inputter | Please describe the area of your opportunity/concern: | I use this area for: (Check all that apply) - Local commuting (Less than 10 miles each way) | Regional commuting (More than 10 miles each way) | Business Travel (Deliveries, moving freight, etc.) | Accessing government services | Accessing Redbank Valley Trail | Accessing local schools | Accessing stores, services, goods, healthcare | Accessing recreational opportunities | Other | If Other, please explain. | How frequently do you use this facility? Daily | Weekly | Monthly | What about this location causes you concerns? (Check all that apply) - Pedestrian safety | Cyclist safety | Roadway safety | Vehicle speeds | Slow moving vehicles | Congestion | Stopping or turning vehicles | Connectivity | Interstate access | Drainage | Parking | Signal timing | Roadway or bridge maintenance | Sight distance | No passing lane | Please explain your concern. | Do you have a photo of this area of concern for us to consider? Please upload it here. | Is there any other information you would like us to know about the Route 28 corridor? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.837713 | -79.466232 | | 374363 | point | | 2/7/2020 | 272911 | | This is a blind intersection. Many accidents have occurred here. | | X | | | | | | | | | X | | | | X | X | X | | | X | | | | | | | | | | | |
| 40.868648 | -79.42881 | | 374364 | point | | 2/7/2020 | 272911 | | Blind intersection pulling onto Route 66/28 | | X | | | | | | | | | X | | | | X | X | X | | | X | | | | | | | | | | | |
| 40.904491 | -79.371154 | | 374365 | point | | 2/7/2020 | 272911 | | Blind intersection coming onto 66/28 | | X | | | | | | | | | X | | | | X | X | X | | | X | | | | | | | | | | | |
| 40.917626 | -79.365017 | | 374366 | point | | 2/7/2020 | 272911 | | Blind intersection heading southbound on 66/28 | X | | | | | | | | | | | X | | | X | X | X | | | X | | | | | | | | | | | |
| 40.924014 | -79.361562 | | 374367 | point | | 2/7/2020 | 272911 | | Blind Intersection | X | | | | | | | | | | | X | | | X | X | X | | | X | | | | | | | | | | | |
| 40.971037 | -79.352951 | | 374368 | point | | 2/7/2020 | 272911 | | High traffic area passes very popular IceCream stand. Very dangerous turning off/on to 66/28 when this is open | | X | | | | | X | | | | | X | | | X | X | X | | | X | | | | X | | | X | | | | |
| 40.972921 | -79.351079 | | 374369 | point | | 2/7/2020 | 272911 | | Dollar general store has poor line of sight. Entering/exiting this store is problematic | | X | | | | | X | | | | | X | | | X | X | X | | | X | | | | | | | | | | | |
| 40.97135 | -79.352528 | | 374370 | point | | 2/7/2020 | 272911 | | Cars parked at this business often obstruct view of northbound traffic | | X | | | | | | | | | | X | | | X | X | X | | | | | | | X | | | | | | | |
| 40.99912 | -79.34296 | | 374371 | point | | 2/7/2020 | 272911 | | Sharp turn has been the scene of many accidents | | X | | | | | | | | | | X | | | | X | X | | | | | | | | | | | | | | |
| 40.868648 | -79.42881 | | 374364 | point | | 2/8/2020 | 272972 | | | | X | | | | | | | | | | | X | | | | | X | X | X | X | X | | | | | X | X | | | |
| 40.818083 | -79.489783 | | 374375 | point | | 2/8/2020 | 272976 | Guest | An opportunity to engage the PA State Legislature to authorize the extension of the Pennsylvania Turnpike System from a point north east of Kittaning at the terminus of SR 28 Expressway to a point along I-80 in the vicinity of Brookville. In order to provide the seamless highway experience a metropolitan area the size of Pittsburgh is entitled to the Dwight D. Eisenhower National System of Interstate and Defense Highways. | | X | X | | X | | | | X | This is also the most direct route between Pittsburgh and New York City. | | | X | X | X | x | X | X | X | X | X | X | | | X | | X | X | Basically this corridor is in need of a completed expressway or turnpike to provide access to I-80. For the longterm economic viability of the region this project must advance. | | |
| 40.99912 | -79.34296 | | 374371 | point | | 2/8/2020 | 272976 | Guest | This tight radius turn is emblematic of the problems with this corridor in general. There is no consistent design typical section, design speed, or corridor context making this corridor extremely challenging to safely navigate. Roadway improvements have obviously been conducted ad-hoc without any regard to the bigger picture or the fact that this is the most direct route from Pittsburgh to the North East and New York City. This corridor is deserving of at the very least a controlled/ limited access right-of-way from the terminus of SR 28 Expressway near Kittaning to a direct interchange with I-80 in the vicinity of Brookville.<br><br>Typical sections and design criteria to be evaluated should range from the low end new alignment such as US 222 from SR 309 to SR 611 as constructed in Eastern PA to the upper range of a full fledged limited access expressway or turnpike.<br><br>An interesting concept would be to develop an alignment and typical section as a demonstration project of what a semi-autonomous vehicle corridor could look like in the future. | | X | X | | X | | | | X | Most direct corridor between Pittsburgh and New York City, this should not be discounted and the state this corridor is in is a disservice to the Pittsburgh Region's connectivity to this important city. | | | X | X | X | X | X | X | X | X | X | X | | | X | X | X | X | This curve requires no explanation as it is so bad. The fact that this curve is still part of the PennDOT's 2 digit SR network is an embarrassment to our commonwealth. A consistent corridor with a consistent limited access typical section is required for this critical connection between the Pittsburgh Region and the North East, New York City Included. | | |
| 41.146965 | -78.993888 | | 374376 | point | | 2/8/2020 | 272976 | Guest | A Direct interchange is required connecting I-80 with the New SR 28 Expressway which needs to be built to connect Pittsburgh with the North East including New York City. This interchange should be part of the initial plan and constructed with the project unlike the I-80/I-99 interchange which has lagged for 15 or so years. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | X | X | | Most Metropolitan Areas the size of Pittsburgh have direct access to their adjacent Interstates, the fact that this road is not a highway is a disgrace to our region and shows malfeasance from our regional planners. | | |
| 41.170674 | -79.095651 | | 374377 | point | | 2/8/2020 | 272976 | Guest | This exit is not explicitly and clearly marked as the best exit for SR 28 south to Pittsburgh. An opportunity here would be to reroute SR 28 from exit 81 to exit 78 along I-80 and revise the current designation to be the Business Route 28. More Clear Signing that this corridor leads to Pittsburgh needs to be added to the exit especially along the WB direction. | | X | X | | | | | | X | Connecting Pittsburgh to NYC along the most direct route. | | | X | | | | | | | | X | X | | | | | | | Making this corridor clear that it connects to Pittsburgh is critical. | | |
| 41.166313 | -79.097636 | | 374378 | point | | 2/8/2020 | 272976 | Guest | The amount of congestion along this corridor is not consistent with my expectations for long distance travel. This corridor connecting Pittsburgh with New York city needs to have controlled or limited access right-of-way and be designed for long distance travel. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | | X | | | | |
| 41.014619 | -79.303425 | | 374379 | point | | 2/8/2020 | 272976 | Guest | The corridor through this area is not consistent with the expectation of through highway. Improvements should be made to provide a safe high speed road in this area. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | X | X | X | | | |
| 40.906673 | -79.371355 | | 374380 | point | | 2/8/2020 | 272976 | Guest | This location is a prime example of failures of the SR 28 corridor projects over the past 3 decades. How do you make typical section improvements just north and just south of this location but still have a short section with tight curve geometry and practically no shoulder. This critical corridor between Pittsburgh and the Northeast should not be subject to sudden and unexpected deterioration in typical section for short or long lengths. A consistent typical section with controlled access or limited access right-of-way is required for a corridor of this significance. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | | | X | X | | | |
| 40.882 | -79.391233 | | 374381 | point | | 2/8/2020 | 272976 | Guest | Another example of corridor inconsistencies. Highway gets realigned in this short section through Slabtown, but neither up-grade (relative to the slope of the road not the quality of the project) included the construction of a truck climbing lane. This is totally inconsistent with the typical sections of other improvement project's along the corridor.<br><br>Corridor design criteria need to be approved with a final selected alternative before any additional inconsistent upgrades are constructed. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | | | X | X | | | |
| 41.089427 | -79.227246 | | 374382 | point | | 2/8/2020 | 272976 | Guest | Work with US congress and Senate to get this route added to the Appalachian Regional Corridor network to get it upgraded to an appropriate alignment and typical section for a significant corridor connecting Pittsburgh and I-80. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | X | X | X | | | |
| 41.160304 | -79.074745 | | 374383 | point | | 2/8/2020 | 272976 | Guest | With 322 already using this road; why not realign 28 onto I-80 to eliminate confusion and make a clear path all the way from I-80 to Pittsburgh.<br><br>If you were traveling west on I-80 and someone told you to get off at the exit for Pittsburgh? Where would you get I-79? Why not make 28 the ideal route and corridor for travel from Pittsburgh to I-80. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | | X | X | X | | | |
| 40.818341 | -79.489719 | | 374384 | point | | 2/8/2020 | 272976 | Guest | This is an opportunity for a round about; especially to signify the transition from one roadway typology to another. | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | | X | X | | | |
| 40.839268 | -79.465478 | | 374385 | point | | 2/8/2020 | 272976 | Guest | Realign cross roads to a single location to provide a more controlled and predictable corridor experience. Signalization should be avoided and roundabouts used instead (typical - corridor) | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | | X | X | | | |
| 40.971229 | -79.352222 | | 374386 | point | | 2/8/2020 | 272976 | Guest | Realign cross roads to a single location to provide a more controlled and predictable corridor experience. Signalization should be avoided and roundabouts used instead (typical - corridor) | | | | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | X | X | | X | | | |
| 41.040227 | -79.256972 | | 374387 | point | | 2/8/2020 | 272976 | Guest | Realign cross roads to a single location to provide a more controlled and predictable corridor experience. Signalization should be avoided and roundabouts used instead (typical - corridor) | | X | X | | | | | | | | | | X | | | X | X | X | X | X | X | X | | | | X | X | X | | | |
| 41.134348 | -79.152858 | | 374388 | point | | 2/8/2020 | 272976 | Guest | Realign cross roads to a single location to provide a more controlled and predictable corridor experience. Signalization should be avoided and roundabouts used instead (typical - corridor) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.163374 | -79.097537 | | 374389 | point | | 2/8/2020 | 272976 | Guest | Good location for a round about to signify the change of roadway typology. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.163374 | -79.097537 | | 374390 | point | | 2/8/2020 | 272976 | Guest | Good location for a round about to signify the change of roadway typology. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.163381 | -79.098 | | 374391 | point | | 2/8/2020 | 272976 | Guest | Round about needed here to alert drivers to the change in roadway type. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.16959 | -79.098027 | | 374392 | point | | 2/8/2020 | 272976 | Guest | Traffic signals poorly timed; round about needed to allow smooth flow for all travelers. | | | | | | | | | | | | | | | | | | | | | | | | | X | | | | | | |
| 41.171319 | -79.098005 | | 374393 | point | | 2/8/2020 | 272976 | Guest | Traffic signals poorly timed; round about needed to allow smooth flow for all travelers. | | | | | | | | | | | | | | | | | | | | | | | | | X | | | | | | |
| 41.167264 | -79.097769 | | 374394 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town. | | | | | | | | | | | | | | X | X | X | X | | X | | | | | | | | | | | | |
| 41.118804 | -79.18959 | | 374395 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town. | | | | | | | | | | | | | | X | X | X | X | | X | X | X | X | | | | | | | | | |
| 41.019508 | -79.273357 | | 374396 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town. | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | | | | | X | X | | | |
| 41.001476 | -79.331408 | | 374397 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town. | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | | | X | | X | X | | | |
| 40.970421 | -79.354402 | | 374398 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town. | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | | | | X | X | | | | |
| 40.838775 | -79.465929 | | 374399 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small village. | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | | | | | X | X | | | |
| 40.821455 | -79.487149 | | 374400 | point | | 2/8/2020 | 272976 | Guest | Why does this significant corridor connecting Pittsburgh with I-80 go through the center of a small town. | | | | | | | | | | | | | | X | X | X | X | X | X | X | X | X | | | | | X | X | | | |
| 40.810439 | -79.551543 | | 374403 | point | | 2/8/2020 | 272976 | Guest | This interchange is in consistent with the corridor providing access from Pittsburgh to I-80. 2 Lanes to Pittsburgh. | | | | | | | | | | | | | | | | X | X | X | X | | X | X | | | | | | X | | | |
| 40.998723 | -79.331177 | | 374404 | point | | 2/8/2020 | 272976 | Guest | When SR 28 Expressway gets relocated across the Creek here make sure there is a interchange for SR 66. | | | | | | | | | | | | | | | | | | | | | X | X | | | | | | | | | |
| 40.894796 | -79.372573 | | 374410 | point | | 2/9/2020 | 273059 | Guest | Speed through goheenville in both directions is far too fast. People go well above the posted limit. When pulling into or out of 1027 the fast moving traffic is a concern. A turning lane would help to get us out of the travel lane to turn into 1027 when coming from kittanning. I put my turn signal on (especially in bad weather) at the top of the hill just past merle early's auto repair. As i slow for the turn at the bottom of the hill people generally swing out into the oncomming lane and continue at travel speed. | X | X | | X | | X | X | X | | I use this intersection multiple times per day. I would say people pass a turning car by crossing into oncoming lane 8 out of 10 times. | X | | | | | X | X | X | | X | | | | | | | | | | | |
| 40.842031 | -79.463525 | | 374414 | point | | 2/9/2020 | 273073 | | Lack of sufficient passing lanes both North and South bound.<br><br>The whole way between Kittanning and New Bethlehem | | | X | X | | | X | | | | X | X | | | | X | X | X | X | | | | | | | | | | The lack of passing lanes causes long back ups behind big trucks which can lead to drivers becoming reckless. | | |
| 40.819073 | -79.489811 | | 374416 | point | | 2/10/2020 | 273095 | Guest | Stop light and lack of signage for stop light | X | X | | | | | | X | | | | X | | | | X | | | X | X | X | | | | X | | | | | | |
| 40.999232 | -79.34286 | | 374417 | point | | 2/10/2020 | 273095 | Guest | | | X | | | | X | | | X | access to I-80 | | | X | | | | | X | | | X | | | | | | X | | Too sharp of a bend. Basically 90 degree in South Bethlehem | | |
| 41.046685 | -79.253945 | | 374418 | point | | 2/10/2020 | 273101 | Guest | | | | | | | | X | | | | | | X | | | | | X | | | | | | | | | | | | | |
| 41.037135 | -79.256691 | | 374422 | point | | 2/10/2020 | 273109 | | Pulling out on Rt 28 from the Mayport road is very difficult and trucks basically stop traffic trying to turn onto this road | | X | | | | | | | | | X | | | | | X | X | X | | X | | | | | | | | | | | |
| 40.999232 | -79.34286 | | 374417 | point | | 2/10/2020 | 273117 | Guest | South Bethlehem Borough and Mahoning Twp. If the roadway is improved this could bring more opportunities for industry in these area due to easier access south to the Pittsburgh area. Please do not bypass the New Bethlehem area, or it will completely kill our town. | X | | | | | X | X | | | | X | | | | | | X | | | | | | | | | | | | | | |
| 40.971117 | -79.352789 | | 374424 | point | | 2/10/2020 | 273110 | | Intersection of rt.28 and Putneyville Road. Area needs improved visibility and better access. This entire area is dangerous with fast moving traffic, many trucks, the traffic from the Distant Delights created connection and difficulty pulling out onto rt. 28. | X | X | | | X | | X | X | | | | X | | X | | X | X | | X | X | | | | X | | | X | | As described previously. | | |
| 40.973049 | -79.350826 | | 374425 | point | | 2/10/2020 | 273110 | | The access to Dollar General. | X | X | | | X | | X | X | | | | X | | | | X | X | X | | X | | | | | | | X | | This access road is in a poor location. Is essentially at the crest of a hill. Poor visibility. Is especially dangerous if pulling out and going north. | | |
| 40.973049 | -79.350826 | | 374426 | point | | 2/10/2020 | 273110 | | The access to Dollar General. | X | X | | | X | | X | X | | | | X | | | | X | X | X | | X | | | | | | | X | | This access road is in a poor location. Is essentially at the crest of a hill. Poor visibility. Is especially dangerous if pulling out and going north. | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.973049 | -79.350826 | | 374427 | point | | 2/10/2020 | 273110 | | The access to Dollar General. | X | X | | | X | | X | X | | | | X | | | | X | X | X | | X | | | | | | | X | | This access road is in a poor location. Is essentially at the crest of a hill. Poor visibility. Is especially dangerous if pulling out and going north. | | |
| 40.998962 | -79.342768 | | 374428 | point | | 2/10/2020 | 273110 | | Sharp turn area on rt. 28. | X | X | | | X | | X | | | | | X | | | | X | X | | | X | | | | | | | | | Long time problem in this area with truck rollovers and such. If rt. 28 continues to go right through New Bethlehem this turn needs changed. Not being an engineer or construction worker, I don't know how. | | |
| 40.973462 | -79.351746 | | 374429 | point | | 2/10/2020 | 273126 | | Opportunity for a Sheetz or other larger gas station | X | X | | X | X | X | X | X | | | X | | | | | | | | | | | | | | | | | | | | |
| 40.917609 | -79.364644 | | 374430 | point | | 2/10/2020 | 273126 | | The visibility of pulling out of Calhoun School Road is terrible. | | X | | | | X | | X | X | I travel this road to work at a local school. | X | | | | X | X | X | | | X | | | | | | | X | | The northbound traffic is extremely difficult to see when pulling into or out of Calhoun School Road. | | |
| 40.956703 | -79.363108 | | 374431 | point | | 2/10/2020 | 273126 | | Very windy road with high-speed travelers | X | X | | X | | X | X | X | | | X | | | | | X | X | | | | | | | | | | | | Vehicles travel at high speeds along this section of the road. The road is very windy. | | |
| 40.822073 | -79.486718 | | 374433 | point | | 2/10/2020 | 273133 | | Between Rt 85 & I-80 traffic flow issues. More passing lanes and or divided highway is my recommendation. | | X | X | | X | | | | | | X | | | | | X | | | X | X | X | X | | | | | | | Traffic congestion | | |
| 40.981469 | -79.345208 | | 374435 | point | | 2/10/2020 | 273133 | | Rte 85 to I-80 has heavy congestion. Needs to be a divided highway. | | X | X | X | | | | | | | X | | | | | X | | X | X | X | X | | | | | | | | | | |
| 41.040227 | -79.256972 | | 374387 | point | | 2/10/2020 | 273139 | | | | | | | | | | | | | X | | | | | X | | | | | | | X | | | | | | | | |
| 40.906376 | -79.370001 | | 374440 | point | | 2/10/2020 | 273143 | | This is a very sharp turn and often people go very fast around this turn, especially semi's/big trucks. I travel this road everyday and this is probably the scariest part of the road. | | X | | | | | | | | | X | | | | | | | | | | | | | | | | | | even though the speed limit is 55mph- people take this turn way too fast. the turn is sharp and just awful. | | |
| 40.92752 | -79.361168 | | 374441 | point | | 2/10/2020 | 273143 | | there is a pull off stop for big trucks that are going to go down the hill. the hill as we call it, is called hog back. a lot of the time big trucks do not use this lane or if they do, they do not stop at the end of it. they take the pull off to slow down and just roll through the stop sign. they do not stop & look to see if there is anyone coming. it's not really safe of them to do a "rolling stop" when it's big trucks going down such a big hill. | | X | | | | | | | | | X | | | | | | | X | X | | | | | | | | X | | Big trucks often dont use this pull off or if they do, they slow just and go through the stop sign. i'm not sure if they can't see people coming and they just keep going or what. I often see people hitting their breaks and slowing down because a big truck pulled out in front of them. | | |
| 40.923319 | -79.360952 | | 374442 | point | | 2/10/2020 | 273143 | | to get onto Calhoun school Rd, you make a right off of 28. right before this road is a passing lane. I feel that there needs to be a pull off to turn into this road. many people pass on this passing lane and they come flying up there and then someone wants to turn, everyone is hitting their breaks and it could case an accident. not a good road to turn right on right after a passing lane | | X | | | | | | | | | X | | | | | | X | X | X | X | | | | | | | | | I fear if I have to make a right onto this road if people are behind me. People go way to fast passing people and then for someone to turn off and everyone behind them breaks, it's an accident waiting to happen. | | |
| 40.954576 | -79.363468 | | 374443 | point | | 2/10/2020 | 273143 | | passing lane is not big/long enough when someone is following a semi/big truck and there are 10-20 cars behind them. | | X | | | | | | | | | X | | | | | | | X | X | | | | | | | | | | I often do not pass semi/big trucks on this passing lane just because there is usually a bunch of cars behind the big truck and often times people are cut off when passing. | | |
| 40.829857 | -79.47724 | | 374444 | point | | 2/10/2020 | 273143 | | this is another turn in the road that is pretty sharp | | X | | | | | | | | | X | | | | | | X | | | | | | | | | | | | People drive way to fast on this road. People down the hill from spaces corners to come into kittanning are often driving way to fast for this turn. it goes the same for people leaving kittanning and coming up the hill. the turn is wide and i hate this one too, not as much as the goheenville one but it's close. | | |
| 40.999134 | -79.343035 | | 374445 | point | | 2/10/2020 | 273145 | | 90 degree left turn with a fuel depot on it. | | X | X | | | | | | | | | | X | | | X | X | X | | | | | | | | | X | | | | No |
| 40.846587 | -79.461235 | | 374446 | point | | 2/10/2020 | 273143 | | bad place to turn left when traffic from the other side is coming up from the hill. | | X | | | | | | | | | X | | | | | X | X | | | | | | | | | | | | it's hard to see if your pulling out of this road. its hard to tell if anyone it coming the other way to make a left turn. Not a good place to turn left. if you pulling out, it's what I like a call a "poke and hope" you poke out and hope nothing is coming. people who turn left, I often see them gas the vehicle more because a car just came up over the hill. I've had several vehicles pull out in front of me here because it's hard to tell if something is coming up over that hill/crest. | | |
| 40.971049 | -79.352241 | | 374447 | point | | 2/10/2020 | 273143 | | bad place to turn into with traffic | | X | | | | | | | | | X | | | Pedestrian safety | | | X | X | X | X | | | | X | | | | | Sweet delights is an ice cream store. Many people during the months of march to the end of October eat here. this is a busy place. People drive way to fast going by this place for children to be there, for vehicles pulling in and out of the parking lot and putneyville road. If you were going south and turning left onto putneyville road, people drive way to fast coming up past the Dollar general that if someone is turning left, it could cause an accident. I feel that this is a bad place to turn and pull into. and a bad place for an ice cream shop with so much traffic that drive way to fast. Maybe a slower speed limit around the ice cream shop. | | |
| 41.016228 | -79.300025 | | 374449 | point | | 2/10/2020 | 273152 | | Consider realignment. | | X | | | | | | | | | | | X | | | | | X | | X | | | | | | | X | | | | |
| 40.879963 | -79.392253 | | 374463 | point | | 2/10/2020 | 273156 | | Need a passing lane going up hill to Robinson fruit market. | | X | | | | | | | | | | | X | | | | | X | X | | | | | | | | | X | | | |
| 40.938323 | -79.363578 | | 374465 | point | | 2/10/2020 | 273156 | | South bound traffic is speeding. Very little site distance when entering 28/66 from Deanville road. Have almost been hit many times when trying to enter 28/66 | X | X | X | | | | | | | | X | | | | | X | X | X | | | X | | | | | | X | | I have been almost hit many times trying to enter 28 66. We also have farm equipment entering the road also. | | South of Brookville in Coder Hollow. Turn is narrow. High traffic area. |
| 40.938323 | -79.363578 | | 374466 | point | | 2/10/2020 | 273156 | | South bound traffic is speeding. Very little site distance when entering 28/66 from Deanville road. Have almost been hit many times when trying to enter 28/66 | X | X | X | | | | | | | | X | | | | | X | X | X | | | X | | | | | | X | | I have been almost hit many times trying to enter 28 66. We also have farm equipment entering the road also. | | South of Brookville in Coder Hollow. Turn is narrow. High traffic area. |
| 41.134006 | -79.152286 | | 374568 | point | | 2/10/2020 | 273164 | | Too many motor vehicle accidents with limited acces for fire departments | | | | | | | | | X | Travel to and from Brookville on my way to Pittsburgh. Also respond there as a member of a local fire department | | X | X | | | X | X | | | | | | | | | | | | | | |
| 41.136277 | -79.14657 | | 374569 | point | | 2/10/2020 | 273163 | | dangerous curve | | X | | | | | | | | | | | X | | | | | | | | | | | | | | X | | intense curve with many accidents, poor visibility intersections | | |
| 41.127248 | -79.163718 | | 374571 | point | | 2/10/2020 | 273163 | | low visibility curve | X | | | | | | | | | | X | | | | | X | | X | | X | | | | | | | X | | | | |
| 41.040026 | -79.257263 | | 374574 | point | | 2/10/2020 | 273163 | | poor sight on major intersection | X | | | | | | | | | | X | | | | | X | X | X | | X | X | | | | | | | | | | |
| 41.145777 | -79.114011 | | 374576 | point | | 2/10/2020 | 273163 | | bad curve | X | X | X | X | | X | X | X | | | X | | | | | X | X | X | | X | | | | | | | X | | | | |
| 41.162984 | -79.096911 | | 374577 | point | | 2/10/2020 | 273163 | | slow moving trucks going up hill | X | X | X | X | | X | X | X | | | X | | | Pedestrian safety | Cyclist safety | X | X | X | X | X | X | | | | X | | | X | slow moving trucks going up hill and then accessing progress st. No pedestrian or bike lanes | | |
| 40.849189 | -79.458807 | | 374579 | point | | 2/11/2020 | 273175 | | Local road that is at crest of hill. Very hard to pull across traffic here with limited view and time. | X | | | | | | | | | | X | | | | | X | X | | | X | | | | | | | X | | | | |
| 40.998723 | -79.331177 | | 374404 | point | | 2/11/2020 | 273178 | | | | X | X | | | | X | | | | | | X | | | X | X | X | X | X | X | X | | | | | X | X | | | |
| 40.907007 | -79.371568 | | 374580 | point | | 2/11/2020 | 273187 | | The sharp curve coming into Goheenville from Distant. | | X | | | | | | | | | | | X | | | X | | | | | | | | | | | X | | Limited sight distance. | | |
| 40.99912 | -79.34296 | | 374371 | point | | 2/11/2020 | 273189 | | | | X | | | | | | | | | | | X | | | X | | | | | | | | | | | | | | | |
| 41.136277 | -79.14657 | | 374569 | point | | 2/11/2020 | 273196 | | | | X | | | | | | | | | | | X | | | X | X | X | X | X | | | X | | | | | | | | |
| 40.999114 | -79.342962 | | 374589 | point | | 2/11/2020 | 273204 | | Needs some kind lit signs to get drives attention to warn how sharp this corner is. | | | | | | | | | X | Going to Pittsburgh and back to DuBois for appointments. | | | X | | | X | | | | | | | | | | | X | | | | From Brookville to Pittsburgh the speed limit signs need to be adjusted to more reasonable speeds. Some could be raised a bit and other through this certain towns could be lowered. |
| 40.981824 | -79.343995 | | 374590 | point | | 2/11/2020 | 273207 | Guest | From mainly New Bethlehem to Kittanning. However the real problem is Brookville to Kittanning. The main problem is trucks. I drive this road atleast 20-30 times a month from Brookville to Kittanning and then some. I have noticed that traffic flows fine and safe when you never encounter a truck from kittanning to I80. If you do you face time delays for work meetings or healthcare. Or safety, most of these trucks are either going way to fast causing potential danger, or way to slow also causing danger. | | | X | | | | X | X | | | | X | | | | | X | X | | | | | | | | | | | The freight trucks. They should just have to be forced to use 79 out of the city to I80 and leave route 28 to local deliveries and regular car traffic. | | Trucks are the only thing that has ever been a problem while using the corridor from I80 to Kittanning. |
| 41.163374 | -79.097537 | | 374390 | point | | 2/11/2020 | 273210 | Guest | | X | | | X | | | X | | | | X | | | Pedestrian safety | | X | X | | X | X | X | | | | X | | | | | | |
| 41.146843 | -79.117534 | | 374591 | point | | 2/11/2020 | 273210 | Guest | Route 28 between the areas of Airport Road Ext. and Cemetery Road. | X | | X | | | | | | X | There are a high volume of motor vehicle accidents in this stretch of highway as is, especially on the hill Northbound from the intersection with Snyder Road. | | X | | | | X | | | | | | | | | | | | | Again, there is a high volume of motor vehicle accidents in this stretch. | | |
| 41.170411 | -79.100301 | | 374592 | point | | 2/11/2020 | 272615 | Guest | No signage on Interstate 80 that directs people to Pittsburgh or Punxsutawney | | X | | | | | | X | | | | X | | | | | | | | | | | | | | | | | there is no signage directing people from the Interstate to Pittsburgh and other points south | | more passing lanes and more consistent speed limits. Some areas drop 10 or MPH then back up again within short distances |
| 40.818083 | -79.489783 | | 374375 | point | | 2/11/2020 | 273293 | | | X | | X | | | | X | | | | X | | | Pedestrian safety | | | | | | X | X | X | X | X | | | | | | | |
| 40.822073 | -79.486718 | | 374433 | point | | 2/11/2020 | 273293 | | | X | | X | | | | | | | | X | | | Pedestrian safety | | | | | | | | X | X | X | | | | | | | |
| 40.849113 | -79.459043 | | 374617 | point | | 2/12/2020 | 273311 | | There is limited visibility for people pulling out of Sloan Hill Road onto Route 28. | X | | | | | | | X | | | | | X | | | X | | | | | | | | | | | X | | There is limited sight distance for traffic pulling out of Sloan Hill Road onto Route 28 as well as for cars turning onto Sloan Hill Road from Route 28. | | |
| 40.835803 | -79.468292 | | 374618 | point | | 2/12/2020 | 273311 | | There is no passing lane on this portion of the hill. | X | X | | | | | | X | | | | X | | | | | | X | | | | | | | | | | X | There is no passing lane on this portion of the hill so passenger cars regularly get stuck behind large trucks. | | |
| 40.8421 | -79.463836 | | 374619 | point | | 2/12/2020 | 273311 | | There is no passing lane on this hill. | X | X | | | | | | X | | | | X | | | | | | X | | | | | | | | | | X | There is no passing lane on this hill and passenger cars regularly get stuck behind large trucks. | | |
| 40.853257 | -79.455182 | | 374620 | point | | 2/12/2020 | 273311 | | There is no passing lane on this hill. | X | X | | | | | | X | | | | X | | | | | | X | | | | | | | | | | X | There is no passing lane on this hill and passenger cars regularly get stuck behind large trucks. | | |
| 40.867094 | -79.434919 | | 374621 | point | | 2/12/2020 | 273311 | | There is no passing lane on this hill. | X | X | | | | | | X | | | | X | | | | | X | | | | | | | | | | | X | There is no passing lane on this hill and passenger cars regularly get stuck behind large trucks. | | |
| 40.870225 | -79.421894 | | 374622 | point | | 2/12/2020 | 273311 | | There are several vertical curves between Ridge Road and Oscar Road that reduce sight distance. | X | X | | | | | | X | | | | X | | | | X | | | | | | | | | | | X | | The vertical curves between Ridge Road and Oscar Road restrict sight distance and make it difficult for vehicles pulling into and out of the gas station to see approaching traffic. | | |
| 40.872416 | -79.413097 | | 374623 | point | | 2/12/2020 | 273311 | | Poor sight distance for vehicles turning into and out of Oscar Road. | X | X | | | | | | X | | | | X | | | | X | | | | | | | | | | | X | | There is limited sight distance for vehicles pulling into and out of Oscar Road. The vertical and horizontal curves limit sight distance. | | |
| 40.874773 | -79.408153 | | 374624 | point | | 2/12/2020 | 273311 | | There is not a passing lane on this hill. | X | X | | | | | | X | | | | X | | | | | | X | | | | | | | | | | X | There is no passing lane on this hill and passenger cars regularly get stuck behind large trucks. | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.877528 | -79.39512 | | 374625 | point | | 2/12/2020 | 273311 | | Now that this section of the road has been improved, I find myself traveling this section of road well above the speed limit. | X | X | | | | | | X | | | | X | | | | | X | | | | | | | | | | | | This dip is now very easy to speed through as a result of the improvements that were made in the past few years. | | |
| 40.885947 | -79.3901 | | 374626 | point | | 2/12/2020 | 273311 | | There is no passing lane on this hill. | X | X | | | | | | X | | | | X | | | | | X | | | | | | | | | | | X | | | |
| 40.887975 | -79.387592 | | 374627 | point | | 2/12/2020 | 273311 | | There is limited sight distance for people entering and existing Robinson's Greenhouse. | X | X | | | | | | X | | | | X | | | | X | | | | X | | | | | | | X | | There is limited sight distance for vehicles entering and existing Robinson's Greenhouse. | | |
| 40.907109 | -79.371125 | | 374628 | point | | 2/12/2020 | 273311 | | This sharp bend with limited sight distance is kind of frightening to negotiate. | X | X | | | | | | X | | | | X | | | | X | X | | | X | | | | | | | X | | This section of the road features a rather sharp bend at the bottom of a hill. The road is quite narrow in this area with limited sight distance. I always worry that an oncoming vehicle will not negotiate the turn and run into me. | | |
| 40.924298 | -79.361618 | | 374629 | point | | 2/12/2020 | 273311 | | Limited sight distance for people pulling into or out of Calhoun Road. | X | X | | | | | | X | | | | X | | | | X | | X | | X | | | | | | | X | | | | |
| 41.001948 | -79.338256 | | 377137 | point | | 2/12/2020 | 273105 | | Sharp turn in south bethlehem !!! Big trucks have trouble with it !!! | | | | | | | X | | | | | X | | | | X | | X | X | | | | | | | | | | I work in EMS we have several problems here each year !!! | | |
| 40.82623 | -79.481911 | | 377142 | point | | 2/12/2020 | 273385 | | From Kittanning to Brookville, it is a 1940's era road. | | X | | | | | | | | | | | X | | | X | | | X | | | | | | | | | | Its a 1940s era roadway. | | |
| 40.875534 | -79.403422 | | 377150 | point | | 2/12/2020 | 273395 | | Always get stuck behind slow moving trucks . | | X | | | | | | | | | X | | | | | | X | X | X | | | | | | | | | | Always slower moving g trucks coming up that hill | | |
| 41.145777 | -79.114011 | | 374576 | point | | 2/12/2020 | 273400 | | 28 close to Brookville there are many wrecks here a lot on a Saturday night. | | | | | | | | | X | I use this Road mainly to go to my Daughters hose. She lives off of Penn Ave. | | | X | | | X | X | | | | | | | | | | | | I think vehicles are going too fast. | | |
| 40.832032 | -79.476289 | | 377163 | point | | 2/12/2020 | 273408 | | | | X | | | | | | | | | X | | | | | | X | X | X | | | | | | | | | | | | |
| 41.089427 | -79.227246 | | 374382 | point | | 2/12/2020 | 273230 | | Brookville To Kittaanning. Speed enforcement severely lacking. Speed limit is 55 mph or less. Vehicles travel a lot faster (65+). | | X | X | | | | X | X | | | | | X | | | X | X | X | | X | | | | | | | | | *Speed / Traffic enforcement* Vehicle speed traveled is dangerous. Nobody goes the posted speed limit. 28 is seen as a shortcut to and from Pittsburgh and they expect to travel interstate speed plus on it. This entire strip of road is small town / farming community. Drivers do not follow at safe distances so they smash into stopping or turning vehicles. Dump trucks and logging trucks traveling at unsafe speeds, going with the flow of gravity and just letting their truck go as fast as it can down the hill. Line of sight on hills and curves need to be investigated. There are blind hills, you don\'t know a car is stopped there trying to turn until it is almost or it is too late. vehicles do not slow down through Summerville to include their own residents. Signs for farm equipment as well as trucks entering exiting highway signs may help a little. | | Route 28 is route 68 twin. Honestly if people want to drive fast, and don\'t want to deal with slow moving traffic or farm equipment, or slow down through towns, they need to travel I-80 West Brookville to I-79 South. I-80 to I-79 to Pitt. = 119 miles 1hr 52 min I-80 to B-ville-SR28-Pitt = 80.8 miles 1hr 36 min Minimum times without delays. |
| 41.007949 | -79.31197 | | 380268 | point | | 2/13/2020 | 273462 | | Need lots of lanes outside M&S Meats because they are fantastic! | | | X | | | | X | | | | | | X | | | | | | | X | | | | | | | | | | | |
| 41.001948 | -79.338256 | | 377137 | point | | 2/13/2020 | 273485 | | the intersection at The A Plus has NO stop light. | X | | | | | | X | | X | Ytravel tis daily go through the intersection gointo to Kittanning, Brookville, Clarion going anywhere | X | | | | | X | | | | | | | | | | | | | you can NOT see oncoming traffic Coming out the road beside A Plus you can NOT see to the left for oncoming traffic. Accidents happen there, close calls happen all the time. This road leads to park and is heavily used to bypass town and the lights | | |
| 40.810439 | -79.551543 | | 374403 | point | | 2/13/2020 | 273496 | | | X | X | X | X | X | X | X | X | | | X | | | | | | | | | X | | | X | | | | | | | | |
| 40.868648 | -79.42881 | | 374364 | point | | 2/13/2020 | 273516 | | 1130 Ridge Road, Templeton, Pa. 16259 Scrubgrass Village OHV Park, Pune Township, 1243 acres, ATV trails - ACTIVE, Public Event OHV family fun rides and ATV, dirt bikes and Woods Racing events. See Www.riderplanetusa.com. Venue is 5 west of Rt 28 on Ridge Road and Scrubgrass and Mahoning Creeks. OHV Park scenic kayaking, canoeing and fishing. Proposed off ramp to park. Contact Armstrong Planning & Developments and County Commissionerâ€™s for update information Truly yours, Frank Garmong, Owner and President of Scrubgrass Village, Inc. 724-868-2382 | | | | | | | | X | | | X | | | | | | | | | | | X | | | | | | | Improve Ridge Road access off ramp. Travel use of OHV, utility trailers and camper vehicles of all sizes. Sometimes heavy traffic to Scrubgrass Village OHV Park. Sometimes traffic is backed up 1 mile on Ridge Road at entrance to park. County economical development is a big economical generator for the county | | Yes, traffic is very slow to get from Kittanning to Interstate 80 due to the many hills and heavy truck traffic |
| 41.001826 | -79.331122 | | 380285 | point | | 2/13/2020 | 273526 | | Traffic flow bi-passing New Bethlehem | | | | | Accessing Redbank Valley Trail | | X | | X | I own a business on Broad Street | X | | | X | X | X | X | | X | X | X | X | | | X | | | | | | Would you consider taking the corridor North on Rt 66 and connect at Clarion for North 66 traffic instead of connecting at Brookville. With a store at the interscection of 66/28 I see a lot of traffic on 66 |
| 40.875072 | -79.404252 | | 380304 | point | | 2/14/2020 | 273593 | | slow truck traffic | | | | | | | X | X | | | | | X | | | | X | X | | | | | | | | | | | | | |
| 40.906306 | -79.371533 | | 380314 | point | | 2/14/2020 | 273604 | | This turn is extremely dangerous and needs to be straightened. | | X | | | Accessing Redbank Valley Trail | | X | X | | | | X | | | | X | X | | | X | | | | | X | | X | | This turn is extremely dangerous as I've driven this road for over 30 years. Both directions it is not wide enough, especially when a semi takes the turn and you are driving the opposite direction. It needs to be straightened. | | There needs to be a four lane highway continued up from Kittanning to Brookville. |
| 40.873171 | -79.406444 | | 380325 | point | | 2/14/2020 | 273621 | | Itâ€™s terrible. Like a race roadway. | | | | | | | X | X | | | | | X | | | X | X | | | | | | | | | | | X | | | Needs to be four lanes |
| 40.923799 | -79.358842 | | 380329 | point | | 2/14/2020 | 273643 | | | | X | | X | | | X | X | | | X | | | | | | X | X | | | | | | | | | | X | | | |
| 40.874773 | -79.408153 | | 374624 | point | | 2/14/2020 | 273638 | | Straighten out the ess curves along the route! Please be smart enough to widen any work out to four lanes! There is a lot of places to go through farm land instead of following the present route! | X | X | | | Accessing Redbank Valley Trail | | X | X | | | X | | | | X | X | X | X | X | | | X | | | | X | X | X | In present state there are too many ess curves and narrow curves in poor weather! | | |
| 40.999654 | -79.334057 | | 380330 | point | | 2/14/2020 | 273647 | | Making PA 28 a four lane highway from Kittanning to I-80 will encourage businesses and industry to consider locating in the New Bethlehem area, which are greatly needed in that region. | X | | | | | | X | X | | | X | | | | | | X | | X | | X | X | | | | | | | Presently all PA 28 traffic must pass through New Bethlehem causing congestion and safety concerns. | | |
| 40.999028 | -79.342542 | | 380337 | point | | 2/15/2020 | 273673 | | Coming through this big bend and then through New Bethlehem is the slowest part of the trip | | | | | | | | X | | | | | X | X | | | | | X | X | | | | | X | | | | It's just slow going in general to move through the town. Signals, parked cars, pedestrians, etc. | | |
| 41.119558 | -79.189607 | | 380338 | point | | 2/15/2020 | 273671 | | I hope this is the correct area, but I do know it is before Brookville and very steep/mountainous. The issue is that when it rains heavily, the bottom of the hill gets flooded out and there is nowhere safe to escape or turn around. Luckily, my car gracefully floated across the road at the time. | | X | | | | | | | | | | | X | | | X | | | | | | | X | | | | | | As I mentioned, in heavy rains it floods quickly with no place to pull over or turn around safely. | | Overall, this stretch of 28 is pretty unsafe to travel solely due to the fact there is no cellphone service for much of the expanse as well. If you break down in a certain area (namely around Brookville) you must rely on the kindness of strangers because Verizon phones do not have service, which is ludicrous and downright dangerous. In addition, if we are speaking economically? There is no industry and little economic opportunity along this corridor. It could use a large 24 hour gas station that has a bathroom/facilities just to begin with--there is really nothing on this whole stretch until you reach Brookville. |
| 41.046685 | -79.253945 | | 374418 | point | | 2/15/2020 | 273687 | | | | | | | | | | | X | Travel this to get to 422 to go to Holidaysburg | | | X | | | X | X | | | | | | | | | X | X | | | | |
| 41.170571 | -79.094856 | | 380339 | point | | 2/15/2020 | 273692 | | Better signage needed saying that this is the best exit to take Route 28 to Pittsburgh. 28 could be rerouted to run concurrent with I-80 between exits, or the interchange could be reconfigured for a potential freeway re-routing of 28 as has been proposed. | | | X | | | | | X | | | | | X | | | X | | | | | X | X | | | | | X | | People could miss their exit or become confused leading to longer travel times. | | I look forward to seeing future development along the corridor and am interested in seeing the results of the planned study for a freeway realignment of Route 28 between Kittanning and Brookville. |
| 40.82623 | -79.481911 | | 377142 | point | | 2/15/2020 | 273730 | | | | X | | | | | | | | | X | | | X | | | X | | X | | X | | | | | | | | | | |
| 40.853257 | -79.455182 | | 374620 | point | | 2/15/2020 | 273738 | | | | X | | | | | | | | The twists and turns and ups and downs for healthcare professional and patient transport makes access to specialists not available in the central PA 80 corridor more challenging than it already is. A patient in pain, sick and immobile has an awful ride. | | | X | | | X | X | X | | | X | X | | | | | | X | So go fast some go slow hit an abrupt turn the push on gas to maintain speed up the hill | | |
| 40.999232 | -79.34286 | | 374417 | point | | 2/15/2020 | 273747 | | 90Â° turn in South Bethlehem Borough | | X | | | | | | | | | X | | | | | X | X | | | | | | | | | | X | | I have lived in this area my entire life, and there are many accidents on this turn every year. This turn needs to be eliminated for every traveler's safety. | | |
| 41.016228 | -79.300025 | | 374449 | point | | 2/15/2020 | 273758 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40.999114 | -79.342962 | | 374589 | point | | 2/15/2020 | 273766 | | This extreme turn is very dangerous. I've seen or been in several close calls there with car coming the other way or cars not slowing down behind me. | | X | X | | | | | | | | | | X | | | X | X | | | | | | | | | | | | Extreme Right Turn | | Why can't this all be a 4 lane expressway like the rest of 28 is? |
| 41.149398 | -79.109749 | | 380367 | point | | 2/15/2020 | 273780 | | Intersection of Snyder Road and Route 28 | X | X | | | | X | | X | | | | X | | | | X | X | | | | | | X | | | X | X | | | | |
| 41.133885 | -79.148201 | | 380368 | point | | 2/15/2020 | 273780 | | | X | X | | | X | X | X | X | X | | | X | | | | X | X | | | | | | X | | | X | X | | | | |
| 41.128454 | -79.177384 | | 380369 | point | | 2/15/2020 | 273780 | | | X | X | | | X | X | X | X | X | | | X | | | | X | X | | | | X | | X | | | X | X | | | | |
| 41.134314 | -79.150282 | | 380370 | point | | 2/15/2020 | 273780 | | | X | X | | | X | X | X | X | X | | | X | | | | X | X | X | | X | X | | X | X | X | X | X | | Intersection of Mendenhall Road and Route 28 UNSAFE | | Section from Rose Township line to Jefferson County line is unsafe due to drainage, sight distances and curves. Even PennDot when replaced drainage cross pipes were installed has created road surface concerns. |
| 41.119526 | -79.187528 | | 380372 | point | | 2/15/2020 | 273780 | | | X | X | | X | X | | X | X | X | | | X | | X | X | X | X | X | X | X | X | | X | | X | X | | | Prior input about NO Industry is incorrect. Large brick plant with employees and tax base for area. Submitter should view the surroundings Traffic making deliveries and pickup does create safety concern | | |
| 40.999104 | -79.342966 | | 380374 | point | | 2/15/2020 | 273782 | | Dangerous area of road, requiring slowing down for a very sharp turn. | | X | X | | | | | | | | | | X | X | X | X | X | X | X | X | | | | | | | | | See previous comments, a dangerous sharp turn with intersections. | | |
| 40.837713 | -79.466232 | | 374363 | point | | 2/15/2020 | 273793 | | very dangerous to pull onto 66 from Anderson Creek rd | | | | | | | X | X | | | | | X | | | X | X | | | X | | | | | | | X | | it is hard to see in both directions at that point slight knob and curve there plus speed of vehicles approaching from either direction | | would love to see mostly 4 lane |
| 40.904491 | -79.371154 | | 374365 | point | | 2/16/2020 | 273843 | | You need to get the Goheenville Dip project started . It's been to long in the process. | X | X | | | | | | | X | I live in this area so I pull out onto 28 multiple times each day leaving for work I drive mini school bus. | X | | | | | X | X | | | | X | | | | | X | X | | Sight distance is a big concern about vehicles coming in the south bound lane when you trying to enter 28 and travel north. Another concern is the road surface it's terribly rough through this area. | | Passing lane south of Orchardville would be a great help. |
| 40.99747 | -79.341149 | | 380379 | point | | 2/16/2020 | 273878 | Guest | sharp turn in South Bethlehem when a tractor trailer is going the other way crossing over the center line | | X | | | | | X | | | | X | | | | | X | | | | | | | | | | | | | | | |
| 41.174065 | -79.095421 | | 380380 | point | | 2/16/2020 | 273881 | | | | X | | | | | | | | | | X | | | | | X | X | X | X | | | | | | | | X | | | |
| 40.906306 | -79.371533 | | 380381 | point | | 2/16/2020 | 273882 | | Lots of turns in road. Lots of truck traffic | | X | | | | | | | | | | | X | | | X | X | | | | | | | | | | X | X | | | |
| 41.040227 | -79.256972 | | 374387 | point | | 2/16/2020 | 273884 | | | | X | | | | | X | X | | | X | | | | | X | X | X | | | | X | | | | | | | | | |
| 41.127248 | -79.163718 | | 380382 | point | | 2/16/2020 | 273887 | | | | | X | | | | | | | | | X | | | | | X | X | X | X | X | X | | | | | | | | | |
| 41.118211 | -79.192026 | | 380383 | point | | 2/16/2020 | 273887 | | | | X | X | | | | | | | | | X | | | | X | X | X | X | | X | X | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|41.019508|-79.273357||380384|point||2/16/2020|273887|||X|X||||||||||X||||X|X|X|X||X|X|||||||||
|41.016228|-79.300025||374449|point||2/16/2020|273887|||X|X||||||||||X|||||X|X|X||X|X|||||||||
|41.010765|-79.307105||380385|point||2/16/2020|273887|||X|X||||||||||X||||X|X|X|X|X|X|X|||||||||
|41.001948|-79.338256||380386|point||2/16/2020|273887|||X|X||||||||||X||||X|X|X|X|X|X|X|||||||||
|40.973049|-79.350826||380387|point||2/16/2020|273887|||X|X||||||||||X||||X|X|X|X|X|X|X|||||||||
|40.844263|-79.461686||380388|point||2/16/2020|273887|||X|X||||||||||X||||X|X|X|X|X|X|X|||||||||
|41.000062|-79.325356||380393|point||2/17/2020|273948||This a great town just North of Pittsburgh. Many opportunities for economic development. Great place to raise a family; yet close to the city for cultural experiences.|X|X|||X|X|X|X|||X||||||X|||||||||||Speeds should be a little slower...15-25 mph tops.||This a wonderful area of Western PA and the small town s have much to offer for those traveling through. If proper want to bypass the small towns they can take 79 North or South to access I-80|
|40.999014|-79.343151||380401|point||2/17/2020|273966||This turn is extremely sharp and contributes often to vehicular accidents, especially by tractor-trailers.|X|X|||||X|X|||X|||||X|X|X||X|||||||||||
|40.906969|-79.37127||380402|point||2/17/2020|273966||This turn is very dangerous. There is little visibility of the roadway around the bend for drivers.||X|||||X|X||||X||||X|X|||X|||||||||||
|41.14572|-79.114471||380407|point||2/18/2020|273987||I live on Snyder Road. This stretch of road to the intersection of Route 322 needs to be addressed. There are small lanes, roadways and a few homes along this stretch and if you look back through the years you will see there are far too many accidents.|X||||||||||||X||||X|X|||X|||||||X||||||
|40.956703|-79.363108||374431|point||2/18/2020|273998|||X|X||||||||||||X||X|||X|X|X|||||||X||||||
|41.145777|-79.114011||374576|point||2/18/2020|274060||too many accidents in this area, bad intersection with Snyder road. Curve is too sharp.|X|X|||X|||X||||X||||X|X|X||X|||||||X||||||
|41.133885|-79.148201||380368|point||2/18/2020|274094||Very dangerous pulling onto route 28 from Jefferson cemetery road. Have to roll windows down to listen for vehicles coming around the curves before pulling out. Have almost been hit there before. Also pulling onto Jefferson cemetery road is dangerous as well.|X|X|||||X|X|X|X|X||||||X|||X||||||||Blind curves...very dangerous pulling onto route 28 from Jefferson cemetery road as well as turning onto jefferdon cemetery road as well|||
|41.142586|-79.14537||380441|point||2/18/2020|274098||Blind curve many accidents happen here|X||||||||X|X|X|||X|X||X|X||X|||||||X||||||
|41.003171|-79.298233||380442|point||2/18/2020|274104|Guest|||||||||||X|X|||X|||X|X|||||||||X|||||||
|41.003171|-79.298233||380442|point||2/19/2020|274107|||X|X||X|X|X|X|||X|||||||||||||||||||||
|40.99747|-79.341149||380379|point||2/19/2020|274115||This corner slows down traffic, and is a safety concern.||X|||||||||||X|||X|X|||||||||||||||28 between New Bethlehem and Kittaning is slow, too winding. The travel time to Pittsburgh would be cut in half if this was a 4 lane.|
|40.810439|-79.551543||374403|point||2/19/2020|274151||||X||||X||X|X|X|||||X|X||X|||||||||||||
|41.145777|-79.114011||374576|point||2/19/2020|274169|||X||X||X|X|X||||X||X||X|||X|X|||||X||||||||
|40.877269|-79.393957||380458|point||2/19/2020|274176||The major issue in the proposed area is Hogback Hill, both for vehicular and freight traffic. Even with the improvements made over the past 50 years, it is still a hazardous piece of road because of its steep grade and many curves.|||X|X|||X|||||X||||X||||||||||||Historic improvements have not really made it that much safer. The steep grade presents a problem for truckers. The numerous curves are bad at any time but worse during inclement weather.||Improving the corridor while minimizing the impact on communities and the environment is key to the success of the project.|
|41.040142|-79.257279||380459|point||2/19/2020|274184||This intersection is the site of many crashes and site distance is an issue. This intersection has been worked on over the years, but perhaps could still be improved.|||||||||X|X|||X|||X|X||||||||||X||||
|40.96123|-79.364125||380473|point||2/19/2020|274197|||X|||||||||||X|||X|||||||X|||X|X||This area has little or no berm area with trees growing over roadway.|||
|40.920643|-79.364125||380474|point||2/19/2020|274197|||X||X|||X|X|||||X|||X||||||||||X|||This stretch of roadway needs resurfaced and widened to provide safety and elimination of some curves.|||
|40.834483|-79.471913||380476|point||2/19/2020|274197|||X||X|||X|X|||||X|||X|X|||||||||X|X||Turn at bottom of hill is narrow and this area has little to no berm.|||
|40.49528|-79.908106||380479|point||2/19/2020|274209||The highland park split on 28S needs to be two lanes, reduce accidents from people merging last minute.|X|X|X||||||||X|||||X|X||X|X||||||||||People merge last minute, causing accidents on split by highland park bridge 28S. There is a need for 2 lanes going straight towards the city to reduce accidents and evening rush hour congestion.|||
|40.849825|-79.458898||380484|point||2/20/2020|274242||||||||||||X||||X|X|X|X|X|||||||||||||
|40.853071|-79.455315||380485|point||2/20/2020|274242||||||||||||X||||X|||||||X|||X|X|X||||
|40.854337|-79.45156||380486|point||2/20/2020|274242||||||||||X|||X||||X|||||||X|||X|X|X||||
|40.873067|-79.412225||380487|point||2/20/2020|274242||||||||||X|||X||||X||X|X|X|X|||||X|X|X||||
|40.874537|-79.409753||380488|point||2/20/2020|274242||||||||||X|||X||||X|X|X|X||X|||||X|X|X||||
|40.906772|-79.371153||380489|point||2/20/2020|274242||Goheenville curve|X|X|X||||X||X|||X||||X|X|X|X|X|X||X|||X|X|X||||
|40.917777|-79.364957||380490|point||2/20/2020|274242|||X|||||X|||X|||X||X||X|X|X|X|X||||||X|X|X||||
|40.946889|-79.363827||380491|point||2/20/2020|274242||From Mahoning Creek Bridge to Distant on north end.|X|X|X|||||X|X|||||||X|X|X|X|X|X||||||X|X||Narrow.|||
|40.996209|-79.342073||380492|point||2/20/2020|274242||90Âº turn in South Bethlehem Borough, New Bethlehem tight access, narrow. Why not build new road across State Game Lands to north side of New Bethlehem to current Route 28 beyond Redbank High School area, with a new Bridge "Access" across Redbank Creek intersecting with Route 66 north downtown New Bethlehem at Broad Street and Wood Street. Do NOT cut off New Bethlehem and Route 66 North to Clarion and the University and I-80 west and route 66 North to Bradford/Olean, NY and Route 322 to points west. These are important transportation routes to northern Pennsylvania, New York State and Ohio through Clarion.|X|X|X|X|X|X|X|X|X||X|||X|X|X|X|X||X|X|X||X|X|X|X|X||||
|41.039369|-79.257315||380493|point||2/20/2020|274242|||X|X|X||X||||X||X|||X|X|X|X|X|X|X|X|X|X||||X|X|X||||
|41.127075|-79.164665||380494|point||2/20/2020|274244|Guest|When coming from Brookville it is hard to turn onto Moore Road, if there are cars coming from Summerville and you get caught waiting to turn and someone comes around the turn heading to Summerville--BAM, you are going to be in serious trouble. People have been hit in the rear and in the frontside trying to pull into and out of this road onto 28. It is a serious hazard. Need to come up with something to make this turn safer for everyone that uses it and for the residents that live there.||||||||||I use this road daily to go to pull onto 28 and to come home from either direction (north or south) depending on where I am going to and coming from. The residents on Moore Road shouldn't have to worry about getting in an accident every time they leave their house.|X|||||X|X|X||X|||||||||I already explained some of them on the previous page. It is a BLIND turn at the top and people speed up to and around that turn.You can end up in an accident coming from Brookville onto Moore Road, or going onto 28 from Moore Road to Brookville or the other direction to Summerville. During the time before winter into spring, the weather warms up and then freezes again, there is some runoff onto the right side of the road heading south coming up around the turn that freezes over and makes it very slippery, especially in the early morning hours.|||
|40.850286|-79.458244||380495|point||2/20/2020|274256|Guest|There is limited sight at the Mechling Road intersection.|X|X||X||X|X|X|||X|||X|||X||||||||||X||If you are entering Rt. 28 from Mechling road to go south, the site distance is only about 100 feet in an uphill direction, traffic can not see a car pulling out of Mechling road due to the crest of the hill. This is a danger to the motoring public.|||
|41.039369|-79.257315||380493|point||2/20/2020|274266||A dangerous sharp turn and very busy intersection with cars, tractor trailers, and much farm equipment|X||X||||||||X|||||X|X|X|X|X||||||||X|||How it will impact our church and private school campus development plan.|
|40.882223|-79.390862||380497|point||2/20/2020|274268||Need passing lanes. had a chance to do it before a few years ago and did not.||X||||||||||X||||||X|X|||||||||X|No passing lane. You often get behind slow moving tractor trailers going up the hill.|||
|40.969772|-79.355557||380498|point||2/20/2020|274273||||||||||||||||X||X|X|||X|X||||||X|||||
|40.906439|-79.370589||380504|point||2/20/2020|274288|Guest|bad turn either direction @ 55 mph.||X|||||||||||X|||X|X|||||||||||X||Regardless of speed limit people will take this turn as fast as they think they can. This turn should be widened as well as lessened by removing and reshaping the adjoining hillside. I would not want to live in Goheenville as is.|||
|40.849456|-79.458908||380505|point||2/20/2020|274288|Guest|bad intersection||X|||||||||||X|||X|X|X|X|X|||||||X||This intersection is at the top of a hill next to a church. There is very little sight if you are pulling out onto 28/66.|||
|40.874784|-79.408073||380506|point||2/20/2020|274288|Guest|needs a passing lane especially for trucks||X|||||||||||X|||X||X||||||||||There is limited opportunities to pass slow moving vehicles especially trucks on this road whether travelling North or South.|||
|40.881339|-79.39168||380507|point||2/20/2020|274288|Guest|needs a passing lane||X|||||||||||X|||X|X|X||||||||||There is limited opportunities to pass slow moving vehicles especially trucks on this road whether travelling North or South.|||
|40.999057|-79.342792||380508|point||2/20/2020|274288|Guest|sharp turn for tractor trailers.||X|||||||||||X|||X|X|X||||||||||there have been several accidents over the years from trucks taking this turn too fast. It need to be redesigned, widened and made less severe of a turn ie 60 degrees instead of 90.|||
|40.969256|-79.355316||380509|point||2/20/2020|274288|Guest|This area needs a bypass.||X|||||||||||X|X||X|X|X||X|||||||X|X|Distant should be bypassed entirely. The passing lane ends half way up the hill so if you get stuck behind one or more slow moving trucks you have to follow them for approximately ten miles to pass them. Cutting a new road to the east behind the main village and between the golf course and game commission and extending the passing lanes in both directions would make the commute safer for the village residents as well as the drivers. This would also straighten the road out and eliminate several intersections especially the one near the top where Dollar General enters with little sight distance.|||
|41.160304|-79.074745||374383|point||2/20/2020|274292|Guest|||X||||||X|||||X||||X|X|X||X|X|X|||||X|||This has been needed for over 40 years|
|41.071988|-79.237402||380510|point||2/20/2020|274301||Cars go too fast on the straight road here and there are sever turn offs. Near the wagon wheel restaurant||X|||||||||||X||||X||||||||||||||
|41.002894|-79.341557||380511|point||2/21/2020|274314||||X||||||||||X|||||X|X||||||||||||
|41.073042|-79.236766||380512|point||2/21/2020|274318||High volume of traffic by tractor trailers, log trucks, and tankers speeding through this area is of great concern. There have been many accidents, some fatal. The Traffic Control Technician of Indiana was contacted, some signs have been installed and there is a dangerous intersection here. It has not impacted the speeding that occurs here in the Shannondale Route 28 area.|X||||||||||X|||X||X|X|||||||||||There are a number of small communities on Route 28 from New Bethlehem to Brookville. Many of them have reduced speed limits, however the Shannondale area of Route 28 still has a speed limit that is too fast for tractor trailers, log trucks, tankers,etc, that travel through this area. If they were rerouted away from this area it would be much safer. It is dangerous even for School buses that have to stop on Route 28 so many times. We have a dangerous intersection here on this flat area of Route 28. There have been many accidents. For more information about this dangerous area, contact the Road Supervisors of PennDOT in Indiana, Pa. at 724-357-2800. We have been in discussions about this area with them on many occasions.||This area is under the jurisdiction of the Redbank Township, Clarion County Supervisers. We have discussed this problem with them also. Contact can be made with Tim Shaffer, Superviser, at 814-229-8327.|
|41.14572|-79.114471||380407|point||2/21/2020|274321|||X|||||||||X|||||X|X||||||||||||||

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.971049 | -79.352241 | | 374447 | point | | 2/21/2020 | 274354 | | This is a tough spot to get out onto the road from sweet delights. We stop there every trip to cooks forest. | | | | | | | X | | | | | | X | | | X | | | | X | | | | | | | | | Especially in the summer when traffic is high its dangerous due to turning and stopping vehicles. | | I would travel more often if the road didn't get so congested. In the summer the traffic backs up at the stop lights. |
| 41.001027 | -79.333107 | | 380515 | point | | 2/21/2020 | 274366 | | A main road going through towns and cities. | | | | | | | | | X | The current route slows traffic as it travels trough towns and cities while also adding to accidents. This three city stretch would be a great place for a new section which could start in state game lands. | | | X | X | X | X | X | X | X | X | | | | | X | | | X | All of these problems beg to be addressed by a new section that bypasses this current section. | | |
| 40.82623 | -79.481911 | | 377142 | point | | 2/22/2020 | 274389 | Guest | | | | | | | | | X | | | | | X | | | | | | X | | X | | | | | | | X | | | |
| 41.01447 | -79.292525 | | 380519 | point | | 2/22/2020 | 274393 | | | | | | | | | | X | | | | | X | | | X | | X | | | | | | | | | | X | | | |
| 41.128364 | -79.179024 | | 380520 | point | | 2/22/2020 | 274407 | | Run off always leaving rock debris in roadway | X | | | | | | | | | | X | | | | | X | X | | | | | | X | | | X | | | No should to drive around debris. People travel so fast and suddenly have to stop when the come upon the debris. | | |
| 40.876953 | -79.398272 | | 380521 | point | | 2/22/2020 | 274414 | | This area should have a passing zone because of semi traffic. There was a good opportunity to widen the road when they redid the road a few years back. The hills going both ways have the semi's at times going 25 mph which holds up alot of traffic | X | X | | | | | | | | | X | | | | | | X | X | X | | | | | | | | | X | | | |
| 41.002134 | -79.330763 | | 380538 | point | | 2/23/2020 | 273737 | | | X | X | X | | | X | X | | | | X | | | | | | | X | X | X | X | | | | | | | | | | We need there to be a route that carries trucks , commuters, travelers around New Bethlehem. New Bethlehem should be used as a small town for the residents of the area. |
| 41.011526 | -79.287419 | | 380539 | point | | 2/23/2020 | 273737 | | | X | X | X | | X | | | | | | X | | | | | X | | | | | X | X | | | | | | | | | Route 28 needs to bypass the whole New Bethlehem/south Bethlehem, Hawthorn, Alcola area. This is a residential area not an area that should be used as the main route between Kittanning 28/422 to get to 80. |
| 41.019039 | -79.274716 | | 380540 | point | | 2/23/2020 | 273737 | | | X | X | X | | | | | | | | | X | | X | | | | | | | X | | | | | | | | | | |
| 40.999246 | -79.341637 | | 380541 | point | | 2/23/2020 | 273737 | | | X | | | | X | | | | | Access to doctors | | X | | | | | | | | | | | | | | | | | | | We really need to move the commercial traffic away from the all the small towns along route 28 |
| 40.905177 | -79.371267 | | 380542 | point | | 2/23/2020 | 274453 | | Narrow<br>Limited Sightlines<br>Deer infested<br>No place to pull off safely if necessary | | X | X | | | | | | | | | X | | X | | X | | X | | X | | X | | | | | X | X | Narrow, with no safe places to pull off the road completely<br>DEER INFESTED<br>Extremely dark at night because of dense forest overgrowth<br>DEER INFESTED<br>Limited Visibility<br>This area needs to be bypassed<br>DEER INFESTED | | Just widening the existing road does not address the dangerous cuerves and wooded areas. This area should be bypassed entirely, not merely "upgraded." |
| 40.989644 | -79.343783 | | 380543 | point | | 2/23/2020 | 273737 | | Dangerous hill | X | X | | | X | X | X | | | | | Weekly | | | | | | | | | | | | | | | | | | | |
| 40.970853 | -79.352881 | | 380544 | point | | 2/23/2020 | 273737 | | Dangerous intersection/ dangerous area to access businesses | X | X | | X | X | X | X | | | This area is especially dangerous in the summer. 28 is extremely busy with traffic going to cook forest, etc and you cannot get out of the putneyville road. | | X | | | | X | | | X | | | | | | | | | | | | |
| 40.892616 | -79.376681 | | 380547 | point | | 2/23/2020 | 273737 | | | X | X | | | | | | | | | | X | | | | | | X | X | | | | | | | | | | | | |
| 40.867388 | -79.432635 | | 380548 | point | | 2/23/2020 | 273737 | | | X | X | | | | | | | | | | X | | | | | | X | X | | | | | | | | | | | | |
| 41.129537 | -79.17707 | | 380549 | point | | 2/23/2020 | 274453 | | PA 28 from Brookville to Distant is a primative back road, with heavy traffic and heavily DEER INFESTED.<br><br>As the road winds and twists along the serpentine meanders of Red Bank Creek, and winds and weaves its way through numerous small villages, the limited sightlines carry the potential for accidents with other vehicles and pedestrians.<br><br>Moreover, the roadway is very narrow and hilly and there is insufficient shoulder area to safely pull off the road should the need arise.<br><br>This ancient footpath needs to be relegated to a secondary status, and an entirely new corridor needs to be developed,. | | X | X | | | | | | X | Traveling from DuBois to Northern Allegheny County requires this road, unless one has the time to take US119 & US22. There is a lot of commercial traffic on PA 28 between Pittsburgh and I-80, and there is no suitable connector between the two for traffic destinations to the east of DuBois.<br><br>An Interstate Specification divided highway, similar to the recent development of US-46 in West Virginia would provide an economic boon to the communities along the existing highway, which have to risk life and limb (and DEER INFESTATIONS) to travel to "the big city" for medical, educational and business needs. | | X | | X | X | X | X | X | X | X | X | X | | X | | | X | X | Allegheny County requires this road, unless one has the time to take US119 & US22. There is a lot of commercial traffic on PA 28 between Pittsburgh and I-80, and there is no suitable connector between the two for traffic destinations to the east of DuBois.<br><br>An Interstate Specification divided highway, similar to the recent development of US-46 in West Virginia would provide an economic boon to the communities along the existing highway, which have to risk life and limb (and DEER INFESTATIONS) to travel to "the big city" for medical, educational and business needs.<br><br>Simply widening the existing roadway would be a colossal waste of taxpayer money. Simply widening the existing roadway would do absolutely NOTHING to improve safety or address the concerns of limited sightlines and DEER INFESTATION, both of which become prohibitive issues at night. PA-28 is a very important highway and deserves a new corridor.<br><br>Feel free to toll it like PA-43 and PA-66 in southwestern PA. I would GLADLY pay a toll | | The current right of way mostly follows the 1830-vintage horse trails and Indian paths that followed Red Bank Creek.<br><br>Today's heavy truck traffic jeopardizes every community the route passes through, as well as posing the risk of an eventual haz-mat spill into Red Bank Creek, which would be a tremendous catastrophe, given that the ONLY access road for responders would be blocked by the draffic backing up on both sides of the truck wreck.<br><br>This road is almost 100 years overdue for realignment and replacement! |
| 40.486057 | -79.972148 | | 380550 | point | | 2/23/2020 | 274457 | | Bottle Neck | | X | | | | | | | | | | X | | | | | X | | X | | | | | | | | X | | Were Rte.28 merges at Milville either way ramps are extremely congested plus vision is limited. Also seems merging is excessive. The entrance ramp from Millvale to Rte.28 North is very dangerous due to line of vision, excess speed, | | |
| 40.818013 | -79.489565 | | 380551 | point | | 2/23/2020 | 274492 | | | | X | | | | | | | | | | X | | | | X | X | | | X | | | | | | | X | X | | | |
| 40.907689 | -79.370517 | | 380552 | point | | 2/23/2020 | 274492 | | | | X | | | | | | | | | | X | | X | | X | X | | | X | | | | | | | X | | | | |
| 40.978177 | -79.345199 | | 380553 | point | | 2/23/2020 | 274492 | | | | X | | | | | | | | | | X | | | | | X | | | | | | | | | | X | | | | |
| 40.999273 | -79.342823 | | 380554 | point | | 2/23/2020 | 274490 | | | | X | | | | | X | | | | | X | | X | X | X | X | | | | | | | | | | | | trucks turning curve use both lanes and go too fast | | |
| 41.039993 | -79.257207 | | 380555 | point | | 2/23/2020 | 274490 | | | | X | | | | | | | | | | X | | | | X | X | X | X | X | | | | | | | | | | | |
| 40.854337 | -79.45156 | | 380486 | point | | 2/24/2020 | 274519 | | | X | X | | | | X | X | | | | X | | | | | X | X | X | X | X | X | X | | | | | X | X | | | It needs to be a 4 lane highway that is routed through undeveloped land near the original route of travel. There is a lot of undeveloped land all along the travel corridor that could be used to route a 4 lane without disturbing existing homes and businesses. |
| 41.001948 | -79.338256 | | 380565 | point | | 2/24/2020 | 274548 | | Bypass New Bethlehem. | X | X | | | | X | | | | | X | | | | | | X | X | X | X | | | | X | | | | | | | Get it built !! Bypass New Bethlehem |
| 41.056868 | -79.243837 | | 380567 | point | | 2/24/2020 | 274551 | | Improving this corridor couldn't come soon enough. They've been working on improving Rt 28 since I was a kid. Such an improvement when they opened the four lane between Tarentum and Brackenridge. | X | | | | | | X | | | | | | X | | | | X | | | X | | | | | | X | X | X | The safety of the route needs improvement | | |
| 40.942943 | -79.363316 | | 380586 | point | | 2/24/2020 | 274567 | | The entire route 28 from Kittanning to Brookville is a rural route and should be treated as such. The speed limit should be regulated to 45 mph. There is truck traffic, pedestrian traffic and agricultural traffic. There should be no expansion to ruin our beautiful landscape. | X | X | | | | | X | X | | | | X | | X | X | X | X | X | | X | | | | | | | | | This corridor is used by so many different types of traffic and is so heavily populated with wildlife. If the people that use this corridor on a daily basis treat it with care, reduce their speeds, and have patience, we will all benefit. These are small towns with schools, family farms, and mom and pop stores. Do not destroy what we hold dear! | | |
| 40.968978 | -79.356199 | | 380642 | point | | 2/25/2020 | 274628 | | The entire stretch between New Beth and Kittanning. Both North and South directions. | | | | | | | X | X | | | | | X | | | X | X | X | X | X | X | X | | | | | | X | From New Beth to Kittanning in either direction is frustrating. Slow moving vehicles and limited opportunities for passing. I can't imagine the positive economic impact there would be for the northern towns like clarion and brookville if this stretch was 4 lanes both directions. Going North is worse than South due far less passing opportunities. | | I am happy that it is being looked into. |
| 40.867571 | -79.432839 | | 380644 | point | | 2/25/2020 | 274628 | | The 5-8 miles from Kittanning or to Kittanning. | | | | | | | X | X | | | | | X | | | X | X | X | X | X | X | X | | | | | | X | This area has the worst congestion/no passing lanes for either direction. | | thanks |
| 40.951698 | -79.364588 | | 380646 | point | | 2/25/2020 | 274628 | | Entire stretch between New Beth and Kittanning | | | | | | | X | X | | | | | X | | | X | X | X | X | X | X | X | | | | | X | X | Ideally this entire route would be a 4 lane divided highway. Since that is not likely, it should be NO TRUCKS! Trucks should use I-79 to go south. This stretch should be for cars and local delivery only. | | thanks |
| 41.011143 | -79.305115 | | 380655 | point | | 2/25/2020 | 274650 | | Better corridor will increase travel and tourism. I have traveled this route hundreds of times. It is scenic and well maintained even in winter. Upgrading will only increase itâ€™s value and usage | | X | X | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40.969314 | -79.357133 | | 380668 | point | | 2/25/2020 | 274674 | | The whole route needs upgraded! I still can't understand why a climbing lane wasn't installed at the bottom of the hill leading up to Orchard Hills when they re-aligned the curve. They had a lane in place for the trucks as a "temporary" lane and then put grass on it! What a WASTE! Also need climbing lanes on hills prior to Palmers Convenience Store. Winter maintenance in Clarion County is horrible. You can be on wet roads in Armstrong and you cross the bridge in New Bethlehem and they are snow covered. ( Don't give me the "I 80 excuse" Armstrong has Rt 422). I've been driving that road daily for 35 years. | | X | | | | | | | | | X | | | | | | | | | | | | | | | | | X | | | see above |
| 40.877743 | -79.401078 | | 380670 | point | | 2/25/2020 | 274674 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 41.127105 | -79.16419 | | 380685 | point | | 2/26/2020 | 274719 | | this is a blind curve whether you're heading north or south. we live here. There have been many accidents and dozens of deer killed. It's almost impossible to get out of our driveway at different times of the day. Perhaps widening the road on the west side would help. The storm drains are also clogged in this area and the water from the hill pours down and remains icy in the winter. | | X | | | | | | | | | X | | | | | X | X | | | X | | | X | | | | X | | This is also where the public turns to get to the Rails to Trails entrance at Moore Road. When someone is sitting on 28 to make a left, they're sitting ducks - as we are when trying to turn left into our driveway. Every year since we've lived there, a vehicle has crashed into our yard going too fast around the bend. Our neighbor's family has been rear-ended on several occasions waiting to turn on to Moore Road.<br><br>The road needs widened and the storm drainage fixed. | | People drive way too fast in a lot of spots on 28. I also frequently drive to Pittsburgh via 28 and the winding curves have speed limits that no one pays attention to. |
| 40.868648 | -79.42881 | | 374364 | point | | 2/26/2020 | 274721 | | | | | | | | | | | | | | | X | | | X | X | | | X | | | | | | | | | Got to cross traffic to turn onto ridge road and can not see over the top of hill for oncoming traffic. | | |
| 41.089427 | -79.227246 | | 374382 | point | | 2/26/2020 | 274726 | | Care of Penn St above high school by the twp. Speed of traffic and safety of students. Lack of concern by twp and local police. My house has been hit twice by cars and my daughter by a car. She is fine now. | X | X | | | | X | X | | X | I live 1/8 of a mile off rt.28 | X | | | X | | X | X | | | | | | X | | | | | | SPEED and by passing 28. | | |
| 41.013811 | -79.299967 | | 380687 | point | | 2/26/2020 | 274734 | | The Fishbasket area need to be straightened. | | | X | | | | | | | | X | | | | | | | | X | | | | | | | | | | The turn needs to be straightened for traffic flow. | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.999841 | -79.332945 | | 380688 | point | | 2/26/2020 | 274730 | Guest | Right across the bridge in New Bethlehem there is a VERY busy Sunoco station with two side roads also pulling in and out within the same "block" area. Visitation is bad depending on how the people park in front of the Sunoco. If they park RIGHT by the road parallel with the 28 you cannot see oncoming traffic from the south with the possibility of pulling out of a vehicle. Perhaps some sort of traffic control would help. No everyone reduces speed from 35 to 25 when entering the town. | | | | | | | X | | | | X | | | X | X | | X | X | X | X | | | | | | | | | | | |
| 40.849923 | -79.458651 | | 380693 | point | | 2/26/2020 | 274739 | | The roadway between Sloan Hill Road and Mechling Road needs shaved down to increase visibility for all motorists | X | X | X | X | | X | X | X | | | X | | | | | X | | | | X | | | | | | | X | | Poor visibility for all drivers on 28, Sloan Hill Road and Mechling Road. Hill top needs shaved down to increase safety and visibility. | | The entire route 28 corridor needs to be minimal three lanes to provide alternating passing lanes and middle turning lanes where needed. |
| 40.818114 | -79.489728 | | 380694 | point | | 2/26/2020 | 274739 | | Install a round-about at the route 85 intersection. PennDOT probably already owns enough right of way and traffic patterns vary so much not only throughout the day but at different times of the year as well. | X | X | X | X | X | X | X | X | | | X | | | X | X | X | X | X | X | | X | | | | X | | | | Route 28 is always concerned about connecting to route 80. With Pennsylvania so high on the tourist industry, Route 28 is the gateway to the North from Pittsburgh and Armstrong County. PennDOT does not normally do traffic counts on weekends and holidays but route 28 needs to have these counts done. People call 911 during holiday weekends reporting the traffic light at 85 is malfunctioning because they sometime have to sit through three light cycles to get through the intersection. A round about would solve all traffic amount issues. | | |
| 40.836089 | -79.468457 | | 380695 | point | | 2/26/2020 | 274739 | | complete the Tickle Hill Project to Anderson Creek Road. | X | X | X | X | X | X | X | X | | | X | | | | | X | X | | | X | | | X | | | | X | | The Tickle Hill to Anderson Creek Rd Project needs completed. It keeps getting pushed back on PennDOT' s priorities list. The sharp curve needs removed along with better visibility to enter on to 28 from Anderson Creek Road. Also, during snow event vehicles slide off of route 28 into the Tickle farm field which closes the roadway until rescue workers can pull the vehicle onto the roadway again. | | |
| 40.96457 | -79.360725 | | 380696 | point | | 2/26/2020 | 274742 | | The changes made on Route 28 between New Bethelhem and Kittanning in recent years have made significant improvements. Additional lanes of traffic would be helpful to reduce delays behind truck traffic. | | X | | | | | | | | | | | X | | | X | | X | X | X | | | | | | | | | Delays behind truck traffic could be improved with additional lanes. Vehicles try to pass in locations where they shouldn't and could cause accidents to many drivers and their passengers. | | |
| 41.000957 | -79.337372 | | 380698 | point | | 2/26/2020 | 274749 | | The increased Truck Traffic on the residential areas of New Bethlehem could cause noise and traffic problems. | | X | | | | | | | X | Visiting friends in Kittanning | | | X | X | X | | X | X | X | X | | | | | | | | | Noise and truck traffic in residential areas. | | None |
| 40.998962 | -79.342768 | | 380706 | point | | 2/26/2020 | 274755 | | This is a sharp turn with no stop signs. In my sedan it feels too sharp. I can only imagine what 18-wheelers experience. I suggest rerouting down Putneyville Rd & South Street. With proper expansion of the road of course. | | | | | | | | | X | Driving to Pittsburgh for Specialist Doctor Visits | | | X | | | | X | | | X | | | | | | | | | This corner is entirely too sharp for all the traffic route 28 receives | | |
| 40.995561 | -79.341912 | | 380707 | point | | 2/26/2020 | 274755 | | From New Bethlehem to Kittaning | | | | | | | | | X | Driving to Pittsburgh for Specialist Doctor Visits | | | X | X | | X | X | | X | | | | | | | | | X | I think from New Bethlehem to Kittaning should be 2 lanes in either direction the entire distance. More than once I've had to follow slow or freight traffic for miles before I could pass. Also, I've been at a standstill often because of an accident. With more lanes emergency services could easily close a lane and traffic would continue to move. | | |
| 40.81194 | -79.491352 | | 380708 | point | | 2/26/2020 | 274763 | | From Kittaning to New Bethlehem is terrible driving, even with the climbing lanes. | | X | | | | | | | | | | | X | | X | | X | X | | X | | X | | | | | X | X | | | |
| 40.804424 | -79.487383 | | 380722 | point | | 2/26/2020 | 274787 | | Keep the speed limit consistent. The four lane speed limits should be 65 and remain consistent between 422 and Route 66. Speed limit jumps around and you never know what it is. Signs say one thing and gps says something else. 55 mpg is ridiculous across the bridge and up to the Indiana junction. No one follows it anyway! | | | | | | | X | | | | | X | | | | | X | X | | | | | | | | | | | Consistency in speed limits. | | Slow moving traffic is a concern. The speed limit between New Bethlehem and the Indiana junction is usually 55, with a few exceptions. When you go the speed limit, then come over a hill and find a vehicle going 35 below the crest of the hill it causes a very dangerous situation. Some folks pull out in front of you then go slow. My other favorite is folks we think they own the passing lane.....maybe some reminder signs to get back over into the right lane. The law stipulates that the passing lane is for ACTIVE PASSING....not a travel lane. Same thing with the 3 lane passing lanes north of 422. We travel 28 because we have to NOT because we like it! |
| 41.001375 | -79.332058 | | 380723 | point | | 2/26/2020 | 274790 | | | | X | | | | | | | | | | | X | X | X | | X | X | X | X | | | | | | | | | | | I think it's great that improvements are being studied. My only concern is long hills and stretches without passing lanes. Sometimes I get stuck following behind a slow truck or farm equipment and it slows me down a little. |
| 40.889694 | -79.381837 | | 380724 | point | | 2/26/2020 | 274794 | | | | X | | | | | | | | | | | X | | | X | X | X | | X | | | | | | X | X | | | | the road is horrible!! twists, turn, up down, not safe. very stressful |
| 40.999082 | -79.343187 | | 380725 | point | | 2/26/2020 | 274795 | | Create more gradual turn. Slow area, especially with truck traffic. | | X | | | | | | | | | X | | | | | | X | X | | X | | | | | | | | | Difficult for trucks to make turn. When traveling northbound sometimes need to stop for vehicles traveling southbound | | |
| 40.941201 | -79.364603 | | 380726 | point | | 2/26/2020 | 274795 | | Hogback hill passing zone | | X | | | | | | | | | X | | | | | X | | | | | | | | | | | X | | Limited visibility in southbound passing lane. Recent fatal accident highlighted a potential safety issue here. | | |
| 40.906744 | -79.371276 | | 380727 | point | | 2/26/2020 | 274795 | | Goheenville blind turn | | X | | | | | | | | | X | | | | | X | | | | | | | | | | | X | | It is unsettling when traveling southbound around this turn. Any way to create a more gradual turn, widen the road or remove banks for visibility would be helpful. | | |
| 40.882719 | -79.391069 | | 380728 | point | | 2/26/2020 | 274795 | | Needed northbound passing zone | | X | | | | | | | | | X | | | | | | X | X | | | | | | | | | | X | Commonly waiting for slow moving trucks on this hill. Passing zone needed. Seems there is plenty of available space to make this happen. | | |
| 40.834683 | -79.471421 | | 380729 | point | | 2/26/2020 | 274795 | | Widen turn | | X | | | | | | | | | X | | | | | X | | | | | | | | | | | | | Tight coming around this turn, especially when passing tractor trailers here. Seems like there could be an opportunity to widen. | | |
| 40.99574 | -79.336942 | | 380734 | point | | 2/27/2020 | 274818 | | | X | | | | | | | | | I believe this road is a real hazard to travel. It has improved since PennDot made some improvements but it is a very hazardous road to exit and enter.The intersections are all very dangerous from Kittanning to Distant. I use to travel ever day from New Bethlehem to Kittanning and I saw a lot of accidents over the years.It is better but still has along way to go. | X | | | | | | | | X | | | X | | | | X | X | The worst one I believe is coming north and turning towards Templeton | | With the amount of traffic it is definitely a sub standard road. |
| 40.907446 | -79.370807 | | 380735 | point | | 2/27/2020 | 274832 | | This area is so very narrow. Many times I travel through here and envision a catastrophe when a big rig is barreling towards me and crushing me. The oncoming traffic is coming downhill and fast at times and any slip in judgement there is no room for error. | | X | | | | | X | X | | | | X | | | | X | X | | | | | | | | | X | X | | This area is so very narrow. Many times I travel through here and envision a catastrophe when a big rig is barreling towards me and crushing me. The oncoming traffic is coming downhill and fast at times and any slip in judgement there is no room for error. | | |
| 40.869955 | -79.422506 | | 380736 | point | | 2/27/2020 | 274832 | | Poor sight lines. | | Regional commuting (More than 10 miles each way) | | Accessing government services | | | Accessing stores, services, goods, healthcare | Accessing recreational opportunities | | | | Weekly | | | | | Vehicle speeds | | | Stopping or turning vehicles | | | | | | | Sight distance | | Very tricky area to pull out of the gas station. You have to watch the little hilltop to the right ( south of the store) just past the store and time it to make sure there is no oncoming traffic if you want to pull out and head north. Itâ€™s impossible to pull out from the left side of the parking lot and see in the little dip if can proceed safely. | | |
| 40.854491 | -79.450919 | | 380737 | point | | 2/27/2020 | 274832 | | Caving road | | X | | X | | | X | X | | | | X | | | | X | | | | | | | | | | X | | X | This area has a section that is always sagging. Fear it will give our like the road did by Dayton recently. The sagging part is on the northbound lane. Often times has patches and cones marking it. Can see the road slowly washing away. Also this section could use a passing lane. Cut the hillside out ( southbound side) and move it all over and include a passing lane. | | |
| 40.837867 | -79.466548 | | 380738 | point | | 2/27/2020 | 274832 | | Turning issue | | X | | X | | | X | X | | | | X | | | | | X | | | X | | | | | | | | | Fast moving vehicles here. People fly up to this road and put on turn signals to late and and sudden braking by followers. Also itâ€™s unnerving to come up to this road and a south bound traveler turns left in from of you as they canâ€™t see very well from the north side. | | |
| 40.877669 | -79.394743 | | 380739 | point | | 2/27/2020 | 274832 | | Make a turning lane. | | X | | X | | | X | | X | | | X | | | | | X | | | | | | | | | | | X | Another place where when traveling and thereâ€™s a sudden onset of turning right for the people behind. A turning lane would be fantastic here. Ensure the safety of people exiting and those following. People not used to the area could rear end someone here. Itâ€™s just such a sudden near stop and slow down from a major highway for people to make the right turn off the highway. And also for people turning off from the northbound lane itâ€™s potentially dangerous. People fly through here. | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40.917525 | -79.365054 |  | 380740 | point |  | 2/27/2020 | 274832 |  | Sight lines |  | X |  | X |  |  | X | X |  |  |  | X |  |  |  |  | X |  |  | X |  |  |  |  |  |  | X |  | When coming up the passing lane , unaware on non locals may not know to look out for left turning vehicles from the north. People are speeding through the passing lane and just hidden till you get to the top, is that turning lane and people dart across<br>All the time<br><br>Had potential to be a deadly place. |  |  |
| 40.998962 | -79.342768 |  | 380741 | point |  | 2/27/2020 | 274832 |  | Turning trucks. | X |  |  |  |  | X | X | X |  |  | X |  |  |  |  |  |  | X |  | X |  |  |  |  |  |  |  |  | Semis take this turn so wide. South bound traffic needs to stop for a north bound semi. And also lots of turn overs as well. This turn is just dumb.<br>Practically a 90 degree turn for semis. Dumb |  |  |
| 40.971229 | -79.352222 |  | 374386 | point |  | 2/27/2020 | 274832 |  | Parking on road | X | X |  | X |  | X | X | X |  |  | X |  |  | X |  | X | X |  | X | X |  | X |  |  |  |  |  |  | People park here to get ice cream. They park on putneyville road. Both sides ( which is still part of state maintenance here) and it limits the ability to get on 28. Makes it dangerous as there is sometime single lane traffic at this major intersection. People are trying to exit off 28 onto putneyville road and canâ€™t safely. |  |  |
| 40.998641 | -79.342194 |  | 380767 | point |  | 2/27/2020 | 274863 | Guest | This turn is too sharp and lanes are narrow without much shoulder between embankment or ledge. |  | X |  |  |  |  |  |  |  |  |  | X |  |  | X | X |  |  | X |  |  |  |  |  |  |  | X |  |  |  |  |
| 41.016901 | -79.30201 |  | 380772 | point |  | 2/27/2020 | 274784 | Guest | Sharp turn-people driving too fast |  | X |  |  |  |  |  |  |  |  | X |  |  | X | X |  | X |  |  |  |  |  | X |  |  |  |  |  |  |  |  |
| 40.849323 | -79.459024 |  | 380773 | point |  | 2/27/2020 | 274887 |  | LINE OF SITE FORVEHICLS ENTERING/LEAVING RT 66 FROM SLOAN HILL RD. |  |  |  |  |  |  |  |  | X | EMERGENCY CALLS, OTHERWISE I AVOID IT |  |  |  |  |  | X | X |  |  | X |  |  |  |  |  |  | X |  |  |  |  |
| 40.872391 | -79.413202 |  | 380774 | point |  | 2/27/2020 | 274887 |  | INTERSECTION OF RT 66 AND OSCAR RD. | X | X |  |  |  |  |  | X |  | EMERGENCY CALLS |  | X |  |  |  | X | X |  |  | X |  |  |  |  |  |  | X |  | NOT ENOUGH LINE OF SITE FOR CARS STOPPING TO TURN OFF OF 66 SOUTH BOUND OR PULLING OUT OF THE OSCAR RD CARS HAVE ENDED UP IN THE YARD OF THE HOUSE AND HAVE HIT THE HOUSE. |  |  |
| 40.836375 | -79.470872 |  | 380805 | point |  | 2/28/2020 | 273634 |  | There isn't a good reason to make this 4 lanes to brookville. although, if you draw a straight line from the end of the four lanes just outside Kittanning to brookville, there's plents of undeveloped land to pass through and not displace people's homes and farms. |  | X |  |  |  |  |  |  | X | Drive this route everyday. | X |  |  |  |  | X | X | X | X | X |  |  |  |  |  |  |  | X | Straighten where you can. Similar to what was done by Baum Pump Station and what is proposed for Goheenville. Cut a corner and add a third lane at a couple of spots and I think it would be good. But...... Why in Gods name didn't PennDot do this when they were upgrading at Pine Creek and Baum???? Maybe add some pull off areas for the slow trucks to let people by as a courtesy. I don't believe there needs to be four lanes the whole way to Brookville. All the commerce is South of Kittanning or West towards Butler anyway, there are already other four lane roads in those areas. |  | Don't displace people's homes and ruin farmland for this!!!<br>I am particulary adamant about this because my family has been displaced NOT ONCE, BUT TWICE, by the development of the route 28 corridor at Slate Lick. I now live close enough to 28 near Shannondale, that if a proposed path would displace me again, I think I might go off the deep end!!! |
| 40.907572 | -79.370624 |  | 380810 | point |  | 2/29/2020 | 275028 |  | This has always been a bad area that usually requires heavy breaking to avoid slower traffic ahead. This road needs to be more straight for traffic in both directions. |  |  | X |  |  |  | X |  |  |  |  | X |  |  |  |  | X | X |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 40.998962 | -79.342768 |  | 380811 | point |  | 2/29/2020 | 241607 | Guest | This turn is terrible for semi trucks as well as cars. It's a blind turn and a major hazard | X | X |  |  |  |  |  |  |  |  | X |  |  | X |  | X | X |  | X | X |  |  |  |  |  |  | X |  |  |  |  |
| 41.112111 | -79.205292 |  | 380812 | point |  | 2/29/2020 | 241607 | Guest | Speed |  | X |  |  |  |  |  |  |  |  |  |  | X | X |  | X | X |  |  |  |  |  |  |  |  |  |  |  | Speed limit drops suddenly no warning signs usually missing |  |  |
| 40.879963 | -79.392253 |  | 374463 | point |  | 2/29/2020 | 275054 |  | Traveling north and south in this area needs passing lanes due to the tractor trailer traffic climbing these hils. This route has alot of potential for travelers, especially freight but need to make this a road that can permit speeds of 65 mph and less tailgaters!!!! |  | X | X |  |  |  | X | X |  | This is a difficult route even for an experienced freight hauler to drive. If a driver is not familiar with this area, it is either very unsafe for anyone to be near that driver or you will be traveling at slow speed due to them being cautious!!!! With few places to pass... | X | X | X |  |  | X | X | X | X | X |  |  |  |  |  | X | X | X |  |  | Yes, seek someone with a loaded tractor trailer and ride along with that person to understand this road better... At this moment, this route is an exciting race track for a four wheeled vehicle, but not for a professional driver with a line of traffic behind them.....<br><br>.... |
| 41.00047 | -79.330098 |  | 380820 | point |  | 2/29/2020 | 275054 |  | Night of here traveling rt28 has too much congestion, not mich flat land to widen road, several communities with excessive speed changes so, convert rt66 into 4 lanes from this point north and make more revenue for towns along rt66 such as Clarion to build more, attract more for college recreation and suitable industry since it is perfect for more jobs to relocate to due to its setting! | X | X | X | X | X | X | X | X |  |  | X | X | X | X | X | X | X | X | X | X | X | X | X | X |  | X | X | X | 4 lanes to Clarion from kittanning after you make enough room for New Bethlehem to build a job building industry or route 4 lanes on to 66n to Clarion where the land is more level than 28north of New Bethlehem now and also is center of every attraction such as recreation, college, job opportunities along I-80/ future 4 lane rt66, perfect idea I say! Clarion has your potential especially with how the contour of the land between New Bethlehem and Clarion is now..... your going with the wide valley in between there.... leave the scenic rt28 north of New Bethlehem the way it is and make for less turns, inclines and bridges! |  | Feel free to contact me anytime, I am a professional of duty and would love to give ideas and help if all possible...... Traveled this area my haul life from 2 wheels to 18 wheels..... |
| 40.824145 | -79.48412 |  | 380821 | point |  | 2/29/2020 | 275059 |  | Going northbound,after the hill, there is a bend that is hard to see and dangerous .Going south it backs things up in traffic. |  | X |  |  |  |  |  |  |  |  |  |  | X |  |  | X | X | X |  |  |  |  |  |  |  |  | X |  | Afraid of being hit by on coming traffic. |  |  |
| 41.001628 | -79.330869 |  | 380836 | point |  | 3/1/2020 | 275112 |  | Bottleneck only New Bethlehem when traveling to Pittsburgh |  | X | X |  |  |  |  |  |  |  |  |  | X | X |  |  | X |  | X | X | X |  |  |  |  |  |  | X |  |  | Finding a way to make 28 4-lane from Brookville to Kitanning would be a major boon to traffic and commuters. If that wonâ€™t work, bypassing the towns and adding passing lanes on the steeper hills would be a good start |
| 41.015467 | -79.300609 |  | 380837 | point |  | 3/1/2020 | 275114 |  | Hawthorn to New Bethlehem are bottle neck delays driving. |  | X |  |  |  |  |  |  |  |  |  | X |  |  |  |  | X | X | X |  |  | X |  |  |  |  |  | X | Driving from Rte 80 to kittanning is very unpredictable time wise. Really should be 4 lane the entire way. Large trucks can delay the travel considerably. |  | In bad weather this route is dangerous with large trucks. Passing those trucks especially in bad weather is very dangerous |
| 40.970095 | -79.35529 |  | 380917 | point |  | 3/3/2020 | 257000 | Guest | Dangerous intersections with access points |  | X |  |  |  |  |  | X | X | Traveling to my camp |  |  | X |  |  | X | X | X |  | X |  |  |  |  |  |  | X |  |  |  |  |
| 41.004304 | -79.327824 |  | 380918 | point |  | 3/3/2020 | 257000 | Guest | Signalization |  |  |  |  |  |  |  | X |  |  |  |  | X |  |  | X |  |  | X | X |  |  |  |  | X |  |  |  |  |  |  |
| 40.872416 | -79.413097 |  | 374623 | point |  | 3/4/2020 | 275373 |  |  | X |  |  |  |  |  |  |  | X |  | X |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# APPENDIX C
## Online Mapping Survey Questions

**Route 28 Corridor Study**
**Wiki-map Survey Questions**
*01.17.20*

ADD PROBLEM OR OPPORTUNITY

1. Select a point type and then place on map.
   [Each point type receives a different list of concerns Q4-7]
   - Traveling via a car
   - Traveling via bike
   - Traveling via walking
   - Traveling via truck/freight vehicle

2. I use this area for: (Select all that apply)
   - Local commuting (Less than 10 miles each way)
   - Regional commuting (More than 10 miles each way)
   - Business travel (Deliveries, moving freight, etc.)
   - Accessing government services
   - Accessing Redbank Valley Trail
   - Accessing local schools
   - Accessing stores, services, goods, healthcare
   - Accessing recreational opportunities

3. How frequently do you use this facility?
   - Daily
   - Weekly
   - Monthly

4. What about this location causes you concerns? [CARS]
   - Pedestrian Safety
   - Cyclist Safety
   - Vehicle speeds
   - Slow moving vehicles
   - Congestion
   - Stopping or turning vehicles
   - Lack of connectivity
   - Interstate access
   - Roadway safety
   - Drainage
   - Parking
   - Signal timing
   - Roadway or bridge maintenance
   - Sight Distance

5. What about this location causes you concerns? [BIKES]
   - No shoulder

- Shoulder is too narrow
- Poor shoulder condition
- Debris
- Lack of bike lane
- Lack of protected bike lane
- Travel lanes are too narrow
- Drainage
- Vehicle speeds
- Roadway safety
- Proximity to large trucks/vehicles
- Connectivity to regional trail system
- Aesthetics

6. What about this location causes you concerns? [FREIGHT]
    - Pedestrian Safety
    - Cyclist Safety
    - Vehicle speeds
    - Roadway incline/grade
    - No climbing lane on steep grade
    - Travel lanes are too narrow
    - Intersection too narrow to safely turn
    - General congestion
    - Stopping or turning vehicles
    - Lack of connectivity
    - Shoulder width/condition

7. What about this location causes you concerns? [WALKING]
    - Sidewalk ends/no sidewalk
    - Sidewalk condition
    - Pedestrian safety/visibility
    - Roadway safety
    - No shoulder
    - Shoulder condition
    - Drainage
    - Vehicle speeds
    - Proximity to large trucks/vehicles
    - Crosswalk
    - Sidewalk not Americans with Disabilities Act (ADA) compliant
    - Connectivity
    - Aesthetics

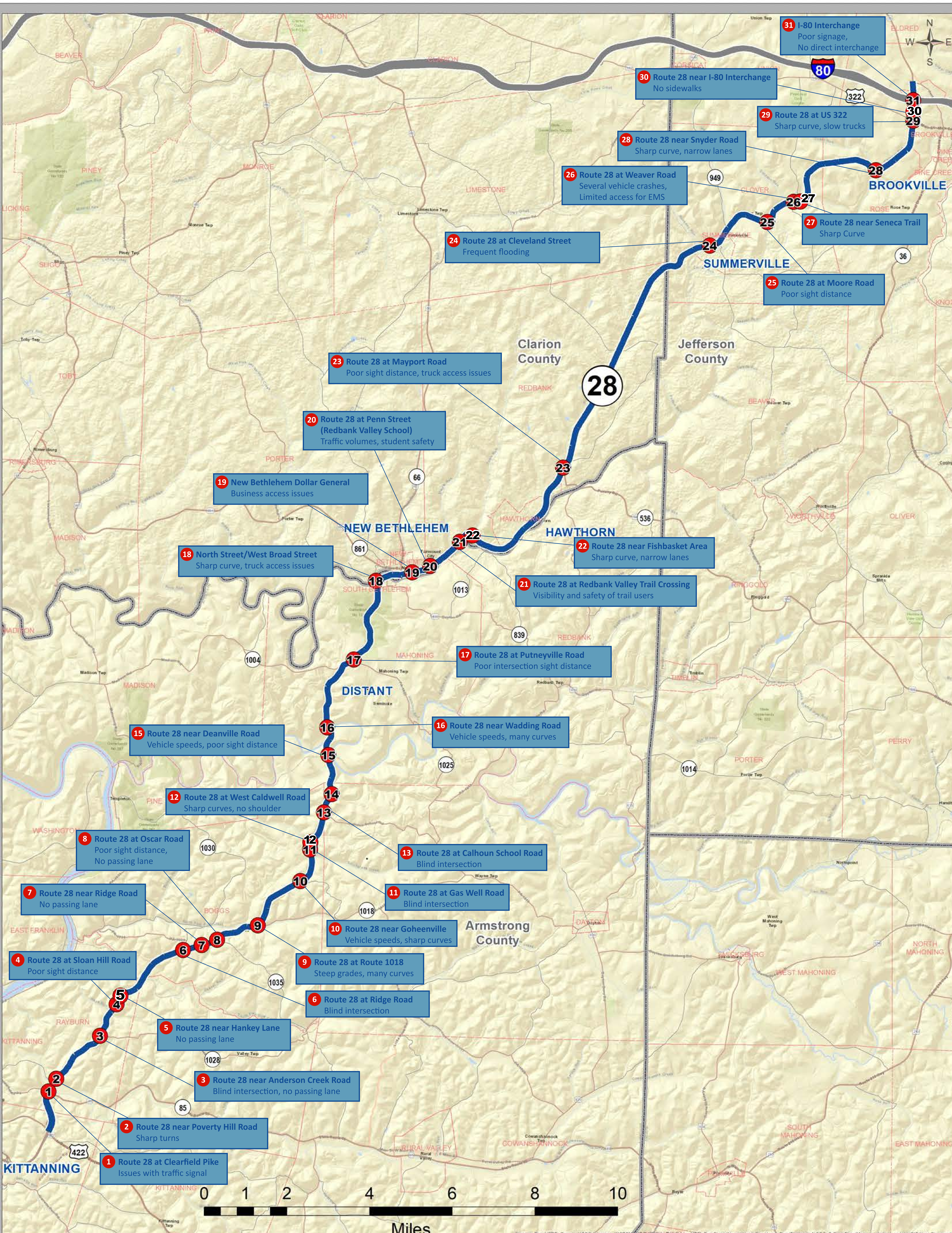
8. Please explain your concern. (open-ended)

9. Do you have a photo of this area of concern for us to consider? Please upload it here.

10. Is there any other information you would like us to know about the Route 28 corridor? (open-ended)

Click submit to return to the map to add any additional problems or concerns.

# APPENDIX D
## Public Concern Map




# Route 28 Kittanning to I-80 Regional Corridor Planning Study
## Public Survey Concern Locations

**Legend**

- County Boundary
- Municipal Boundary
- Route 28 Study Corridor
- State Routes
- Public Concern

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

# APPENDIX E
## Stakeholder Meeting Minutes

*Meeting:* Stakeholder Interview Meeting - Brookville *Date:* February 26, 2020

*Location:* Jefferson County Conservation District *Time:* 10:00am to 11:30am

*Attendees:* See attached sign-in sheet

*Purpose:* The purpose of the meeting was to interview a variety of stakeholders for the Route 28 Corridor Study Project to obtain input from their local knowledge for consideration of proposed improvement within the study.

*Discussion:* The format of the meeting followed an intial list of questioned provided to the stakeholders to guide the discussion. This list provided a general outline of project specific question regarding the use, operation and safety within the Route 28 Corridor. The following information provided a summary of the stakeholders input at the meeting and discussion:

- Traffic signals are not synchronized, and during an emergency detour situation, can cause traffic congestion. Presently, municipalities control them, but it would be good if a centralized authority made up of various stakeholders had operational control during emergencies.
- When traffic is detoured on I-80, some vehicles don't use the posted detour, and a lot of traffic is converging in Brookville at the intersection of SR 28 and US 322 near Sheetz. When I-80 is detoured, need coordination in Brookville due to traffic gridlock at that intersection.
- There is no parallel route for I-80 closures, people don't realize the detours and cell phones will just bring them right back into the detour. It was suggested to install message boards on parallel routes to control traffic on SR 28.
- Recently, a tanker had an accident on I-80, and traffic was detoured to SR 28. Traffic was at a standstill for hours and hazardous material freight was coming off the interstate onto SR 28 which creates potential for accident or contamination that close to the Red Bank Creek. There is a need for a spill response team or plan along the corridor.During detour traffic, it is also extremely difficult for local emergency vehicles to get through the detour congestion since the shoulders on the corridor are so narrow. They cannot bypass the traffic.
- I-80 has no signage to show that SR 28 leads to Pittsburgh, and the Pittsburgh Airport.
- Many accidents occur from the Brookville Borough line to Snyder Road.
- Coder Road experiences accidents with commercial vehicles turning into Coder Road.
- There are landslides that occur north of Summerville.
- There are issues on Anderson Creek Road with commercial vehicles in the wintertime getting stuck on the top of the hill due to the steep grade.
- The Redbank Creek runs parallel to SR 28. The main concerns are with its proximity to the roadway, including potential for hazardous materials spills, flooding, ice jams, and narrow shoulders around the Summerville area.
- I-80/SR 322/SR 28 is a potential economic hub/area for development that would benefit from improved alignment and traffic conditions.
- Mendenhall Road is a safety concern due to sight distance/blind curve.
- Mayport Road is a safety concern as trucks have difficulty turning here due to the skew of the intersection, which is compounded by poor sight distance caused by the hill and the curvature of the roadway.
- Amy Kessler asked the question if there would be an increase in freight traffic due to the Shell Pennsylvania Petrochemicals Complex in Beaver County (cracker plant). The consensus was there would not be significant changes, though some minor manufacturing trips to process the plastic pellets could use the corridor.
- Since the turnpike tolls are high, and some trucks use 28 as a connector. This increases commuter and truck traffic on SR 28. Fuel tax is also too high. Many trucks will drop down to take 68 and pay the lower gas tax in Maryland.
- The issue with possible tolling of major highways and its implication on SR 28 was discussed.
- The Potters Mills project further east on US 322 was discussed. It was the consensus that when this project is complete more traffic that would use the Turnpike will instead be using SR 28 as an alternate route since it's a better connection.
- Jefferson County PennDOT maintenance stated that there are several crash clusters along SR 28 due to hills and curves. They also reiterated that congestion becomes an issue when traffic is detoured from I-80, but vehicles are following GPS instead of the posted detour. Noted a need for coordinated overhead messaging signs. Transporting a sign out from the

District office to tell people to stay on the detour route takes too long to be efficient at moving people before it becomes gridlock.

- There is inconsistency in speed limit and prevailing speed on SR 28 for the length of the corridor.
- The Redbank Valley Trail does not have good connections to Route 28. There is a lack of signage denoting where the trail can be accessed. The current trail crossing north New Bethlehem is perceived as particularly challenging.
- The Mayport curve was discussed as having sight distance concerns.
- The Baxter curve was discussed as having issues due to geometry and sight distance. Trucks also speed through Baxter. A possible improvement would be Baxter and Summerville widening and flattening the existing curves.
- It was mentioned that cell phone coverage along SR 28 is inconsistent, which could cause concerns for vehicle breakdowns and for those following GPS.
- Miller Transportation indicated they have daily deliveries on the corridor and speed is an issue for them. They would like to see a 4-lane roadway from Brookville to Kittanning as they are expecting deliveries to grow.
- The Conservation District indicated that water quality and spills were a major concern with the potential for increased traffic and the frequent use of Route 28 as a I-80 detour route.
- Amy Kessler asked about truck parking on the corridor. Generally the consensus was that truck parking presents little concern along the corridor. No one noted designated or unofficial locations of truck parking overnight on the corridor. The representative of the local freight community said that more shippers are providing overnight amenities at their facilities due to the new regulations. Haulers are also considering changes to their hours of operation to take shipments to more effectively meet the regulations.
- Hazen interchange was discussed as a possible future development project that could impact the traffic on SR 28.
- ATV crossings were noted along SR 28. ATV signs in the area around Dewey Road.
- In general, school bus stops along the corridor are hazardous, particularly where there is a 3-lane section with a passing lane. Cars will pass school buses even when they are supposed to stop. For example, south of Coder Hollow, a bus stop is located where the 3-lane road begins. Not an ideal place for a bus stop as people are speeding to get to the 3-lane road and pass slower moving vehicles.
- The guide rail is thought to be insufficient in Summerville and Baxter because you are so close to the water. It was noted that in recent years, a vehicle ran off the road and a woman drowned in the creek.
- In the summer, farming equipment using the road south of Summerville and throughout the corridor often slows traffic.
- The following tourism draws were discussed:
    - Cooks Forest draws a lot of traffic from Pittsburgh
    - Trout season
    - Deer Season
    - Poker Runs
    - Peanut Butter Festival
    - Historic Brookville
    - Laurel Festival
    - Several festivals in the summer
    - Hazen Flea Market
    - Autumn Leaf Festival
- Companies located along the corridor are doing their own shipping which increases the number of trucks on the road. Logging company employs independent drivers.

A list of action items was developed to summarize the stakeholders input and potential improvement areas within the study. The study team will further evaluate these stakeholder concern locations with our existing conditions, crash history, geometric conditions, public input, and operational conditions. The stakeholder action items to be considered are listed below:

Action Item List:

- Determine existing Variable Messaging Signing (VMS) that exists on I-80 and its proximity to the Route 28 Corridor.
- Further discuss areas where VMS placement along the corridor at strategic locations may provide helpful information during an I-80 emergency detour for travelers to consider prior to entering into congested areas to reduce gridlock. Also, this could serve as advanced warning for winter weather events or incidents along Route 28.
- Evaluate potential directional signing updates along I-80 to indicate that Route 28 connects to Pittsburgh and the Pittsburgh International Airport.
- Potential areas where emergency responders may have difficulty getting through congested areas during the use of Rt 28 as an I-80 detour route.
- Further investigate specific concerns noted by stakeholders at the following locations:
    - Brookville Borough line to Snyder Road
    - Route 28 near the Redbank Creek near Summerville
    - Mendenhall Road sight distance
    - Route 28 and Mayport Road sight distance/truck turning concerns with entrance skew
    - Summerville and Baxter potential for deficient guide rail

The meeting was adjourned at approximately 11:15 a.m. by thanking the stakeholders for their feedback and time.

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

ROUTE 28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

**BROOKVILLE**
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| Josh Spano | SPC | jspano@spcregion.org | — |
| Ashley Tracy | McCormick Taylor | antracy@mccormicktaylor.com | |
| Kari Shedlock | French Engineering | Kshedlock@frenchengr.com | |
| Mary Eberhardt | French Engineering | meberhardt@frenchengr.com | |
| Evan Schoss | SPC | eschoss@spcregion.org | |
| Deb Wilson | JCCD | jccd@windstream.net | |
| Amy Kessler | NC R.P.O | Amy@ncentral.com | 814-773-3162 |
| Dave Tomaswick | PennDOT DISTRICT 10 | DTOMASWICK@PA.GOV | 724 357 2845 |
| Jamie [illegible] | JCDC | | |
| Steve McPherson | Miller Fabrication Solu. | smcpherson@millerfabricationsolutions.com | 814-715-0691 |
| Joe Barber | Barber Trucking | joe@barbertrucking.com | 814-913-1526 |
| AARON EMHOFF | PENNDOT | aemhoff@pa.gov | 814-939-9167 |
| Jack Matson | Jefferson County | Jmatson@JeffersonCountyPA.com | 814-849-1653 |
| Herb Bullers Jr | Jefferson Co. | hbullers@jeffersoncountypa.com | 849-1653 |
| Jeff Pisarcik | Jefferson cty | jpisarcik@jeffersoncountypa | 849-1653 |

ROUTE 28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
## INTERVIEW INVITATION SIGN IN SHEET

**BROOKVILLE**
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| Tracy Zents | Jefferson County | tzents@jeffersoncountypa.com | 849.5052 |
| Chris Clark | Jefferson County 911 | cclark@jeffersoncountypa.com | 849-4009 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

*Meeting:* Stakeholder Interview Meeting – New Bethlehem | *Date:* February 26, 2020

*Location:* New Bethlehem Public Library Community Room | *Time:* 1:00pm to 2:30pm

*Attendees:* See attached sign-in sheet

*Purpose:* The purpose of the meeting was to interview a variety of stakeholders for the Route 28 Corridor Study to obtain input from their local knowledge for consideration of proposed improvement within the study.

*Discussion:* The format of the meeting followed an intial list of questioned provided to the stakeholders to guide the discussion. This list provided a general outline of project specific question regarding the use, operation and safety within the Route 28 Corridor. The following information provided a summary of the stakeholders input at the meeting and discussion:

- The pedestrian crossing at Redbank Valley School is challenging with fast-moving vehicles nearby and many pedestrians. Vehicles typically park across SR 28 from the school and children cross SR 28 to get to their parents. They would like to evaluate a sign and/or traffic signal.
- The trail crossing is under PUC authority because it's a railbanked corridor. The crossing is particularly difficult and would benefit from signing in advance of and at the crossing, flashing lights, as well as a realignment of the trail so that it is perpendicular to the road and shortened, instead of crossing at a diagonal. The painted crosswalk across SR 28 was removed due to driver complaints, but the location has anecdotally had numerous accidents with folks driving off the road.
- The question was also posed if the restrictions on Tourist Oriented Directional Signing (TODS) could be lessened. The town would benefit from markers for economic development of businesses on trail, including B&B's, as well as for parking areas.
- There may be trail counts done by the Redbank Valley Trail Association, though most counters have been damaged or stolen. Study team will look into obtaining previous counts taken of the trail users.
- The Mahoning Township supervisors mentioned a study that was done to look at locations for the trail or roadway in front of Nolf Chrysler, that would side cut the hill, flatten the trail past Chrysler but there was a wetland issue that stopped the study moving forward. Wetland mitigation was mentioned as a potential solution for the project. Study team will look into obtaining this information.
- Redbank Valley High School has issues with pedestrians crossing the street during the school dismissal hour at 3:10pm. Parents park in the Subway and Chiropractor parking lots and then jump onto Route 28. They said there is plenty of parking in the back of the school, but that parents and students don't want to use it. They have crossing guards but are curious if a traffic signal could help. It's primarily drivers, with some walking students crossing to walk down the trail to get back to their homes. Dr. Mastillo, superintendent of the Redbank Valley School District, was supposed to attend but could not at the last minute, study team will follow up with him.
- It was discussed that congestion becomes an issue when traffic is detoured from I-80 but vehicles are following GPS instead of the posted detour.
- There is a operational concern at the SR 28/SR 66 intersection when trying to detour trucks due to geometric constraints. Trucks frequently hit the building and traffic signals at this location. The pole has been hit 8 times since the pedestrian ramp was installed. One day there was a bollard, but it kept getting hit and never came back. Cars also regularly pull beyond the stop bar and this creates congestion because trucks cannot navigate the turn with them there.
- Generally, the PSP has issues along SR 28 due to hills, climbing lanes (or lack of) needed at Hogback Hill and Orchardville Hill toward Exxon Station to Baum Pump Station. Other issues include snow, trucks that get diverted from I-80, and speeding along the corridor.
- PSP said speed along Route 28 is a safety concern, but there is not a high rate of crashes in this area of Route 28 if you compare it to the lower portion of Route 28.

- There is a choke point at the bridge in New Bethlehem over Redbank Creek which causes congestion. Any major crash, spill, or slide would wreak havoc on the transportation system because there is no way around it. The transportation system is very limited in this area.
- It was indicated that there should be improvements to the crosswalks throughout New Bethlehem and Hawthorn.
- Speed is an issue at the mini mall. The speed limit is 35 mph in one direction and 25 mph in the other. PennDOT mentioned that it should not be signed differently in opposing directions, and that the roadway needs to meet certain requirements to be posted at 25mph, including 85$^{th}$ percentile speed and residential density.
- There was another speed limit difference noted in Hawthorn, where it is 45 mph in one direction and 35 mph in the other. PennDOT again stated that it should not be signed as such.
- Along SR 28 from Kittanning, there are issues with erosion which is causing the guiderail to shift.
- Generally, the Redbank Creek runs along SR 28 too close to the road (horizontally and vertically) and during the winter months, ice jams cause issues over the roadway, including flooding. It was suggested that the stream needs to be dredged in some areas to remove debris. The Leisure Run flood is still being cleaned up.
- The 3-lane roadway ends at the Mahoning Creek Bridge.
- There is a 55/40/55 speed differential through difficult geometry which makes traveling through Distant difficult.
- A northbound turning lane begins where a passing lane ends at the crest of a hill at Calhoun School Road. This poses a safety concern for potential rear end and head on collisions. People think this is an extension of the passing lane and use it for passing.
- There is an ice cream shop directly adjacent to SR 28 that is very popular near Distant. Distant Dairy and Dollar General have a lot of traffic and generate pedestrians close to the roadway. Dollar General is noted as a difficultarea to pull out of due to blind curves. Some places in Distant lack sidewalks.
- There are rockslide and hill side erosion issues along the corridor which occur frequently and in many places.
- The intersection of SR 28 and SR 536 Mayport Road has deficient sight distance.
- Smucker's currently has access issues to their plant that could be addressed with a future project. In particular, the intersection of Wood and Penn poses an issue for trucks driving to Smucker's having to use local roads. Trucks get trapped and end up driving into people's yards and break the curb and sidewalk. They would like to see Smucker's have their own access road, but a study was done in the past and there was possibly a problem with sight distance that could not be overcome. Ms. Amato was involved with the Economic Development Commission with this study. The study team will obtain a copy.
- New Bethlehem Borough provided a list of issues that are included as an attachment to this summary.
- The passing lane at Distant is not long enough coming up the hill, then you hit 40mph, and SR 1004 is a quick turn with poor deceleration length.
- Upper/Lower Hayes at 28, and South Main Street could use a turn lane to separate turning vehicles from the general through traffic.
- Parking near the Sunoco/Key Beverage on Broad Street causes issues for traffic traveling WB turning into Sunoco. It could use a turn lane or restrict some parking closer to the area to provide room to turn into these businesses.
- There is acid mine drainage from Summerville to Moore Road in Corsica.
- On the 3 lane sections of SR 28, it has been noticed by PSP that vehicles in the opposing outermost lane do not stop for school buses when they legally are required to.
- There are sight distance issues at the PennDOT maintenance/school bus turnaround location at the Jefferson County line.
- The sidewalks in Distant and South Bethlehem are in poor condition.
- It was suggested that turning lanesare needed at Sloan Hill Road and Calhoun Crest.
- There are little to no issues with freight loading in the downtown New Bethlehem area. There aren't many places that freight has to stop.
- The following tourism draws were discussed:
    - Redbank Valley Trail

- Redbank Creek during trout season
  - Bed and Breakfast locations
  - Local campgrounds
  - The County Fair at the end of July is a large traffic generator
  - Poker Runs (ATV event)
  - Peanut Butter Festival
  - Friday night football games
  - Deer season
  - I-80/SR 28 in Brookville is a route to the Pittsburgh International Airport

The meeting was adjourned at approximately 1:15 p.m. by thanking the stakeholders for their feedback and time. A list of action items was developed to summarize the stakeholders input and potential improvement areas within the study. The study team will further evaluate these stakeholder concern locations with our existing conditions, crash history, geometric conditions, public input, and operational conditions. The stakeholder action items to be considered are listed below:

Action Item List:

- Consider potential for climbing lanes at Hogback Hill and Orchardville Hill toward Exxon Station to Baum Pump Station.
- Consider potential/need for alternate route to bypass bridge in New Bethlehem over Redbank Creek during an incident.
- Consider designated crosswalk improvements for consistent and safe pedestrian access across Route 28.
- Obtain trail counts and previous studies on crossing locations performed by the Redbank Valley Trail Assocation.
- Obtain Smucker's access study for consideration.
- Connect with school superintendent separately to note New Bethlehem School District's concerns along the corridor.
- Document areas of inconsistent speed limits along Route 28 and in certain area in NB and SB directions.
- Investigate potential narrow shoulders or flooding issues where Redbank Creek is close to Route 28.
- Consider potential turning lanes at Upper/Lower Hayes Road and at South Main Street.
- Consider pedestrian access and sidewalks in Distant and South Bethlehem.
- Consider improvements at Sloan Hill Road and Calhoun School Road to improve sight distance and safety.
- Further investigate specific concerns noted by stakeholders at the following locations:
  - Pedestrian crossing at Redbank Valley High School.
  - Redbank Trail crossing at Route 28.
  - SR 28/SR 66 intersection geometric improvements for trucks to navigate the intersection.
  - Calhoun School Road where the northbound passing lane ends at the crest of a hill and stops in a turning lane.
  - Pedestrian connections and sight distance at Distant Dairy and Dollar General.
  - SR 28 and SR 536 Mayport Road and potential improvements to address deficient sight distance.
  - Hogback Hill potential lengthening of passing lane coming up into Distant.
  - Jefferson County line PennDOT maintenance/school bus turnaround location sight distance issues.

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

Borough of New Bethlehem Identified Areas of Concern

Photos of Meeting

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

**NEW BETHLEHEM**
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| Annie Latour | XIX | | |
| Ryan Gordon | SPC | | |
| Tom Seidle | Mahoning Twp | tomseidle@yahoo | 814-319-5600 |
| Terry Beamer | Hawthorn | | |
| Ken Blake | Mahoning Twp | | 814-221-9819 |
| Malinda Little | Hawthorn Boro. | | 814-319-3401 |
| Eric Simko | PSP Kittanning | ESIMKO@PA.GOV | 724-543-2011 |
| Dave Tomaswick | PennDOT District 10 | DTOMASWICK@PA.GOV | 724 357 2845 |
| Kristi Amato | Clarion Co. Planning | kamato@co.clarion.pa.us | 814-226-4000, x2800 |
| Keith Schreckengost | Mahoning Twp Arms | | 814-229-5441 |
| Gordon Barrows | New Bethlehem Mayor | mayor@NewBethlehemBoro.com | 814-275-2003 |
| Josh Clinger | Clarion County PennDOT | jclinger@pa.gov | 814 226-8200 |
| Sandy Mateer | New Beth Boro, Redbank Valley Trails Assn | scmateer1@gmail.com | 814-275-1718 |
| Ashley Tracy, Josh Spano, Evan Schoss, Kari Shedlock, Mary Eberhardt (Project Team) | | | |
| | | | |

| | | | |
|---|---|---|---|
| *Meeting:* | Stakeholder Interview Meeting - Kittanning | *Date:* | February 26, 2020 |
| *Location:* | The Belmont Complex | *Time:* | 4:00pm to 5:30pm |

*Attendees:* See attached sign-in sheet

*Purpose:* The purpose of the meeting was to interview a variety of stakeholders for the Route 28 Corridor Study Project.

*Discussion:* The following outlines the highlights of the discussion:

- The concerns expressed by the EMS/Ambulance representative were that the hills and geometry of SR 28 present a challenge in getting patients to the most appropriate local hospital. The Armstrong Hospital has advanced cardiac technologies that other local hospitals do not, and many times flights are needed to get patients to the Armstrong Hospital.
- Truck traffic presents an operational and safety concern due to speed differentials between cars and trucks. Many times, vehicles pass slow moving trucks in a no passing zone. Suggested a need for additional truck climbing lanes near Orchardville.
- Spacious Corners / Sloan Hill Road has poor sight distance due to the hill and curve.
- At the top of Hogback Hill at the truck weigh station, sight distance is poor, and trucks are slowing down, stopping, pulling over in this location. Trucks also sometimes don't stop as directed and roll through the brake check area and pull out in front of cars.
- Goheenville – speeding issues are noted. An improved project in this area is currently being designed by PennDOT.
- The concerns expressed by the local trucking company, who delivers heating oil and other seasonal products, were that houses are too close to the road in many locations. Other areas of concern were brake check stops, the Baum Pump Station, and the "tickle turn" by Horse Trader just north of SR 85 that has a sharp turn that is difficult for trucks to maneuver at high speeds. There was a recent project that fixed some geometric issues but the project limits did not address that turn. They would like to see the improvements continued to address the sharp turn.
- The crosswalk at Fish Basket needs to be straight across the road. (This is the New Bethlehem crossing of the Redbank Valley Trail).
- Speeding is a concern at the 15 mph curve in South Bethlehem. Trucks frequently overtrack and sometimes roll over.
- The discussion regarding the traffic models incorporating drawing additional freight traffic from other major adjacent highways such as I-79, I-80, Route 8, and US 119 was discussed. It was determined that the tools to address this quantitatively are limited, so this would be considered qualitatively..
- There are sight distance and access concerns coming out of Oscar Road.
- There is significant congestion in the afternoon in New Bethlehem. Better coordination of the two signals in New Bethlehem was suggested.
- There is a crash history in Distant due to the narrow roadway/shoulders and the stream located so close to the road, north of Wadding Road to Redding Road.
- There is an active slide at the Pine Creek Bridge.
- Other general concerns included narrow shoulders, lack of truck lanes, trout and deer season congestion, Sloan Hill Road blind curve with buses pulling out, sight distance at Lower Hays to Upper Hays Run, and SR 28 near SR 1035 Oscar Rd needs truck lanes and wider shoulders.
- The following tourism draws were discussed:
    - Port Armstrong Folk Fest
    - Armstrong Festival
    - Arts on Allegheny
    - ATV events
    - Cooks Forest

- Autumn Leaf Festival
- Peanut Butter Festival
- Proposed ATV Facilities – large scale improvements, Poker Runs, Scrubgrass Run, a big draw

The meeting was adjourned at approximately 5:15 p.m. by thanking the stakeholders for their feedback and time. A list of action items was developed to summarize the stakeholders input and potential improvement areas within the study. The study team will further evaluate these stakeholder concern locations with our existing conditions, crash history, geometric conditions, public input, and operational conditions. The stakeholder action items to be considered are listed below:

Action Item List:

- Consider EMS provider concerns with Route 28 geometry and access to Armstrong Hospital.
- Consider local freight provider concerns with Route 28.
- Consider a need for additional truck climbing lanes near Orchardville.
- Consider better coordination of the two signals through New Bethlehem.
- Further investigate specific concerns noted by stakeholders at the following locations:
    - Sloan Hill Road sight distance.
    - Hogback Hill in general at the truck weigh station.
    - Route 28 at the Redbank Trail concerns for pedestrians crossing.
    - 15mph curve south of New Bethlehem where trucks frequently overtrack and sometimes roll over.
    - Oscar Road sight distance and truck access concerns.
    - Lower Hayes Run turning vehicle provisions.
    - Discuss with School District separately their concerns along the corridor.
    - Coordinate with Armstrong County on planned and potential future developments.

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

Photos of Meeting

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

KITTANNING
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| ALFRED S. KAMMERDIENER | BOGGS TWP. | | 724-545-7142 |
| Allie Pence | Armstrong Co. Planning | arpence@co.armstrong.pa.us | 724-548-3734 |
| Carmen Johnson | Arm. Co. Planning & Development | cejohnson@co.armstrong.pa.us | 724.548.3721 |
| Dave Tomaswick | PENNDOT District 10 | DTOMASWICK@PA H2O | 724 357 2845 |
| Bill Clark | Boggs Twp / Pinetop Fire | WCST87@yahoo.com | 724954 6791 |
| Lynda Pozzuto | Armstrong Chamber | lynda@akstrong.com | 724-224-3400 |
| Mike Coonley | Arm. Co. Economic Dev | mpcoonley@co.armstrong.pa.us | 7245481500 |
| Steven Baker | Kittanning Twp VFD | stelibaker@yahoo.com | 724-664-3995 |
| Keith Bowser | Bradigans Inc | keith@bradigans.com | 724-525-3562 |
| Andy Bradigan | Bradigan's Inc | andy@bradigans.com | 724-525-8956 |
| Jason Orton | ACMH | jason.orton@AHN.org | 412-491-9256 |
| Justin Nolder | Arm. Co. Econ. Dev. | jrnolder@co.armstrong.pa.us | 724-548-1500 |
| Ryan Gordon, Ashley Tracy, Kari Shedlock, Mary Eberhart (Project Team) | | | |
| | | | |
| | | | |

# APPENDIX F

## Existing Conditions Memorandum

ROUTE 28
CORRIDOR STUDY
FROM KITTANNING TO I-80

# EXISTING CONDITIONS MEMO

June 2020

Prepared by: McCORMICK TAYLOR

Prepared for: SOUTHWESTERN PENNSYLVANIA COMMISSION (SPC)

# Table of Contents

## CONTENTS


Table of Contents .......... 2
List of Exhibits .......... 3
Appendices .......... 4
Study Area .......... 5
  Transportation and Land Use Context .......... 5
  Geography .......... 5
  Steering Committee & Study Goals .......... 7
Previous Studies .......... 8
  Previous and Related Studies .......... 8
Traffic Analysis .......... 12
  Existing Traffic Conditions .......... 12
  Counted Intersections .......... 14
  Traffic Analysis Methodology .......... 18
  Synchro and Intersection Control Assumptions .......... 18
  Highway Capacity Analysis Assumptions .......... 26
  Traffic Analysis Results .......... 27
  Speed and Travel Times .......... 29
  Grades .......... 33
  Detour Conditions .......... 35
  Streetlight Data .......... 40
Safety Analysis .......... 47
  Methodology .......... 47
  Crash History Analysis .......... 47
  Crash Rate Comparison .......... 51
  PennDOT Safety Screening .......... 52
  Safety Summary .......... 52
Multimodal Facilities .......... 61
  Distant .......... 61
  South Bethlehem .......... 61
  New Bethlehem .......... 61
  Library and Redbank Valley High School .......... 62
  Redbank Valley Trail Crossing .......... 62
  Hawthorn .......... 63
Geometric Considerations .......... 71
  Design Criteria .......... 71
  Typical Sections .......... 71
  Horizontal and Vertical Geometry .......... 71
Community Outreach .......... 76
  Stakeholder Outreach .......... 76
  Public Survey .......... 77
Field Observations .......... 82
  Field View .......... 82
Conclusion .......... 84

## List of Exhibits


Exhibit 1 – Study Area Limits ....6
Exhibit 2 – Previous Studies Areas of Concern ....10
Exhibit 3 – Estimated Cost Breakdown for 1994 and 2020 ....11
Exhibit 4 – Average Daily Traffic Data ....12
Exhibit 5 – Route 28 Permanent Count Station Hourly Traffic Counts ....12
Exhibit 6 – PennDOT Count Stations ....13
Exhibit 7 – Counted Intersections ....14
Exhibit 8 – Turning Movement Count Locations ....15
Exhibit 9 – Peak Hour Volumes and Truck Percentages (2019 AM Peak) ....16
Exhibit 10 - Peak Hour Volumes and Truck Percentages (2019 PM Peak) ....17
Exhibit 11 – Intersection Characteristics ....19
Exhibit 12 – Level of Service Criteria for Signalized and Unsignalized Intersections ....19
Exhibit 13 – Intersection Level of Service (2019 AM) ....20
Exhibit 14 - Intersection Level of Service (2019 PM) ....23
Exhibit 15 - Level of Service Thresholds for Interstates ....26
Exhibit 16 - Level of Service Thresholds for Twolane Highways ....26
Exhibit 17 – Highway Capacity Analysis Results for General Segments ....27
Exhibit 18 – Highway Capacity Analysis Results for Climbing Lanes ....28
Exhibit 19 – Speed Limits ....30
Exhibit 20 – Maximum Observed Speeds All Vehicles ....31
Exhibit 21 – Speed Differential between Cars and Trucks ....32
Exhibit 22 – Grades and Climbing Lanes ....34
Exhibit 23 - Route 28 Posted Detour Routes ....36
Exhibit 24 – I-80 Posted Detour Routes ....37
Exhibit 25 - Southbound Route 28 Speed Effects during I-80 Closure (Near US 322) ....38
Exhibit 26 - Southbound Route 28 Speed Effects during I-80 Closure (Near New Bethlehem) ....38
Exhibit 27 - Southbound Route 28 Speed Effects during I-80 Closure (Near Kittanning) ....39
Exhibit 28 - Trip Characteristics ....40
Exhibit 29 - Home Grids for Route 28 Corridor Travelers ....41
Exhibit 30 - Origin-Destination Heat Map (Weekdays) ....41
Exhibit 31 - Redbank Valley Trail (New Bethlehem) User Demographics ....42
Exhibit 32 - Redbank Valley Trail (New Bethlehem) Trip Characteristics ....43
Exhibit 33 - Distribution of Traffic Passing a Point On Route 28 near South Main St Brookville ....44
Exhibit 34 - Distribution of Traffic Passing a Point On Route 28 near South Main St Brookville ....45
Exhibit 35 - Top Routes from Pittsburgh to Brookville ....46
Exhibit 36 – Geographic Context of Overall Crash Frequency ....47
Exhibit 37 – Crashes by Context Area ....48
Exhibit 38 – Crash Location Breakdown ....49
Exhibit 39 – Crash Type Breakdown ....49
Exhibit 40 – Crash Severity Breakdown ....49
Exhibit 41 – Crash Time of Day Breakdown ....50
Exhibit 42 – Crash Weather Condition Breakdown ....50
Exhibit 43 – Crash Seasonality Breakdown ....50
Exhibit 44 – Crash Illumination Type Breakdown ....50
Exhibit 45 – Crash History Comparison (Fatalities) ....53
Exhibit 46 – Crash History Comparison (Hit Fixed Object) ....54

Exhibit 47 - Crash History Collision Type Analysis (Insets 1) ........55
Exhibit 48 - Crash History Collision Type Analysis (Insets 2) ........56
Exhibit 49 - Crash History Collision Type Analysis (Insets 3) ........57
Exhibit 50 – Crashes Involving a Pedestrian ........58
Exhibit 51 – Crashes Involving a School Bus ........59
Exhibit 52 – PennDOT Safety Screening Segments ........60
Exhibit 53 – Redbank Valley Trail System........64
Exhibit 54 - Multimodal Facilities (Distant)........65
Exhibit 55 – Multimodal Facilities (South Bethlehem)........66
Exhibit 56 - Multimodal Facilities (New Bethlehem)........67
Exhibit 57 – Multimodal Facilities (New Bethlehem Plaza and High School Area) ........68
Exhibit 58 - Multimodal Facilities (Redbank Valley Trail Crossing of Route 28) ........69
Exhibit 59 - Multimodal Facilities (Hawthorn)........70
Exhibit 60 – Design Chart Horizontal Radii........71
Exhibit 61 – Areas with Horizontal Radii Less Than Current Recommended Design Value ........72
Exhibit 62 – Areas of Horizontal Deficiency........73
Exhibit 63 – Area with Vertical Grades Exceeding Maximum Design Grade........74
Exhibit 64 – Vertical Deficiency ........75
Exhibit 65 – Stakeholder Concern Locations........78
Exhibit 66 – Public Survey Concern Locations ........79
Exhibit 67 – Summary of Public Survey Concern by Mode ........80
Exhibit 68 – Field Observation Locations ........83

## Appendices

Appendix A – Cost Estimate
Appendix B – Capacity Analysis
Appendix C – Design Criteria
Appendix D – Stakeholder Meeting Minutes
Appendix E – Survey Summary
Appendix F – Field Notes

## Study Area

### Transportation and Land Use Context

The Route 28 Corridor Study focus area encompasses an approximately 40-mile length of Route 28 from the US 422 interchange near Kittanning to the south to the I-80 interchange near Brookville in the north (**Exhibit 1**). The land use surrounding the corridor is primarily agricultural, low-density residential, and undeveloped forest. Communities developed along Route 28 in support of the industries of lumber, mining, farming, and manufacturing in the early 1800's and 1900's, including Kittanning (est. 1803, pop. 3795), New Bethlehem (est. 1853, pop. 929), Hawthorn (est. 1916, pop. 466), Summerville (est. 1887, pop. 528), Brookville (est. 1830, pop. 3933) and villages such as Distant and Orchardville. Many of these industries continue to operate along the corridor to this day, though at reduced capacity similar to the trends of the region and nation for similar types of roadway and demographics. Freight operators in the corridor typically deliver heating oil, timber, coal, aggregates, and mechanical equipment.


Route 28 was designated from Pittsburgh to Kittanning in 1927. In the highway expansion era of the 1960's, the route was widened from Pittsburgh to Kittanning to a primarily four-lane divided expressway. Early studies evaluated widening of the remainder of Route 28 from Kittanning to Interstate 80. Over the years, a series of improvements to the existing two-lane template have been made within the study corridor to improve operations and safety and regional connectivity.

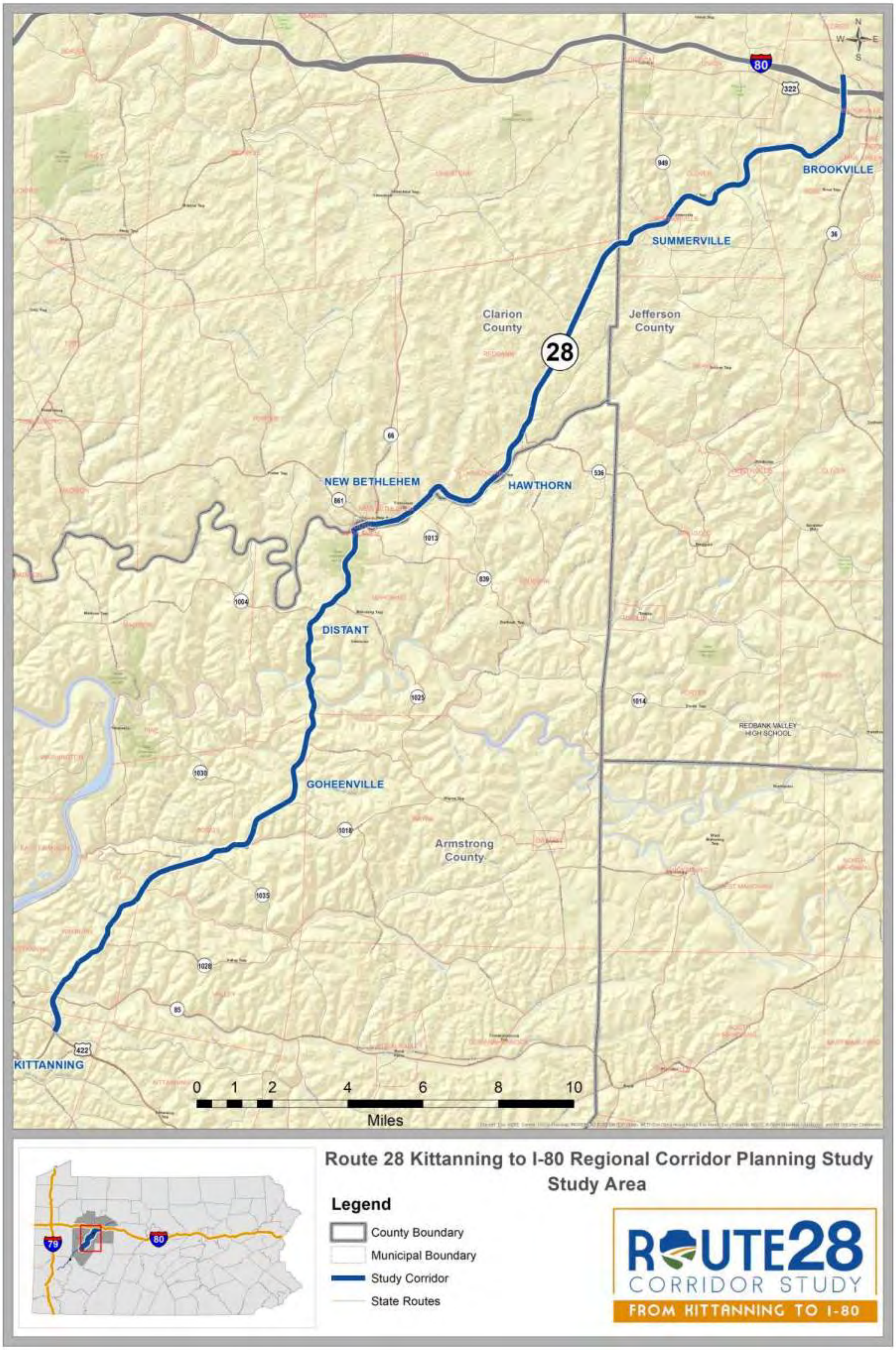
The corridor today serves many purposes. It serves short trips for residents and local agriculture and business owners, and longer regional trips for Pittsburgh-bound commuters and freight operators. Taking New Bethlehem as the approximate middle point of the corridor, it takes approximately 1 hour 10 minutes to drive to Pittsburgh along Route 28. The corridor between Pittsburgh and I-80 provides a critical temporary detour of I-80 traffic during fairly frequent traffic incidents on I-80.

The surrounding land and environmental features draw outdoor enthusiasts, including hunting, fishing, camping, and ATV riding. ATV organizations on the corridor frequently host Runs, which draw thousands of ATVs to the valley and its trails. Redbank Creek offers trout fishing and kayaking activities. The creek runs roughly parallel to the corridor north of New Bethlehem, visibly close to the roadway in some areas where it winds through Summerville toward Brookville. Businesses are frequently located directly adjacent to the corridor. Route 28 runs through the Central Business District of New Bethlehem and the campus of Redbank Valley High School. There is an at-grade trail crossing of the Redbank Valley Trail in New Bethlehem. The last train ran on the rail corridor in 2007, when it was railbanked and transformed into the Redbank Valley Trail, a 51-mile non-motorized trail that connects from Brookville in the north, westward to the Armstrong Trail.

### Geography

Route 28 runs through unique geography that could roughly be broken down into three sections. The southern section from approximately Kittanning to New Bethlehem hosts mountainous terrain adjoining steep slopes with long grades exceeding 9% in some areas and winding turns. Truck climbing lanes and brake check areas are found throughout this portion of the corridor. In the middle section of the corridor from approximately New Bethlehem to Summerville, the mountains begin to break to flatter, rolling hills with passing zones and clearer lines of sight. The northern section of the corridor from Summerville to US 322 has rolling terrain, but winds horizontally around the mountain and generally follows the Redbank Creek. The segment from US 322 to I-80 is built-up with commercial businesses and densely spaced driveways, travel service amenities, signals, and four lanes of traffic with turning lanes.

*Exhibit 1 – Study Area Limits*



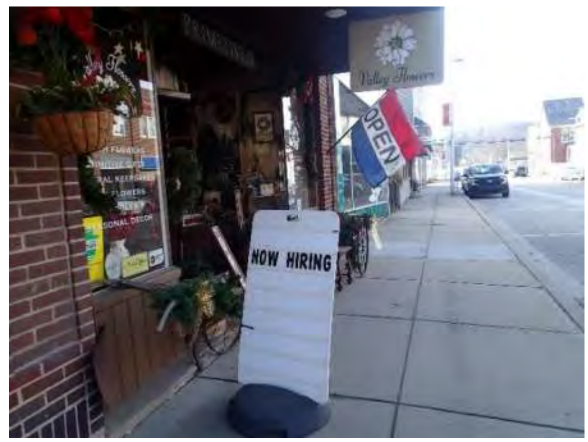
## Steering Committee & Study Goals

**Steering Committee Members**
Southwestern Pennsylvania Commission
North Central RPO
Northwest RPO
Armstrong County
Clarion County
Jefferson County
PennDOT District 10

The purpose of this study is to understand and address the present and future needs of the Route 28 corridor, from an operational and safety perspective for all modes of travel to support current and future business development and enhance the quality of life for the residents along the corridor. A Steering Committee was established to guide the study and make decisions as it progressed. The goals of the study were developed with the Steering Committee. These goals were used to guide conversations with the public and corridor stakeholders to uncover specific areas of concern or opportunity for improvements. These goals will also be used to determine the effectiveness of conceptual improvement alternatives.

**Route 28 Study Corridor Goals**:

- **Improve Safety -** improve safety for all modes of transportation
  - **Improve Security** – improve security by maintaining critical assets such as bridges and reducing emergency response times
- **Support Regional Economic Development** – promote the corridor as a regional trade route between I-80 and Pittsburgh, in addition to attracting new businesses
  - **Promote Tourism** – promote tourism to historic locations, trails, and outdoors activities
- **Facilitate Regional Connectivity** – facilitate connections to regional routes
  - **Accommodate Multimodal Use** – improve existing and plan for new multimodal connections to non-motorized facilities
  - **Accommodate Freight Movement** – facilitate access for freight and trucks
- **Improve Operations** – improve operations and reduce congestion
  - **Improve Resiliency / Reliability** – provide reliable travel times
  - **Focus on Asset Preservation** – maintain a good state of repair of assets such as bridges, guide rail, signs, drainage, slopes, lighting, and pavement structure




- **Minimize Environmental Impacts** – minimize impacts to the environment and community
    - **Improve Quality of Life** – improve quality of life by providing access to a safe and efficient transportation system and public resources
    - **Gain Community Buy-in/Satisfaction** – promote projects that have broad community support and meet the study's goals, and minimize impacts to the traveling public during construction

# Previous Studies

## Previous and Related Studies

The Route 28 Corridor is also known as the Alexander H. Lindsay Memorial Highway or the Allegheny Valley Expressway. This section of the Route 28 Corridor from Kittanning to Brookville, mile marker 40 to mile marker 80 of the 98 mile corridor has been the subject or mentioned in a number of studies over the past 30 years. The relevant previous studies were reviewed for their findings to assist in evaluating the corridor to consider advancing with future conceptual improvements with this study (**EXHIBIT 2**).

The studies consulted included:

- State Route 28 Feasibility Study Kittanning to I-80 Armstrong, Clarion & Jefferson Counties, Pennsylvania. Michael Baker, Int'l. June 1994.
- Armstrong County Comprehensive Plan. Mullin & Lonergan Associates Incorporated, 2005.
- Clarion County Comprehensive Plan. Clarion County Planning Commission & Graney, Grossman, Ray and Associates, 2004.
- Jefferson County Comprehensive Plan Update – 2018. The EADS Group, July 2018.
- North Central PA RPO Long Range Transportation Plan. North Central PA Rural Planning Organization, July 2017.
- North Central PA Regional Safety Study. McCormick Taylor, March 2012.
- Northwest PA Commission 2015-2040 Long Range Transportation Plan. Northwest PA Commission, June 2015.
- Redbank Valley Trail Feasibility Study. Mackin Engineering Company, June 2011.
- Smart Moves for a Changing Region. Southwestern Pennsylvania Commission, 2019.
- Southwestern Pennsylvania Regional Freight Plan. Resource System Group Inc. (RSG), French Engineering, Whitman, Requardt, and Associates, LLP (WRA), 2016.

The most recent previous study was the State Route 28 Feasibility Study Kittanning to I-80 Armstrong, Clarion & Jefferson Counties, Pennsylvania. Michael Baker, Int'l., June 1994. This feasibility study examined the section of Route 28 between Kittanning, PA and Interstate 80. The initial recommendation based on a Preliminary Location Study for State Route 28 completed by The Pennsylvania Department of Transportation in the 1960's was to extend a 4 lane, limited access facility from Aspinwall to I-80. A portion of this recommendation was built in the 1970s and 1980s terminating in Kittanning, PA. This study examined the feasibility of continuing the 4-lane template from Kittanning to I-80. As part of the study a conceptual cost estimate was completed to complete this widening. This cost estimate was examined and escalated to 2020 dollars (**EXHIBIT 3**). While this estimate accounts for the construction cost, it does not take into account more stringent modern environmental regulations. In particular, regulations related to stormwater management volume and rate management and water quality treatment and the mitigation of protected environmental features such as streams and wetlands located throughout the corridor. Accounting of this design, permitting, environmental and community impacts, construction, and future maintenance, presents potentially hidden costs which would place a further strain on initial design and construction costs and future PennDOT maintenance of the permitted stormwater and mitigation features.

The Southwestern Pennsylvania Regional Freight Plan provided insight into the freight movement within the region. Most of the report focused on the I-80 & I-79 corridors. There were three potential future project recommendations specifically related to the RT 28 Corridor.

- RT 28 Truck Climbing Lane
- RT 28 Geometry Improvements
- RT 28 North Lane Expansion to County Line

The County Comprehensive Plans were reviewed for recommendations and future goals of each county. Some of the specific local concerns related to this study from the individual Comprehensive Plans include:

<u>Armstrong County:</u>

- Maintaining the 372 state owned bridges
- Public opinion favors improved public transportation
- Longer than state average commuting times

<u>Clarion County:</u>

- Desire to retain young workers in the area
- Public opinion favors improved public transportation
- Public opinion favors recreational trails in the area
- Some interchange areas with commercial development are seeing some traffic congestion. Route 68 between PA-66 to I-80

<u>Jefferson County:</u>

- No major North/South routes, lack of limited access highways in the area.
- Limited public transportation available in Jefferson County
- Freight rail lines operate in the County but no rail passenger service

*Exhibit 2 – Previous Studies Areas of Concern*

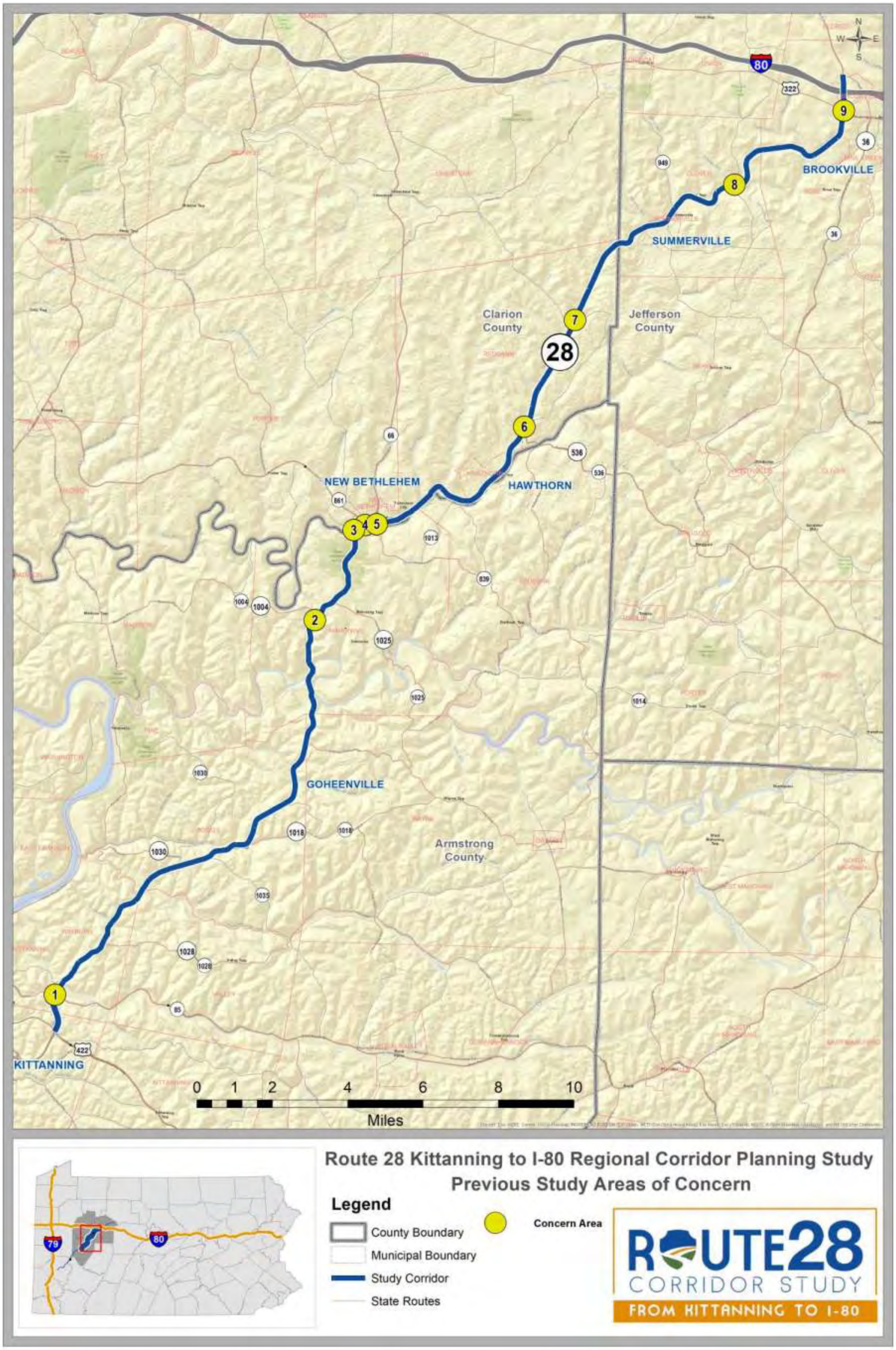


*Exhibit 3 – Estimated Cost Breakdown for 1994 and 2020*

| Item | Michael Baker's 1994 Study Cost/Mile (1994) | Michael Baker's 1994 Study 35 Miles (1994) | McCormick Taylor's 2020 Study Update Cost/Mile (2020) | McCormick Taylor's 2020 Study Update 35 Miles (2020) |
|---|---|---|---|---|
| Clearing and Grubbing | $150,000 | $5,250,000 | $150,000 | $5,250,000 |
| Roadway Excavation | $3,000,000 | $105,000,000 | $3,567,000 | $124,845,000 |
| Pavement, Shoulders, Curbs | $3,200,000 | $112,000,000 | $4,460,000 | $156,100,000 |
| Drainage | $900,000 | $31,500,000 | $1,200,000 | $42,000,000 |
| Guiderail and Barrier | $70,000 | $2,450,000 | $132,000 | $4,620,000 |
| Right-of-Way Fence | $110,000 | $3,850,000 | $158,400 | $5,544,000 |
| Landscaping | $130,000 | $4,550,000 | $217,545 | $7,614,075 |
| Temporary Traffic Control | $210,000 | $7,350,000 | $351,418 | $12,299,630 |
| Utility Relocations | $200,000 | $7,000,000 | $334,684 | $11,713,940 |
| Bridges, Box and Arch Culverts | $3,900,000 | $136,500,000 | $6,526,331 | $228,421,585 |
| Signalization and Signing | $30,000 | $1,050,000 | $50,203 | $1,757,105 |
| Pavement Markings and Delineators | $20,000 | $700,000 | $33,469 | $1,171,415 |
| Erosion and Sedimentation Control | $250,000 | $8,750,000 | $418,355 | $14,642,425 |
| Miscellaneous | $400,000 | $14,000,000 | $669,368 | $23,427,880 |
| Mobilization/Field Office | $450,000 | $15,750,000 | $753,039 | $26,356,365 |
| Stormwater Management | - | - | $418,355 | $14,642,425 |
| **Subtotal** | | $455,700,000 | | $680,405,845 |
| Design Engineering (10%) | | $45,570,000 | | $68,040,585 |
| Construction Engineering (5%) | | $22,785,000 | (10%) | $68,040,585 |
| **Subtotal** | | $524,055,000 | | $816,487,014 |
| Right-of-Way | | $26,202,750 | | $40,824,351 |
| **TOTAL** | | $550,257,750 | | $857,311,365 |

See **Appendix A** for the Full Cost Estimate explanation.

# Traffic Analysis

## Existing Traffic Conditions

Traffic conditions vary along the approximately 40-mile length of the Route 28 study corridor. The Average Daily Traffic (ADT) is a measure of the vehicle volume passing over a segment of roadway in a 24-hour period. Average Daily Truck Traffic (ADTT) measures only truck traffic. The most recent ADT data collected between 2017 and 2019 shows ADTs ranging from 5,600 to 7,300 vehicles per day south of New Bethlehem to 4,100 to 4,600 vehicles per day north of New Bethlehem (**EXHIBIT 4**). Truck percentages are consistently around 15%, which is fairly high compared to the statewide average.

**EXHIBIT 5** shows the hourly distribution of traffic from the six count stations. Traffic during the PM peak hour is generally higher than the AM, with passenger cars showing the biggest variation in hourly volumes likely due to commuter and school traffic. Truck volumes are relatively consistent throughout the daylight hours, picking up in the early morning around 5am and tapering off in the late afternoon around 4pm. This may reflect daylight operations of resource extraction industries such as timber, coal, natural gas, fuel and heating oil, and equipment hauling. This data reflects observations on the corridor. This data is referenced from six (6) regularly counted PennDOT count stations along the Route 28 corridor (**EXHIBIT 6**).

***Exhibit 4 – Average Daily Traffic Data***

| ID | Location | Year | ADT | ADTT | Truck % |
|---|---|---|---|---|---|
| 11706 | Route 28 north of SR 85 | 2019 | 7,298 | 1,140 | 15.6 |
| 164 | Route 28 south of Calhoun School Rd | 2019 | 5,601 | 881 | 15.7 |
| 165 | Route 28 south of South Bethlehem | 2019 | 7,320 | 1,031 | 14.1 |
| 1342 | Route 28 north of New Bethlehem | 2017 | 7,025 | 821 | 11.7 |
| 31595 | Route 28 near North Passing Zones | 2018 | 4,147 | 624 | 15.0 |
| 32137 | Route 28 north of Summerville | 2018 | 4,635 | 731 | 15.8 |

***Exhibit 5 – Route 28 Permanent Count Station Hourly Traffic Counts***

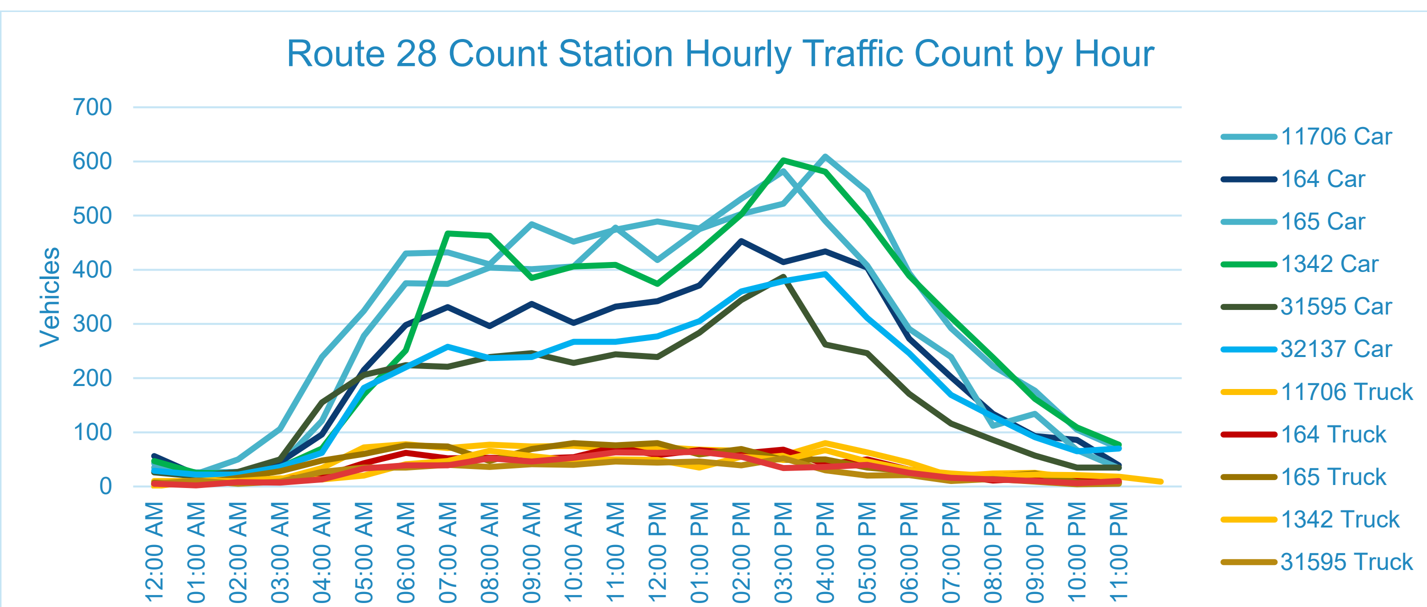
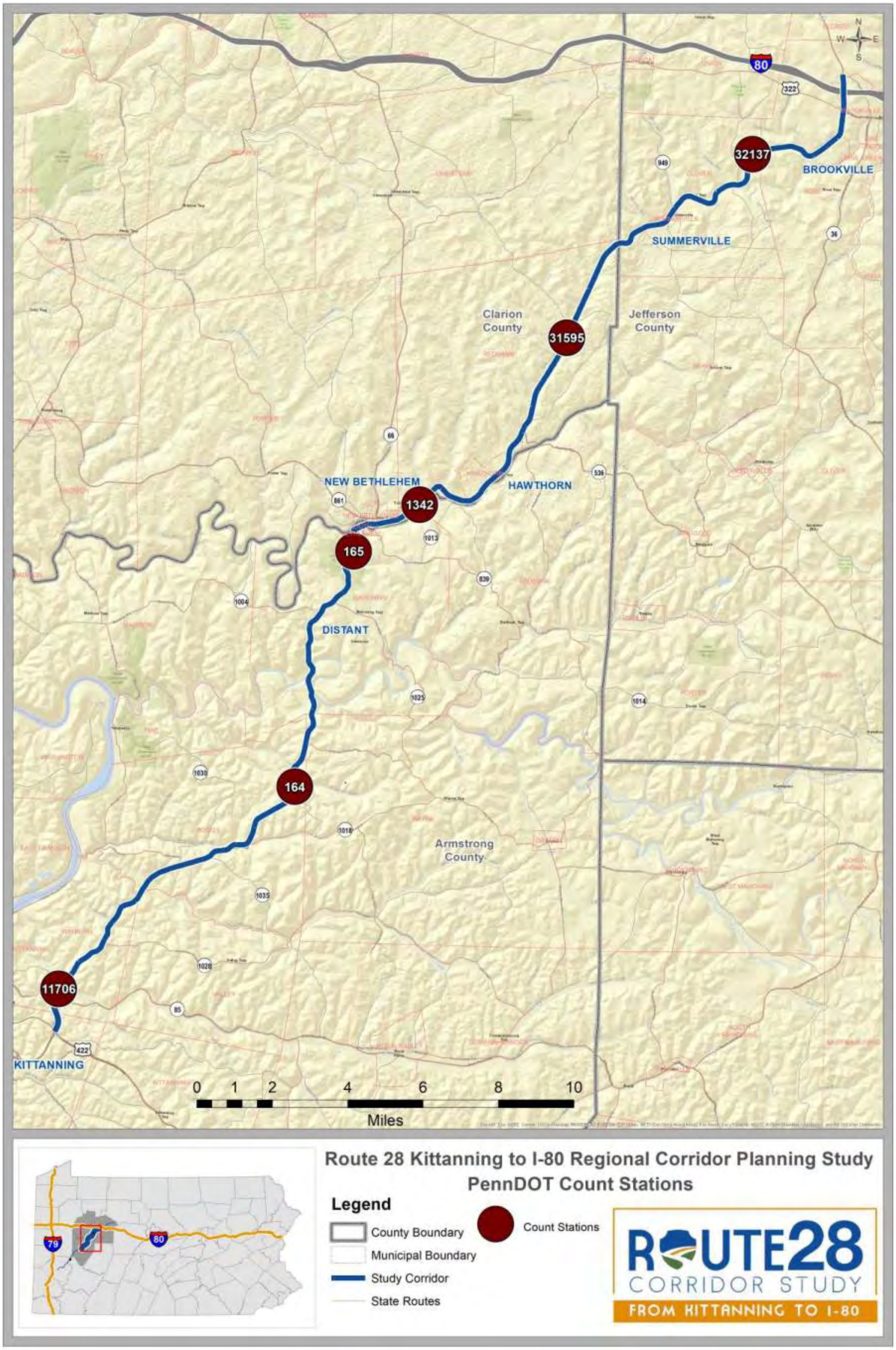


*Exhibit 6 – PennDOT Count Stations*



## Counted Intersections

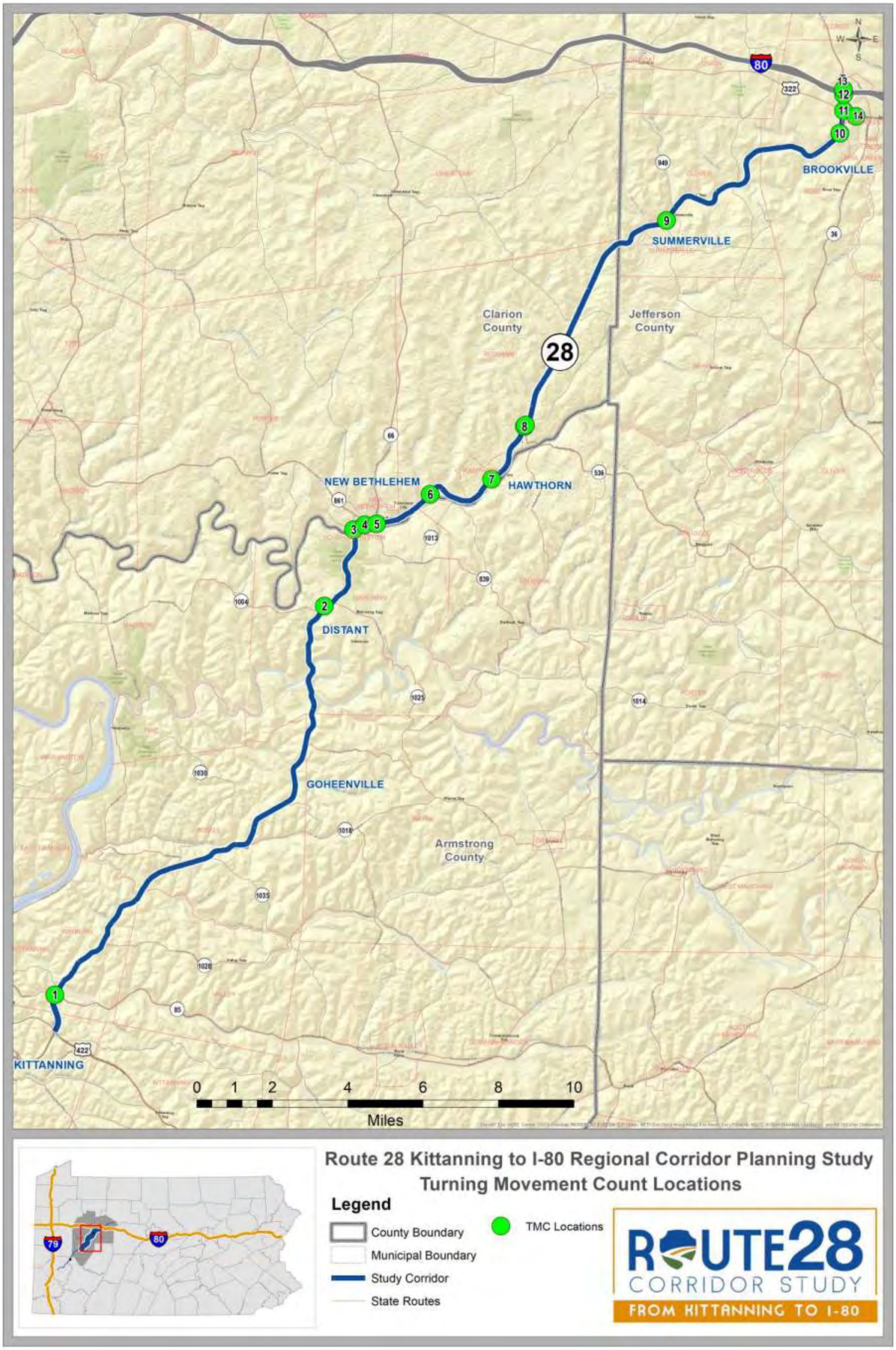
In order to pinpoint locations of concern for existing and future traffic operations, turning movement counts were collected at 16 intersections along the corridor previously identified by the Steering Committee as higher volume or potentially congested intersections (**Exhibit 7** and **Exhibit 8**). The counts were conducted using MioVision camera technology. Passenger cars and heavy vehicles were counted on Tuesday, November 19, 2019, an average weekday while school was in session. Count data for the AM and PM peak hours can be found in the diagrams in **Exhibit 9** and **Exhibit 10**, respectively, along with truck percentages and peak hour factors.

Due to the length of the study corridor, intersections were grouped by area to determine the AM and PM peak hours. Some intersections belong to no grouping as they are isolated and far from the influence of other intersections. Generally, the AM peak hours began between 7:15 AM and 7:45 AM, and the PM peak hours began between 3:15 PM and 4:00 PM. Car and truck volumes were left unbalanced due to the distance between intersections along the corridor with intermediate driveways and businesses. A minimum value of 1 vehicle was applied for each movement that is allowed. This was done to improve reasonableness for the operational analysis, as zero values can create errors in the results.

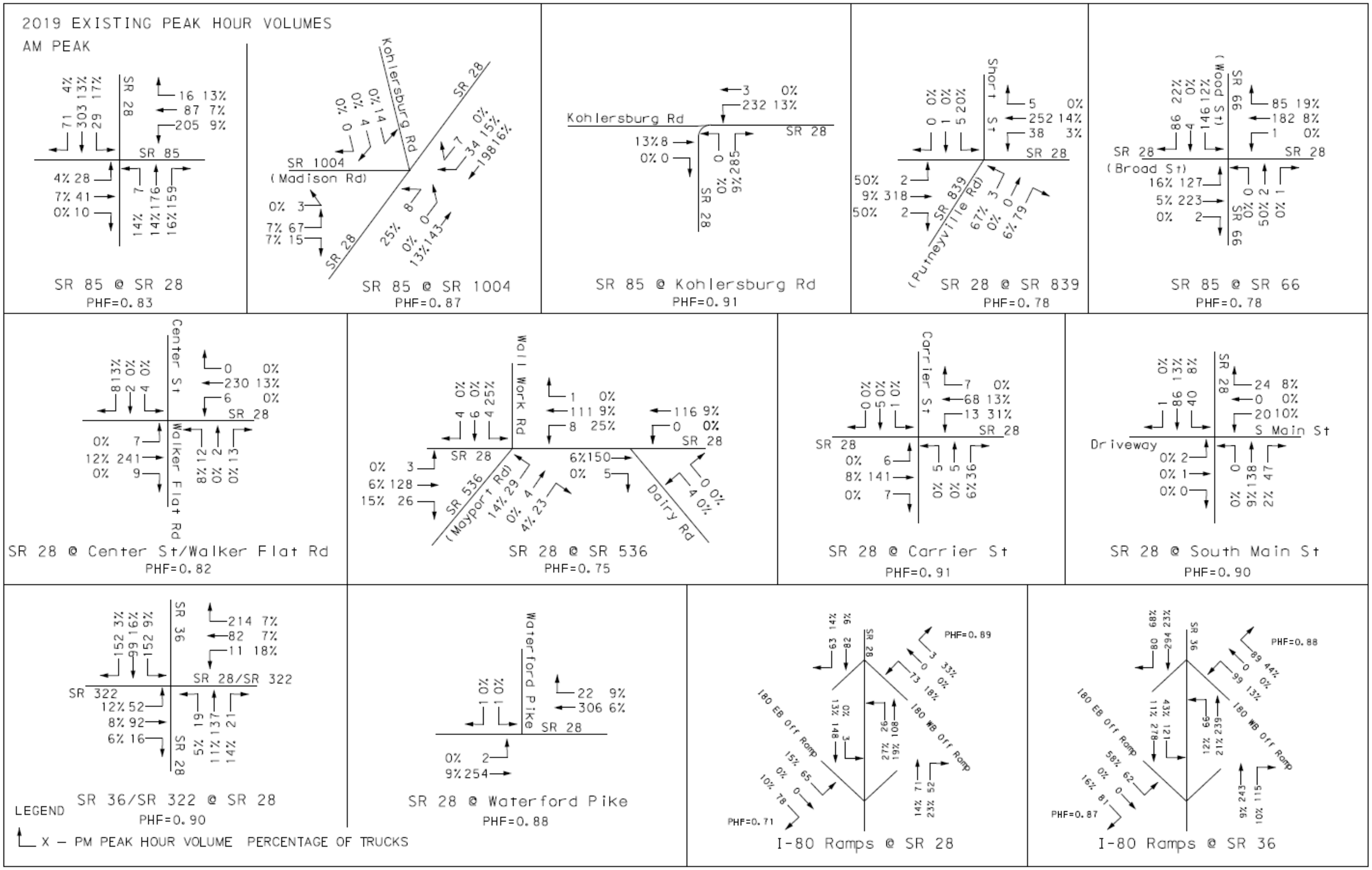
***Exhibit 7 – Counted Intersections***

| ID | Intersection Name |
|---|---|
| 1 | SR 28 & SR 85 |
| 2 | SR 28 & SR 1004 (Madison Road) & Kohlersburg Road |
| 3 | SR 28 & Kohlersburg Road |
| 4 | SR 28 & SR 1025 (Putneyville Road) |
| 5 | SR 28 (Broad Street) & SR 66 (Wood Street) |
| 7 | SR 28 & Center Street / Walker Flat Road |
| 8 | SR 28 & SR 536 (Mayport Road) |
| 9 | SR 28 & Carrier Street |
| 10 | SR 28 & South Main Street |
| 11 | SR 28 & SR 0322 |
| 12 | SR 36 & I-80 EB Ramps |
| 13 | SR 36 & I-80 WB Ramps |
| 14 | SR 28 & Waterford Pike |
| 15 | SR 28 & I-80 EB Ramps |
| 16 | SR 28 & I-80 WB Ramps |

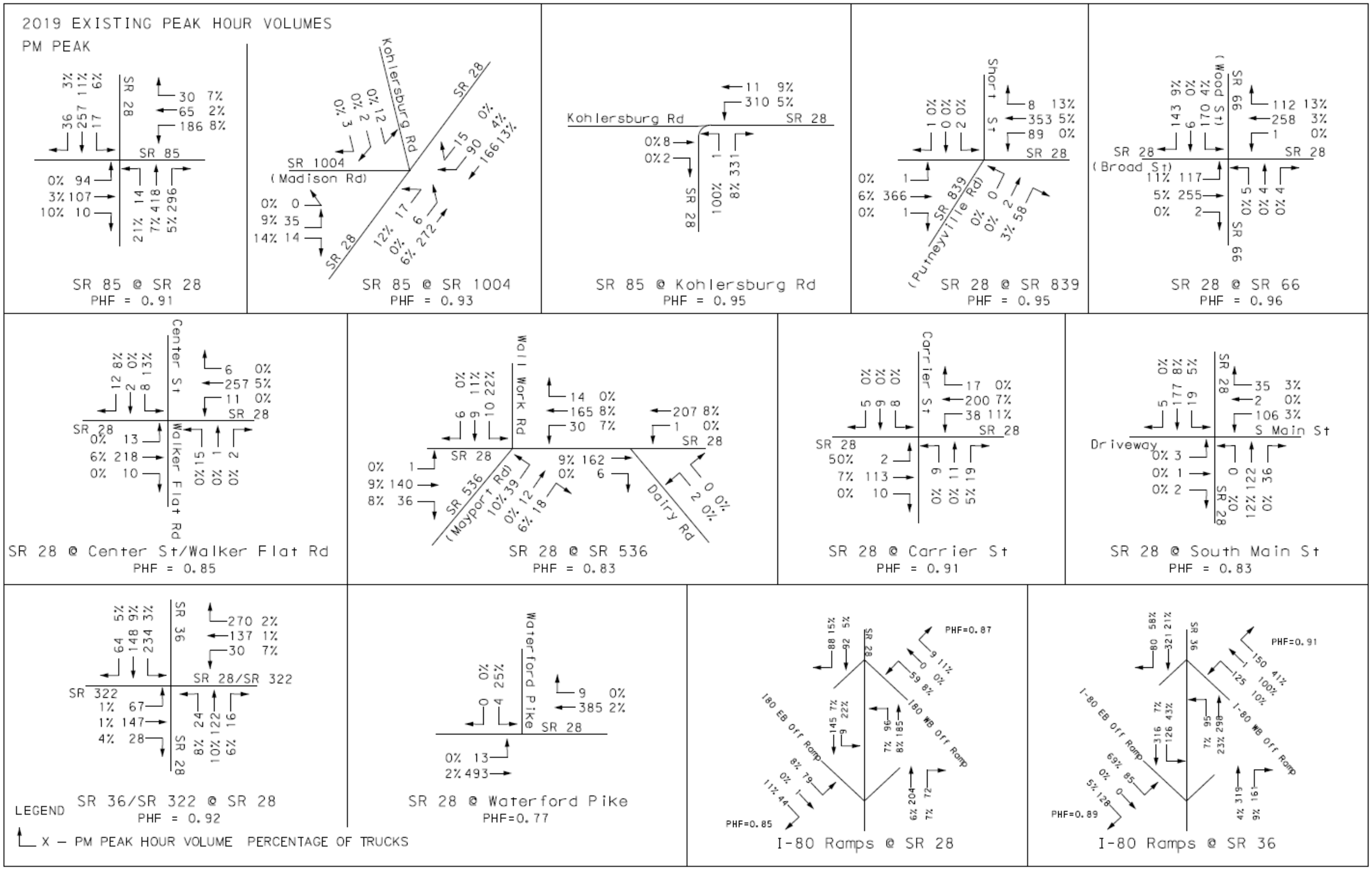
*Exhibit 8 – Turning Movement Count Locations*



## *Exhibit 9 – Peak Hour Volumes and Truck Percentages (2019 AM Peak)*



## Exhibit 10 - Peak Hour Volumes and Truck Percentages (2019 PM Peak)



## Traffic Analysis Methodology

Capacity and level of service (LOS) analyses were completed to evaluate the operational performance of vehicular traffic within the study area. These analyses were completed for Base Year 2019 (Existing) and will be conducted for the future year 2045 in the Future Conditions Memorandum. The traffic analysis software used to analyze the operations at intersections was TrafficWare Synchro 10.3, Build 28, Revision 0. For two-lane highway, freeway, and ramp segments, the software McTrans Highway Capacity Software 7 (HCS) was used. HCS7 uses the *Highway Capacity Manual, 6th Edition* methodology to develop Level of Service measures.

## Synchro and Intersection Control Assumptions

Traffic signal plans were obtained from the PennDOT District 10-0 Traffic Unit for the signalized intersection locations on the corridor. The AM and PM peak period timing plan phasing, cycle lengths, splits, and offsets were input to Synchro software. The following parameters were used in the intersection traffic analysis:

- Peak hour factors were input by intersection by peak hour.
- Traffic volumes and heavy vehicle percentages by movement were also input by peak hour.
- Where applicable, the phasing and timings were translated to NEMA-compliant phasing to obtain consistent delay and level of service results.
- Parameters from *PennDOT Publication 46 – Traffic Engineering Manual* such as lost time adjustments and saturation flow rates were asserted according to information such as land use for intersections.
- Intersections were assumed as “rural” type except for the intersections in New Bethlehem and Brookville which were analyzed as “suburban”.

Synchro assumptions for the intersections are listed in **EXHIBIT 11**. The Level of Service criteria used for signalized and unsignalized intersections is shown in **EXHIBIT 12**. The delay and Level of Service results from the Synchro analysis follow *Highway Capacity Manual, 6th Edition* methodology, except where it cannot provide information due to complex geometry. In those cases, Synchro results for delay were used. LOS results for the 2019 AM peak hour and 2019 PM peak hour are found in **EXHIBIT 13** and **EXHIBIT 14** respectively.

All intersections currently operate at a LOS “C” or better overall. The left-turns at the signal at SR 85 (intersection #1) operate under protected-only phasing, when coupled with long cycle times leads to poor levels of service in the peak hours. In the PM peak hour, the signalized off-ramp at I-80 and SR 36 (intersection #13) exhibits a poor level of service for left-turns which are also protected-only. In general, capacity at intersections is not a major concern.

*Exhibit 11 – Intersection Characteristics*

| ID | Intersection Name | Control Type | AM Peak Hour | PM Peak Hour | Grouping | Land Use Type |
|---|---|---|---|---|---|---|
| 1 | SR 85 | Signal | 7:15 | 4:00 | None - isolated | Rural |
| 2 | Madison/Kohlersburg Rd | Stop | 7:15 | 4:15 | None - isolated | Rural |
| 3 | Kohlersburg Rd | Stop | 7:15 | 3:15 | 1 | Suburban |
| 4 | Putneyville Rd | Stop | 7:15 | 3:15 | 1 | Suburban |
| 5 | Broad at Wood | Signal | 7:15 | 3:15 | 1 | Suburban |
| 7 | Hawthorn | Stop | 7:30 | 4:15 | None - isolated | Rural |
| 8 | Mayport | Stop | 7:15 | 3:30 | None - isolated | Rural |
| 9 | Carrier St | Stop | 7:15 | 3:00 | None - isolated | Rural |
| 10 | South Main | Stop | 7:45 | 3:45 | 2 | Suburban |
| 11 | SR 322 | Signal | 7:45 | 3:45 | 2 | Suburban |
| 12 | Waterford Pike | Stop | 7:45 | 3:45 | 2 | Suburban |
| 13 | I-80 EB Ramps at SR 36 | Signal | 7:45 | 3:45 | 2 | Suburban |
| 14 | I-80 WB Ramps at SR 36 | Signal | 7:45 | 3:45 | 2 | Suburban |
| 15 | I-80 EB Ramps at SR 28 | Stop | 7:30 | 3:45 | 3 | Suburban |
| 16 | I-80 WB Ramps at SR 28 | Stop | 7:30 | 3:45 | 3 | Suburban |

*Exhibit 12 – Level of Service Criteria for Signalized and Unsignalized Intersections*

| Level of Service | Intersection Delay (seconds/vehicle) | |
|---|---|---|
| | Signalized | Unsignalized |
| A | 0 - 10 | 0 - 10 |
| B | > 10 - 20 | > 10 - 15 |
| C | > 20 - 35 | > 15 - 25 |
| D | > 35 - 55 | > 25 - 35 |
| E | > 55 - 80 | > 35 - 50 |
| F | > 80 | > 50 |

*Exhibit 13 – Intersection Level of Service (2019 AM)*

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SR 28 @ SR 85 | SR 85 | EB | EBL | 67.3 | E | 51.7 | D | 38.3 | D |
| | | | | EBT/R | 40.9 | D | | | | |
| | | SR 85 | WB | WBL | 47.8 | D | 41.4 | D | | |
| | | | | WBT/R | 26.3 | C | | | | |
| | | SR 28 | NB | NBL | 319.2 | F | 29.7 | C | | |
| | | | | NBT | 18.8 | B | | | | |
| | | | | NBR | 0 | A | | | | |
| | | SR 28 | SB | SBL | 129.6 | F | 37.5 | D | | |
| | | | | SBT/R | 28.7 | C | | | | |
| 2 | SR 28 at SR 1004 (Madison Rd) | SR 1004 | EB | EBL/R | 12.6 | B | 12.6 | B | 3 | A |
| | | SR 28 | NB | NBL/T | 9.3(L) | A | 0.5 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 21 | Kohlersburg Rd at SR 1004 (Madison Rd) | SR 1004 | EB | EBL/T/R | 6.8 | A | 6.8 | A | 7.1 | A |
| | | Slip Ramp | WB | WBL/T/R | 7.4 | A | 7.4 | A | | |
| | | SR 1004 | NB | NBL/T/R | 7.9 | A | 7.9 | A | | |
| | | Kburg Rd | SB | SBL/T/R | 7.3 | A | 7.3 | A | | |
| 3 | SR 28 @ Kohlersburg Rd | Kburg Rd | EB | EBL/R | 13.4 | B | 13.4 | B | 0.2 | A |
| | | SR 28 | NB | NBL/T | 8.7(L) | A | 0 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 4 | SR 28 @ SR 839 | SR 28 | EB | EBL/T/R | 8.9(L) | A | 0.1 | A | 2.1 | A |
| | | SR 28 | WB | WBL | 9.4 | A | 1.2 | A | | |
| | | | | WBT/R | 0 | A | | | | |
| | | SR 839 | NB | NBL/T/R | 11 | B | 11 | B | | |
| | | Short St | SB | SBL/T/R | 24.9 | C | 24.9 | C | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | SR 28 at SR 66 | SR 28 | EB | EBL | 9 | A | 8.1 | A | 14.6 | B |
| | | | | EBT/R | 7.7 | A | | | | |
| | | SR 28 | WB | WBL/T/R | 19.1 | B | 19.1 | B | | |
| | | Wood St | NB | NBL/T/R | 13.5 | B | 13.5 | B | | |
| | | SR 66 | SB | SBL/T/R | 19.1 | B | 19.1 | B | | |
| 7 | SR 28 at Center St | SR 28 | EB | EBL/T/R | 9.5 (L) | A | 0.3 | A | 1.2 | A |
| | | SR 28 | WB | WBL/T/R | 9.6(L) | A | 0.2 | A | | |
| | | Walker Flat Rd | NB | NBL/T/R | 13.3 | B | 13.3 | B | | |
| | | Center St | SB | SBL/T/R | 12.1 | B | 12.1 | B | | |
| 8 | SR 28 at Mayport Rd SR 536 | SR 28 | EB | EBL/T/R | 9(L) | A | 0.2 | A | 2.6 | A |
| | | SR 28 | WB | WBL/T/R | 9.3(L) | A | 0.6 | A | | |
| | | Mayport Rd | NB | NBL/T/R | 11.1 | B | 11.1 | B | | |
| | | Driveway | SB | SBL/T/R | 12 | B | 12 | B | | |
| 9 | SR 28 at Carrier St | SR 28 | EB | EBL/T/R | 8.8(L) | A | 0.3 | A | 2.3 | A |
| | | SR 28 | WB | WBL/T/R | 9.1(L) | A | 1.3 | A | | |
| | | Carrier St | NB | NBL/T/R | 9.8 | A | 9.8 | A | | |
| | | Carrier St | SB | SBL/T/R | 10.5 | B | 10.5 | B | | |
| 10 | SR 28 at S Main St | Driveway | EB | EBL/T/R | 10.8 | B | 10.8 | B | 2.3 | A |
| | | S. Main St | WB | WBL/T/R | 10 | B | 10 | B | | |
| | | SR 28 | NB | NBL/T/R | 8.2(L) | A | 0 | A | | |
| | | SR 28 | SB | SBL/T/R | 8.7(L) | A | 2.7 | A | | |
| 11 | SR 28 at SR 322 | SR 322 | EB | EBL/T/R | 16.6 | B | 16.6 | B | 12.9 | B |
| | | SR 322 | WB | WBL/T/R | 14.9 | B | 14.9 | B | | |
| | | SR 28 | NB | NBL | 10.7 | B | 13.6 | B | | |
| | | | | NBT/R | 14 | B | | | | |
| | | SR 36 | SB | SBL | 9.4 | A | 9.7 | A | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SBT | 10.2 | B | | | | |
| | | | | SBR | 0 | A | | | | |
| 12 | SR 36 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T | 31.1 | C | 33 | C | 11.1 | B |
| | | | | EBR | 34.5 | C | | | | |
| | | SR 36 | NB | NBT/R | 7 | A | 6.8 | A | | |
| | | SR 36 | SB | SBL | 4 | A | 7.1 | A | | |
| | | | | SBT | 8.4 | A | | | | |
| 13 | SR 36 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T | 30.2 | C | 32.2 | C | 10.5 | B |
| | | | | WBR | 34.4 | C | | | | |
| | | SR 36 | NB | NBL | 3.7 | A | 0.9 | A | | |
| | | | | NBT | 0.1 | A | | | | |
| | | SR 36 | SB | SBT/R | 7.6 | A | 7.5 | A | | |
| 14 | SR 28 at Waterford Pike | SR 28 | EB | EBL/T | 9(L) | A | 0.1 | A | 0.1 | A |
| | | SR 28 | WB | WBT/R | 0 | A | 0 | A | | |
| | | Waterford Pike | SB | SBL/R | 9.8 | A | 9.8 | A | | |
| 15 | SR 28 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T/R | 10.1 | B | 10.1 | B | 3.6 | A |
| | | SR 28 | NB | NBT/R | 0 | A | 0 | A | | |
| | | SR 28 | SB | SBL/T | 8.3(L) | A | 0.2 | A | | |
| 16 | SR 28 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T/R | 9.8 | A | 9.8 | A | 2.8 | A |
| | | SR 28 | NB | NBL/T | 8.3(L) | A | 1.7 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 81 | SR 28 at Dairy Rd | SR 28 | EB | EBT/R | 0 | A | 0 | A | 0.2 | A |
| | | SR 28 | WB | WBL/T | 9.2(L) | A | 0.1 | A | | |
| | | Dairy Rd | NB | NBL/R | 10.6 | B | 10.6 | B | | |

### *Exhibit 14 - Intersection Level of Service (2019 PM)*

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SR 28 @ SR 85 | SR 85 | EB | EBL | 51.7 | D | 47.7 | D | 34.9 | C |
| | | | | EBT/R | 44.3 | D | | | | |
| | | SR 85 | WB | WBL | 50.5 | D | 45 | D | | |
| | | | | WBT/R | 29.2 | C | | | | |
| | | SR 28 | NB | NBL | 108.3 | F | 26.8 | C | | |
| | | | | NBT | 24.1 | C | | | | |
| | | | | NBR | 0 | A | | | | |
| | | SR 28 | SB | SBL | 117.2 | F | 29.2 | C | | |
| | | | | SBT/R | 23.3 | C | | | | |
| 2 | SR 28 at SR 1004 (Madison Rd) | SR 1004 | EB | EBL/R | 13.3 | B | 13.3 | B | 2 | A |
| | | SR 28 | NB | NBL/T | 9.2(L) | A | 0.7 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 21 | Kohlersburg Rd at SR 1004 (Madison Rd) | SR 1004 | EB | EBL/T/R | 7.3 | A | 7.3 | A | 7.5 | A |
| | | Slip Ramp | WB | WBL/T/R | 7.6 | A | 7.6 | A | | |
| | | SR 1004 | NB | NBL/T/R | 7.8 | A | 7.8 | A | | |
| | | Kburg Rd | SB | SBL/T/R | 7.3 | A | 7.3 | A | | |
| 3 | SR 28 @ Kohlersburg Rd | Kburg Rd | EB | EBL/R | 14.6 | B | 14.6 | B | 0.2 | A |
| | | SR 28 | NB | NBL/T | 8.9(L) | A | 0 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 4 | SR 28 @ SR 839 | SR 28 | EB | EBL/T/R | 9.1(L) | A | 0 | A | 1.8 | A |
| | | SR 28 | WB | WBL | 9.5 | A | 1.9 | A | | |
| | | | | WBT/R | 0 | A | | | | |
| | | SR 839 | NB | NBL/T/R | 10.6 | B | 10.6 | B | | |
| | | Short St | SB | SBL/T/R | 24.8 | C | 24.8 | C | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | SR 28 at SR 66 | SR 28 | EB | EBL | 9.4 | A | 8.6 | A | 15.6 | B |
| | | | | EBT/R | 8.3 | A | | | | |
| | | SR 28 | WB | WBL/T/R | 19.3 | B | 19.3 | B | | |
| | | Wood St | NB | NBL/T/R | 13.5 | B | 13.5 | B | | |
| | | SR 66 | SB | SBL/T/R | 19.7 | B | 19.7 | B | | |
| 7 | SR 28 at Center St | SR 28 | EB | EBL/T/R | 9.7(L) | A | 0.5 | A | 1.4 | A |
| | | SR 28 | WB | WBL/T/R | 9.5(L) | A | 0.4 | A | | |
| | | Walker Flat Rd | NB | NBL/T/R | 15.3 | C | 15.3 | C | | |
| | | Center St | SB | SBL/T/R | 12.5 | B | 12.5 | B | | |
| 8 | SR 28 at Mayport Rd SR 536 | SR 28 | EB | EBL/T/R | 9.2(L) | A | 0.1 | A | 3.3 | A |
| | | SR 28 | WB | WBL/T/R | 9.4(L) | A | 1.4 | A | | |
| | | Mayport Rd | NB | NBL/T/R | 13.1 | B | 13.1 | B | | |
| | | Driveway | SB | SBL/T/R | 14 | B | 14 | B | | |
| 9 | SR 28 at Carrier St | SR 28 | EB | EBL/T/R | 9.3(L) | A | 0.1 | A | 2.4 | A |
| | | SR 28 | WB | WBL/T/R | 9.1(L) | A | 1.4 | A | | |
| | | Carrier St | NB | NBL/T/R | 11.4 | B | 11.4 | B | | |
| | | Carrier St | SB | SBL/T/R | 12.1 | B | 12.1 | B | | |
| 10 | SR 28 at S Main St | Driveway | EB | EBL/T/R | 11.2 | B | 11.2 | B | 4 | A |
| | | S. Main St | WB | WBL/T/R | 12.4 | B | 12.4 | B | | |
| | | SR 28 | NB | NBL/T/R | 8.6(L) | A | 0.1 | A | | |
| | | SR 28 | SB | SBL/T/R | 8.6(L) | A | 0.8 | A | | |
| 11 | SR 28 at SR 322 | SR 322 | EB | EBL/T/R | 18.5 | B | 18.5 | B | 14.1 | B |
| | | SR 322 | WB | WBL/T/R | 16.4 | B | 16.4 | B | | |
| | | SR 28 | NB | NBL | 12.4 | B | 15.4 | B | | |
| | | | | NBT/R | 16 | B | | | | |
| | | SR 36 | SB | SBL | 9.3 | A | 10 | A | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SBT | 11.1 | B | | | | |
| | | | | SBR | 0 | A | | | | |
| 12 | SR 36 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T | 29.5 | C | 33.9 | C | 13.2 | B |
| | | | | EBR | 36.8 | D | | | | |
| | | SR 36 | NB | NBT/R | 8.7 | A | 8.5 | A | | |
| | | SR 36 | SB | SBL | 5.1 | A | 8.2 | A | | |
| | | | | SBT | 9.4 | A | | | | |
| 13 | SR 36 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T | 174 | F | 97.1 | F | 29.7 | C |
| | | | | WBR | 32.7 | C | | | | |
| | | SR 36 | NB | NBL | 5.7 | A | 1.5 | A | | |
| | | | | NBT | 0.2 | A | | | | |
| | | SR 36 | SB | SBT/R | 10.9 | B | 10.8 | B | | |
| 14 | SR 28 at Waterford Pike | SR 28 | EB | EBL/T | 9.6(L) | A | 0.2 | A | 0.2 | A |
| | | SR 28 | WB | WBT/R | 0 | A | 0 | A | | |
| | | Waterford Pike | SB | SBL/R | 13.4 | B | 13.4 | B | | |
| 15 | SR 28 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T/R | 10.1 | B | 10.1 | B | 2.4 | A |
| | | SR 28 | NB | NBT/R | 0 | A | 0 | A | | |
| | | SR 28 | SB | SBL/T | 8.7(L) | A | 0.5 | A | | |
| 16 | SR 28 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T/R | 12.6 | B | 12.6 | B | 3.3 | A |
| | | SR 28 | NB | NBL/T | 8.6(L) | A | 3.1 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 81 | SR 28 at Dairy Rd | SR 28 | EB | EBT/R | 0 | A | 0 | A | 0.1 | A |
| | | SR 28 | WB | WBL/T | 9.2(L) | A | 0 | A | | |
| | | Dairy Rd | NB | NBL/R | 11.1 | B | 11.1 | B | | |

## Highway Capacity Analysis Assumptions

Highway Capacity Software 7 (HCS7) was used to analyze the operations of two-lane highways, freeway segments, and ramps. Assumptions behind HCS inputs such as free flow speed, peak hour factor, terrain type, and driver population are as follows:

- Highway free flow speeds were assumed as posted speed limit plus 5 miles per hour. Ramp free flow speeds were assumed as posted speed plus 5 miles per hour.
- All were assumed to have rolling terrain, a familiar driver population, non-severe weather, and rural area type.

Where no corridor-specific data was available to assert otherwise, default values in HCS were maintained. These assumptions were carried through to all future year analyses.

Level of service from HCS7 reflects the criteria outlined in the *Highway Capacity Manual, 6th Edition.* Level of service for basic freeway segments and freeway merge and diverge segments can be found in **EXHIBIT 15**. Level of service for freeways and merge and diverge segments is based on roadway density in passenger cars per mile per lane. There are no weaving segments in existing or future conditions within the area of influence.

Level of service thresholds for two-lane highways can be found in **EXHIBIT 16**. For two-lane highways of Class I, level of service is based on the segment average travel speed (ATS) in miles per hour, and percent time spent following (PTSF) in percent. Class II two-lane highway level of service is based on PTSF.

Since the corridor is over 40 miles long and has varying lane and shoulder widths, the capacity analysis focused on five representative typical sections along the corridor, as well as nine locations of existing climbing lanes, and four areas with significant grades for potential climbing lanes.

***Exhibit 15 - Level of Service Thresholds for Interstates***

| Level of Service | Interstate Density (pc/mi/ln) |
|---|---|
| A | >0-11 |
| B | >11-18 |
| C | >18-26 |
| D | >26-35 |
| E | >35-45 |
| F | Demand exceeds capacity |

***Exhibit 16 - Level of Service Thresholds for Twolane Highways***

<table>
<tr><th rowspan="2">Level of Service</th><th colspan="2">Class I Highway</th><th>Class II Highways</th></tr>
<tr><th>Average Travel Speed (mph)</th><th>PTSF%</th><th>PTSF%</th></tr>
<tr><td>A</td><td>>55</td><td><=35</td><td><=40</td></tr>
<tr><td>B</td><td>>50-55</td><td>>35-50</td><td>>40-55</td></tr>
<tr><td>C</td><td>>45-50</td><td>>50-65</td><td>>55-70</td></tr>
<tr><td>D</td><td>>40-45</td><td>>65-80</td><td>>70-85</td></tr>
<tr><td>E</td><td><=40</td><td>>80</td><td>>85</td></tr>
</table>

## Traffic Analysis Results

**Exhibit 17** shows the results from the Highway Capacity Analysis for general corridor segments. Inputs and outputs from the highway capacity analysis can be found in **Appendix B**. In general, the analysis shows acceptable levels of service on the typical sections.

**Exhibit 18** shows the results for the segments where the uphill grade is significant or over a long length, such as for the currently 1-lane segments at southbound ID #92. At this location, the LOS is E due to a low average travel speed. Anything at or below 40mph is considered failing for Class I Highways. This may be a candidate for a future climbing lane, pending the traffic criteria and warrants are met.

This traffic analysis along with field observations and input from locals have shown that while roadway capacity isn't the main issue, the likelihood of experiencing a slow down during a long trip due to following a slow-moving vehicle without frequent opportunities to pass causes significant driver frustration. A driver's anticipation that a long trip should be at highway speeds of 55mph or more also factors into the perceived poor operations, due to frequent speed limit changes below 55mph throughout communities on the corridor.

***Exhibit 17 – Highway Capacity Analysis Results for General Segments***

| ID | Direction | Southern Terminus | Northern Terminus | 2019 | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | AM Peak Hour | | | PM Peak Hour | | |
| | | | | Average Travel Speed (mph) | Percent Time Spent Following | Level of Service | Average Travel Speed (mph) | Percent Time Spent Following | Level of Service |
| 1 | Northbound | Oscar Rd | Baum Pump Station | 46.8 | 56 | C | 45.3 | 76.9 | D |
| | Southbound | | | 46.2 | 72.2 | D | 45.6 | 62.5 | C |
| 2 | Northbound | SB Truck Climbing Lane | 0.3 miles south of King St | 47.5 | 68 | D | 47.1 | 68.5 | D |
| | Southbound | | | 47.9 | 58.6 | C | 47.4 | 66.2 | D |
| 3 | Northbound | Longview Rd | Yearney Lane | 47.5 | 66.3 | D | 48.1 | 60.7 | C |
| | Southbound | | | 47.8 | 61.8 | C | 48.1 | 66.5 | D |
| 4 | Northbound | Dewey Rd | SR 2001 | 45.5 | 58.1 | C | 45.4 | 52.9 | C |
| | Southbound | | | 45.7 | 50.7 | C | 44.9 | 64.6 | D |
| 5 | Northbound | Moore Rd | Mendenhall Rd | 46.5 | 63.1 | C | 46.3 | 49.9 | C |
| | Southbound | | | 47.2 | 43.7 | C | 45.3 | 71.1 | D |

*Exhibit 18 – Highway Capacity Analysis Results for Climbing Lanes*

| ID | Direction | Configuration | 2019 | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | AM Peak Hour | | | PM Peak Hour | | |
| | | | Average Travel Speed (mph) | Percent Time Spent Following | Level of Service | Average Travel Speed (mph) | Percent Time Spent Following | Level of Service |
| 10 | Northbound | 2 Lanes | 53.9 | 7.6 | B | 54.3 | 12.7 | B |
| 11 | Northbound | 2 Lanes | 53 | 6 | B | 56.4 | 8.6 | A |
| 12 | Northbound | 2 Lanes | 53.5 | 6 | B | 56.8 | 8.6 | A |
| 13 | Northbound | 2 Lanes | 52.4 | 6.6 | B | 50.3 | 6.1 | B |
| 90 | Northbound | 1 Lane | 42 | 48.5 | D | 41.4 | 77 | D |
| 91 | Northbound | 1 Lane | 44 | 47 | D | 43.8 | 65.7 | D |
| 14 | Southbound | 2 Lanes | 52.7 | 6.9 | B | 53.7 | 5.8 | B |
| 15 | Southbound | 2 Lanes | 53.4 | 7.2 | B | 54.7 | 6 | B |
| 16 | Southbound | 2 Lanes | 57.1 | 7 | A | 53.7 | 9.7 | B |
| 17 | Southbound | 2 Lanes | 54.4 | 2.7 | B | 56.6 | 6.9 | A |
| 18 | Southbound | 2 Lanes | 53 | 4 | B | 53.6 | 10.1 | B |
| 92 | Southbound | 1 Lane | 39.1 | 59.2 | E | 40.5 | 44.2 | D |
| 93 | Southbound | 1 Lane | 43.2 | 59.2 | D | 44.4 | 44.2 | D |

## Speed and Travel Times

Speed and travel time are noted concerns for residents and businesses that use the Route 28 corridor. Observations on the corridor show that getting stuck behind a slow-moving vehicle in an area with no climbing lanes or passing zones creates driver frustration, leading to aggressive driving behavior such as speeding and improper passing. The data shows a wide range of preferred speeds for travelers on the corridor, as well as the speed differentials between passenger cars and large commercial vehicles.

**Speed limits** fluctuate throughout the corridor from 25mph in built-up areas like New Bethlehem, to 35mph leaving the city, 40 mph, and 45mph around curves and 55mph in most sections between communities. The speed limit fluctuates frequently between Distant, New Bethlehem, and Hawthorn. It was noted during stakeholder interviews that speed limits may not be consistently posted for the same segment of roadway in opposing directions. Current posted speed limits are shown in **Exhibit 19**.


SPC provided observed speed and travel time data for the corridor from INRIX. INRIX is a data repository for historical congested travel speeds and travel times. There are 13 INRIX segments that cover the length of the Route 28 corridor, ranging from 0.1 to 7.4 miles in length. On average, the segments are about 3 miles in length. The date range used in the INRIX analysis was the average of weekday peak 7-8 AM hour and 4-5 PM hours in 2018. The free flow speed referenced for this study was assumed to be the maximum observed average speed on weekdays or weekends.


**Speeding** is a noted concern – maximum observed speeds are shown in **Exhibit 20**. In areas like New Bethlehem, maximum speeds range from 35 to 40 mph in the posted 25 mph zone. Most segments in the corridor have maximum observed speeds trending above 55 mph, including on areas with significant grades and curvature. On average, the maximum speeds for cars on the corridor is 57 mph. The average maximum speed for trucks on the corridor is 51 mph. This 6 mph speed differential is exacerbated on areas where there are significant grades. **Exhibit 21** illustrates the speed differentials between passenger cars and trucks. The longest segment of speed differential between cars and trucks is from approximately Goheenville to Distant (5 to 10 mph difference) over the area known locally as Hogback Hill. Field observations and GIS data noted areas of significant grade change in this area. Another segment with a high-speed differential between cars and trucks is coming into South Bethlehem around the 15 mph curve through New Bethlehem (10 to 15 mph difference).

*Exhibit 19 – Speed Limits*

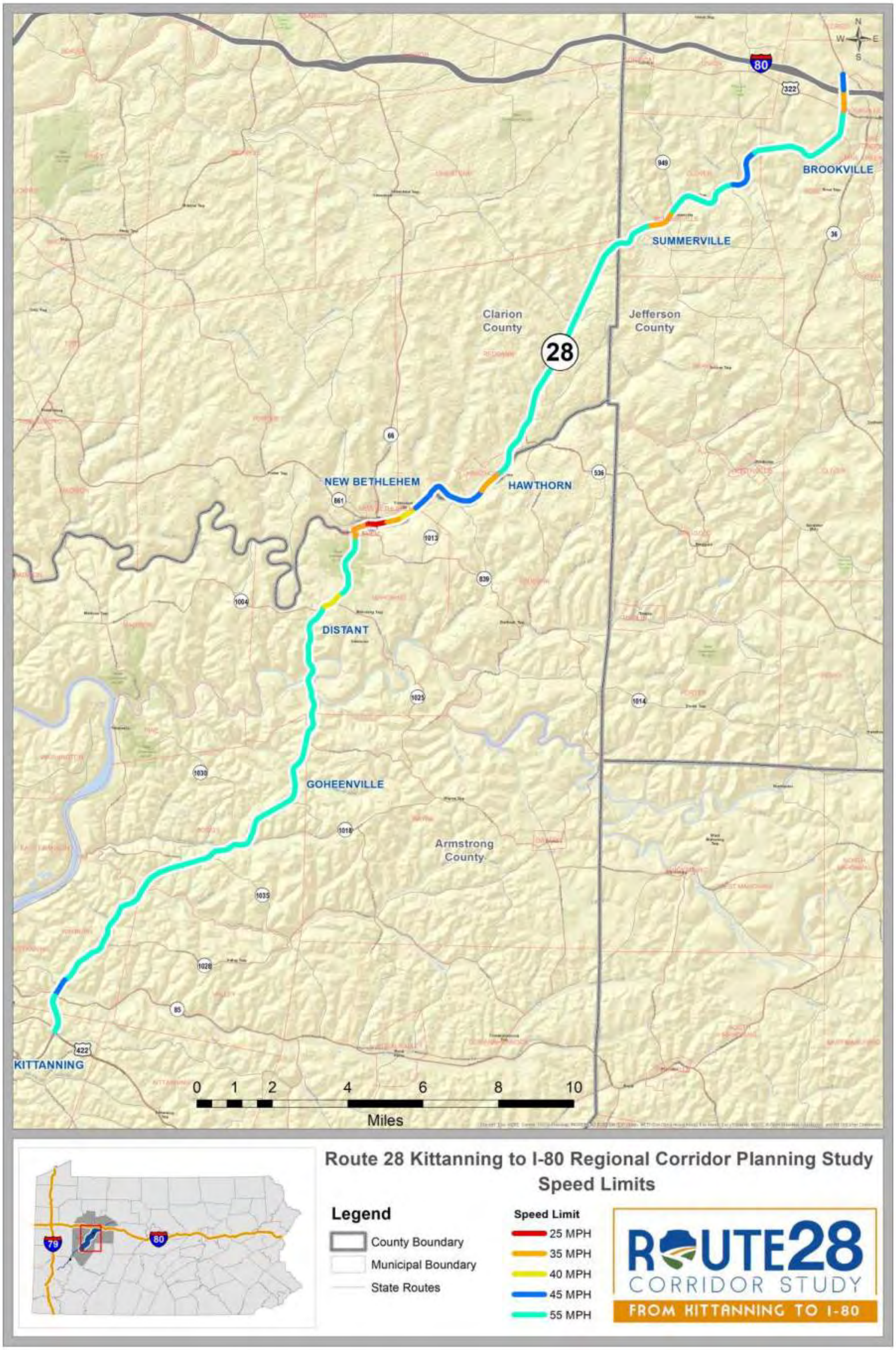


*Exhibit 20 – Maximum Observed Speeds All Vehicles*

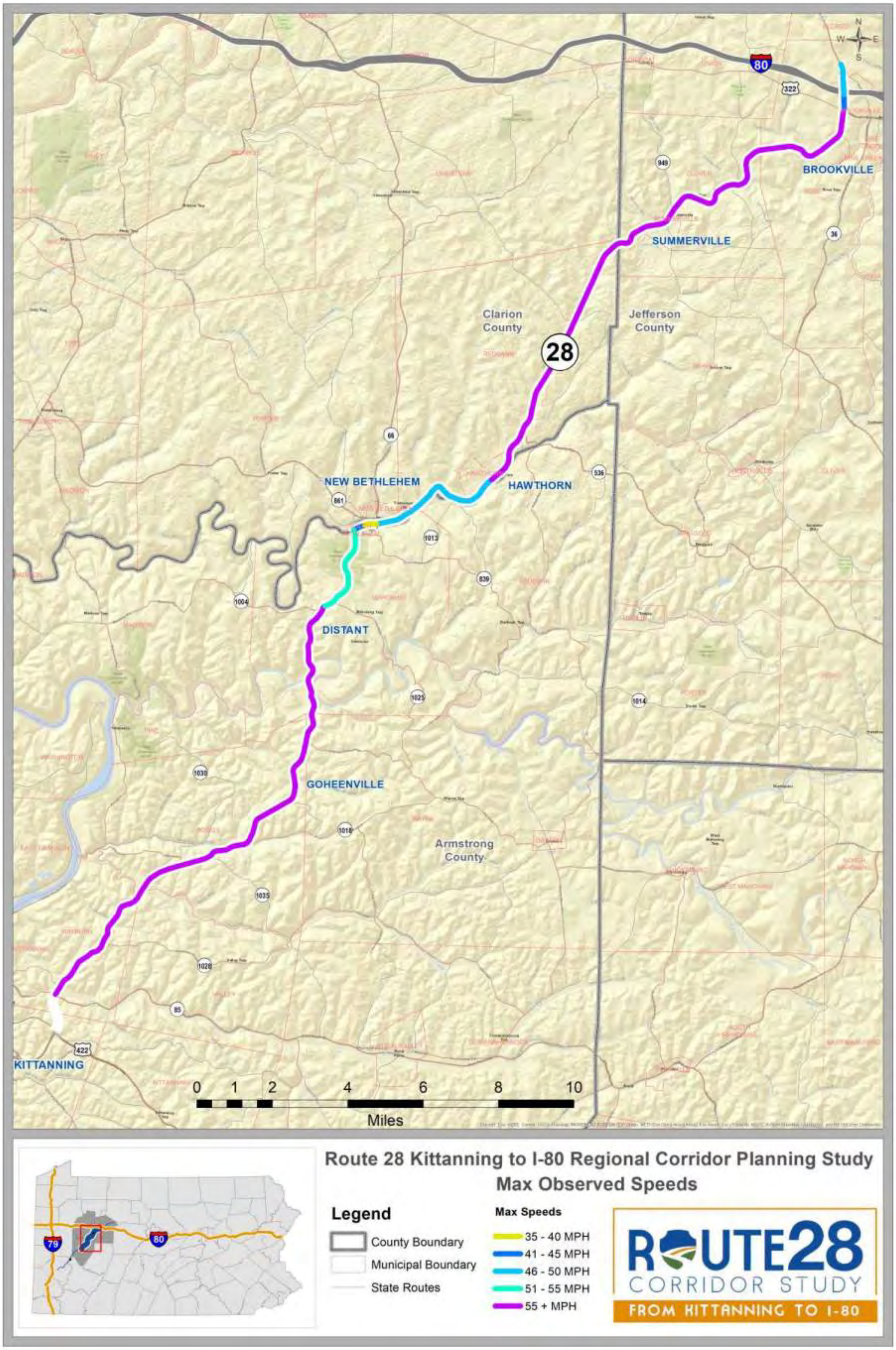
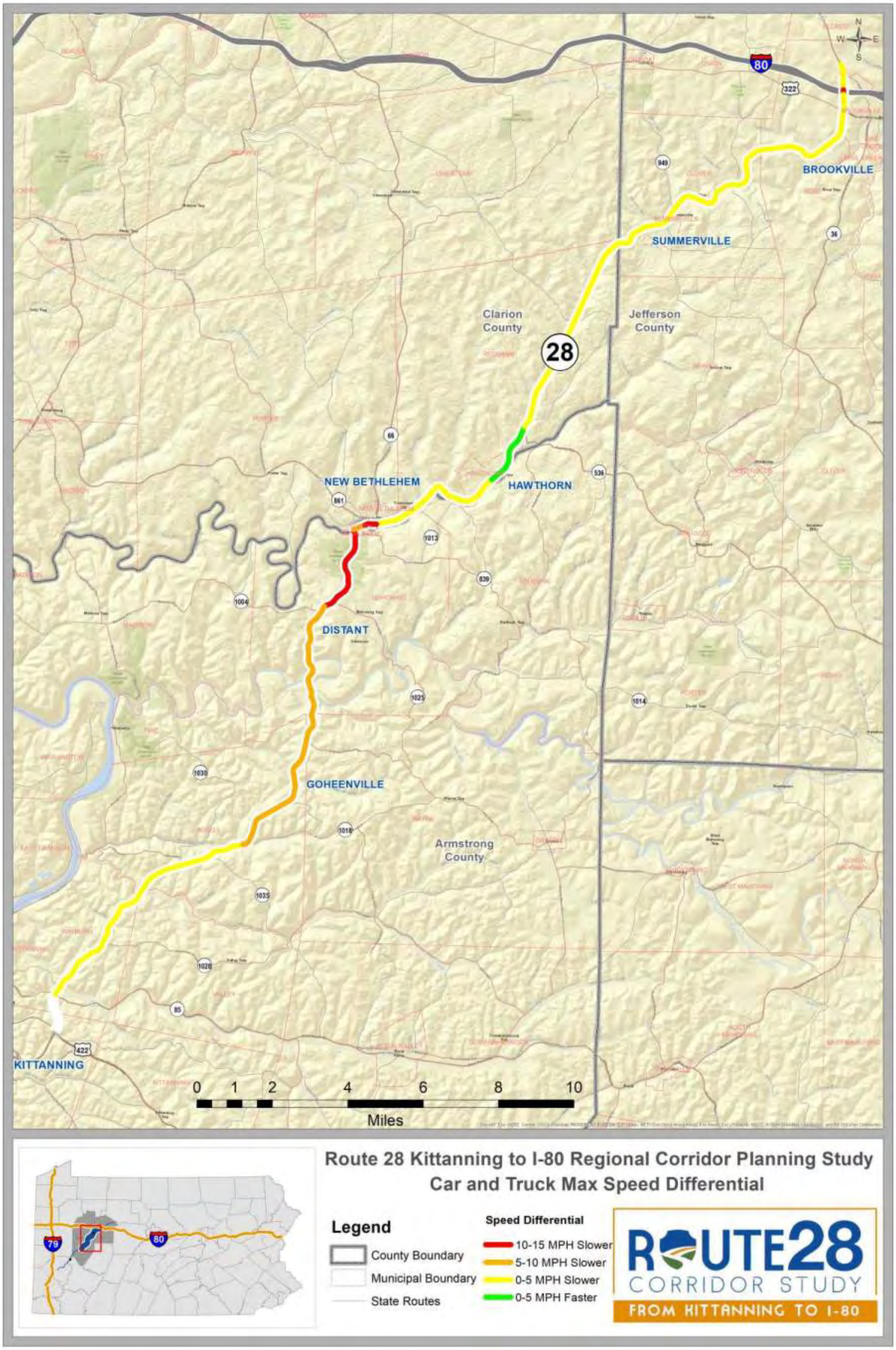


*Exhibit 21 – Speed Differential between Cars and Trucks*



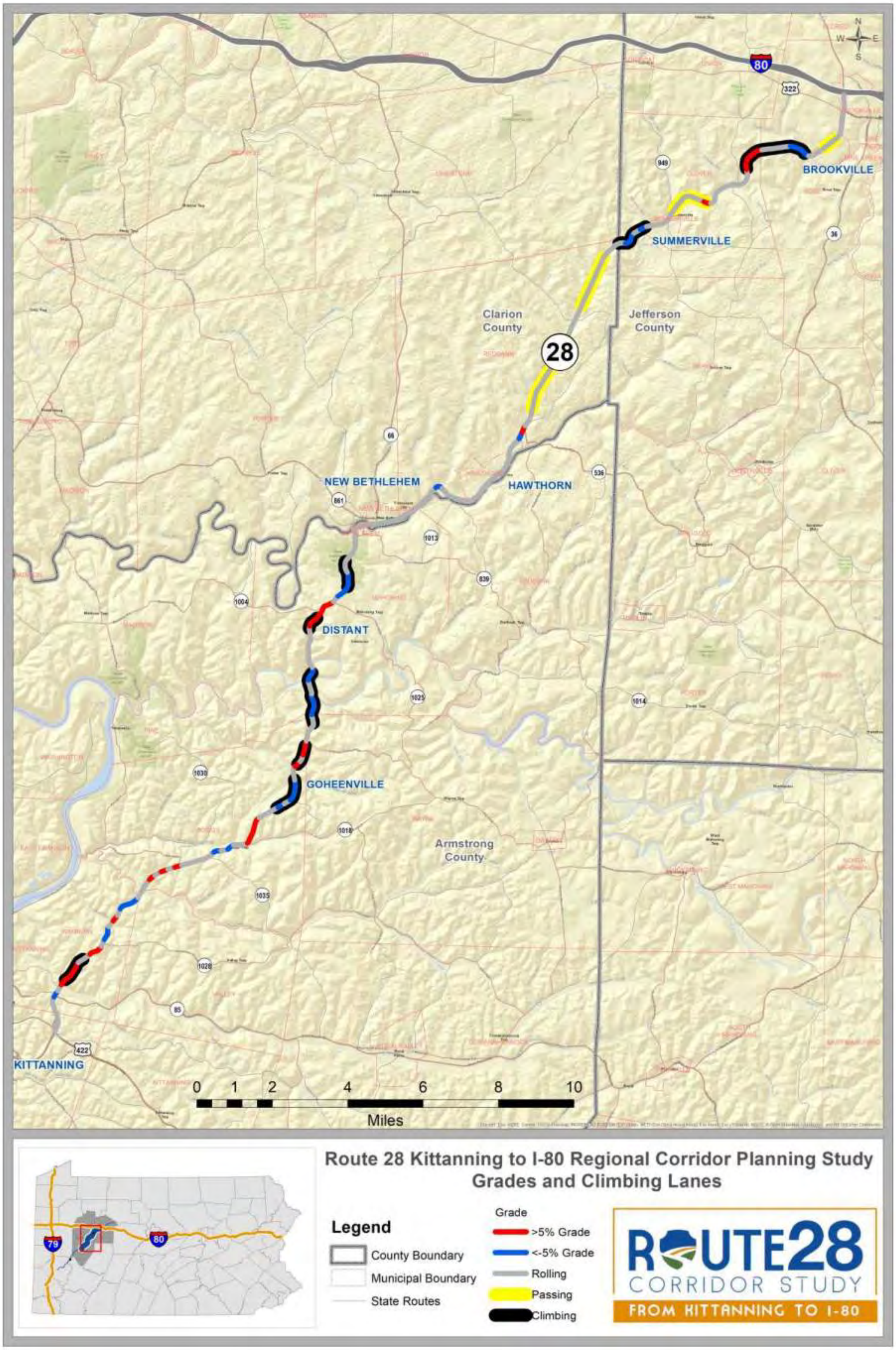
## Grades

Roadway grades were mapped for the corridor to better understand areas where cars and trucks are subject to different acceleration and braking requirements. Grades were mapped using elevations captured at 1000-foot intervals. In the northbound direction, the uphill grades (> 3%) are shown in red, and downhill grades (< 3%) are shown in blue. Anything between 3% grade was shown as "rolling" or "flat". Based upon the observed average maximum speed for cars and truck at approximately 55 MPH, grades exceeding 5% have been identified. This correlates with PennDOT's Design Manual 2 maximum vertical grade criteria of 5% based upon functional classification of the Route 28 Study Corridor. This vertical grade is shown to provide an understanding of locations where existing grades may be effecting traffic operations.



The mapped grade data was compared to the locations of existing truck climbing lanes and passing zones, in order to understand where truck climbing lanes might be warranted (**Exhibit 22**). General purpose passing zones on relatively flat surfaces are also included on this map to give an idea of how frequently there are opportunities to overtake vehicles. The map shows locations south of New Bethlehem that have steep grades for long stretches with no climbing lanes.

*Exhibit 22 – Grades and Climbing Lanes*



## Detour Conditions

Posted detour routes on Route 28 can be seen in **Exhibit 22**. Detour traffic from I-80 was a concern noted by nearly all stakeholders as portions of the SR 28 corridor are marked for the Orange, Blue, and Green detours converging at US 322 as shown in **Exhibit 23**. Detour traffic from travelers following their personal navigation devices and getting back on to be detoured again was identified as an issue.


INRIX historical speed data was used to understand the range of influence and operational impact of I-80 detour traffic on the corridor. Incident logs were pulled to identify dates of full roadway closures on I-80 in the vicinity of the study area. This data was analyzed to evaluate historical hourly speed data. One particular closure of I-80 was examined. This was an incident that occurred on August 8th, 2016 where I-80 had a significant hours-long closure due to a multi-vehicle accident. The closure started around 2pm and extended through the PM peak hours. This incident was evaluated using three INRIX segments of probe data on SR 28 – near I-80, the middle of the corridor near New Bethlehem, and the south near Kittanning.

**Exhibit 24** shows the southbound segment of Route 28 in the vicinity of US 322, closest on the corridor. Average hourly speeds drop from approximately 32 mph before the closure down to about 5mph for three hours during the closure, as traffic has detoured traffic away from I-80. The congestion lasts until approximately 9pm when speeds return to about 31mph. **Exhibit 25** shows the southbound segment of Route 28 approximately 20 miles south of I-80 near New Bethlehem. New Bethlehem speeds began to drop from 40mph at 3pm to a low of 19mph at 7pm. Speeds in New Bethlehem climbed back to free flow by about 8pm. **Exhibit 26** shows the southernmost segment of the Route 28 corridor approximately 35 miles south of I-80 near Kittanning. A small drop in speed was experienced around 2pm, perhaps as travelers were notified of the closure and changed their routes mid-navigation.

This analysis supports that interstate closures can have widespread impacts on the corridor traffic operations. This in conjunction with detour route choice and signage, and travelers using personal devices to navigate off of I-80 create bottleneck conditions that are challenging for emergency responders, residents, and the traveling public.

The New Bethlehem bridge was identified by stakeholders as an infrastructure security concern as there is no redundancy in the roadway system. The Black Detour route is posted for the New Bethlehem bridge closures. The typically 17-mile stretch of Route 28 is detoured westward at a length of more than 43 miles through many villages and communities that are not easily navigable by trucks to reach New Bethlehem or Kittanning.

*Exhibit 23 - Route 28 Posted Detour Routes*

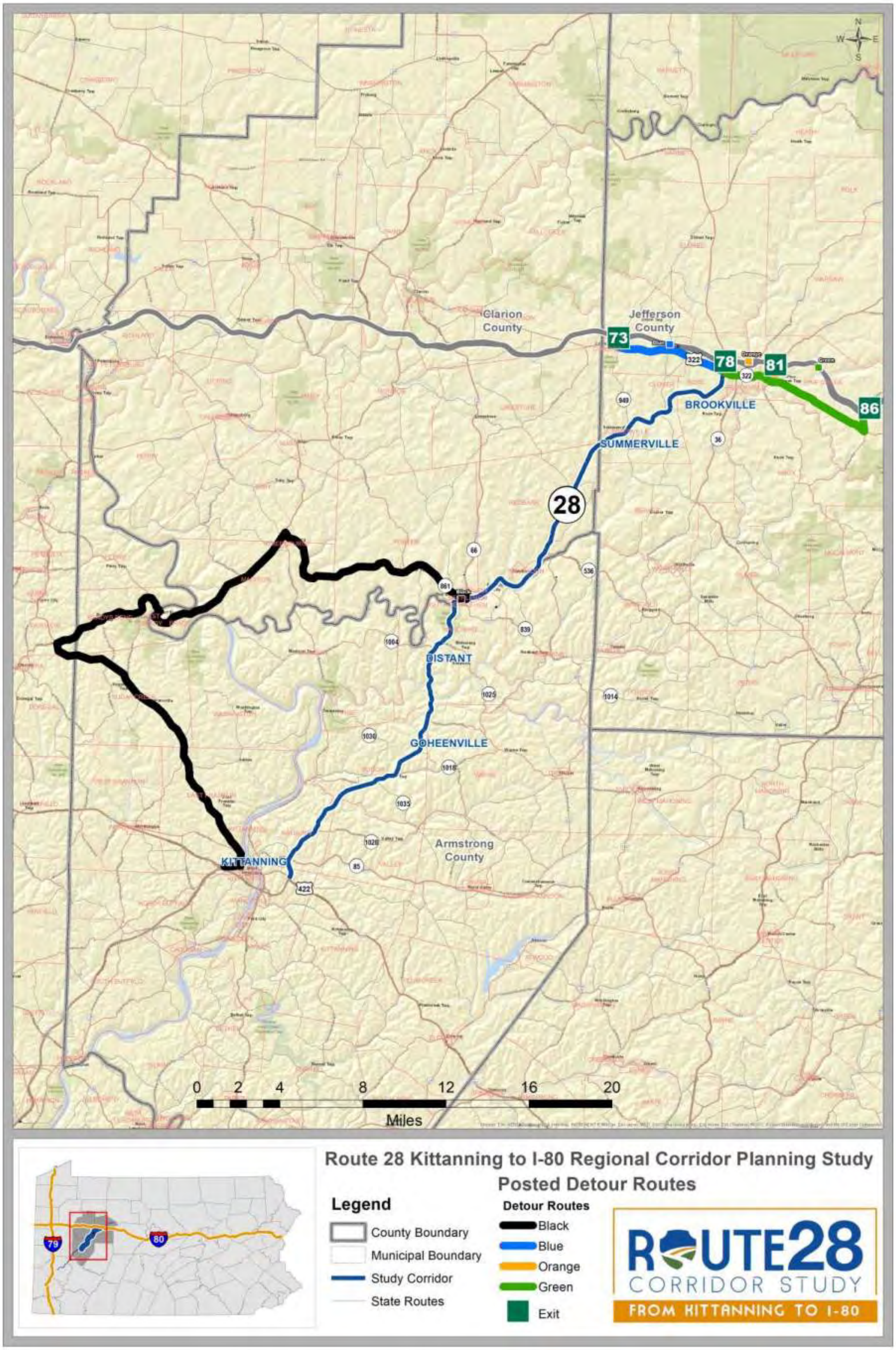


*Exhibit 24 – I-80 Posted Detour Routes*

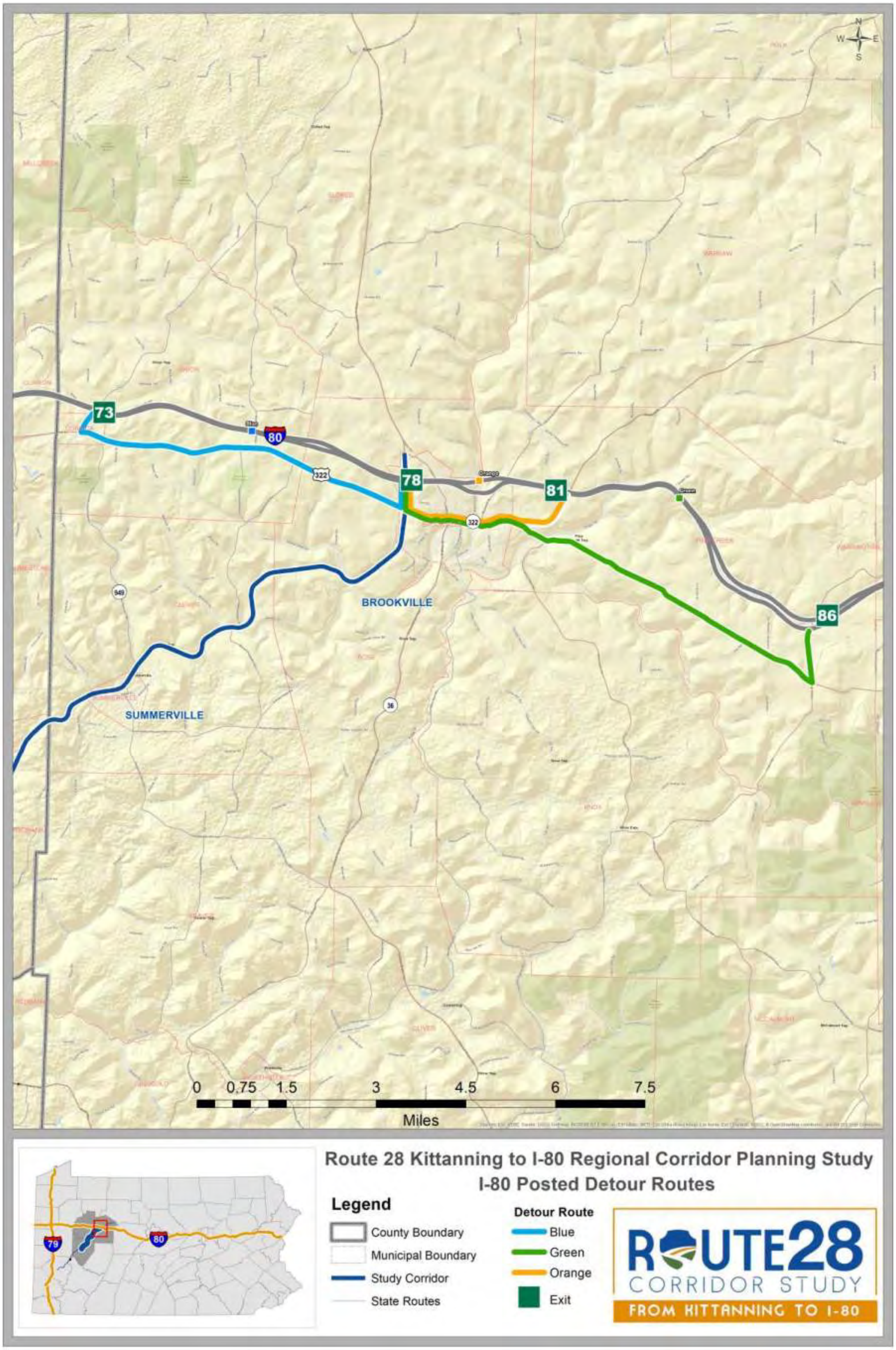


*Exhibit 25 - Southbound Route 28 Speed Effects during I-80 Closure (Near US 322)*

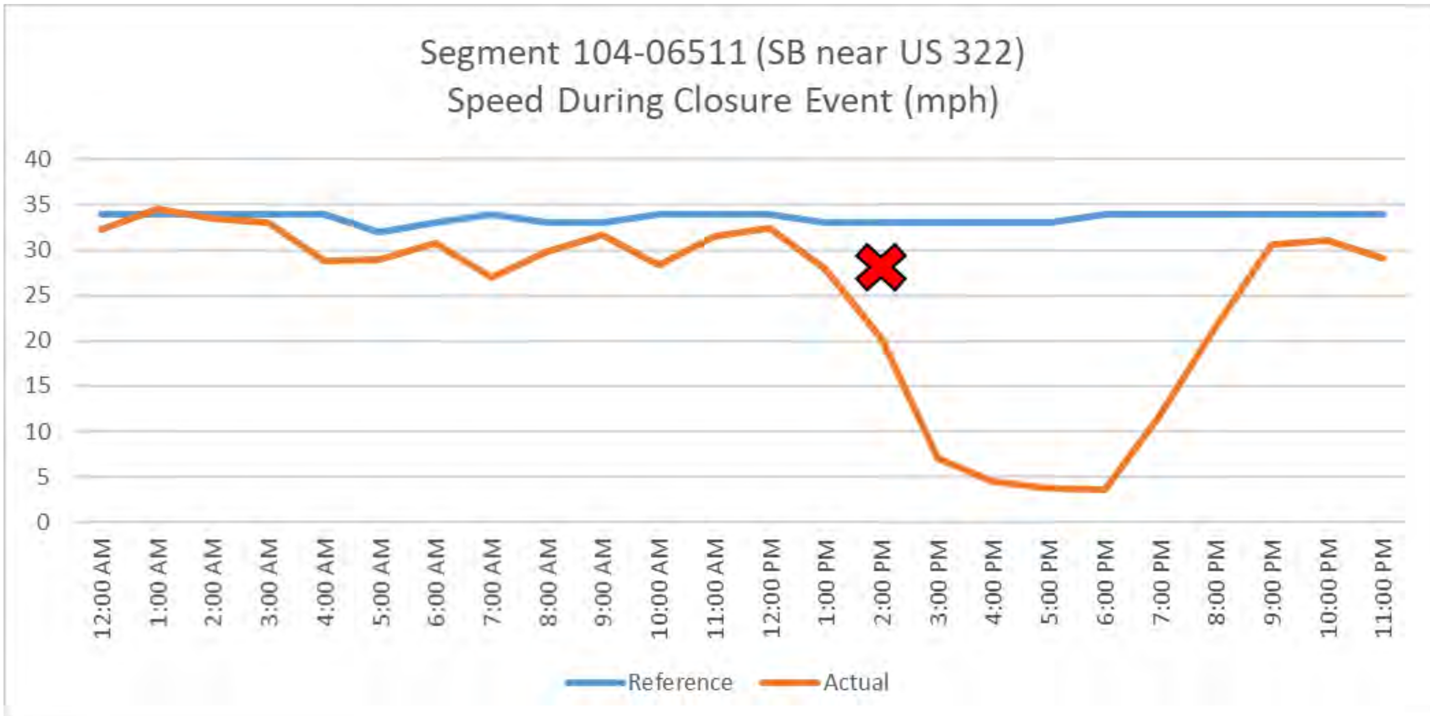



*Exhibit 26 - Southbound Route 28 Speed Effects during I-80 Closure (Near New Bethlehem)*

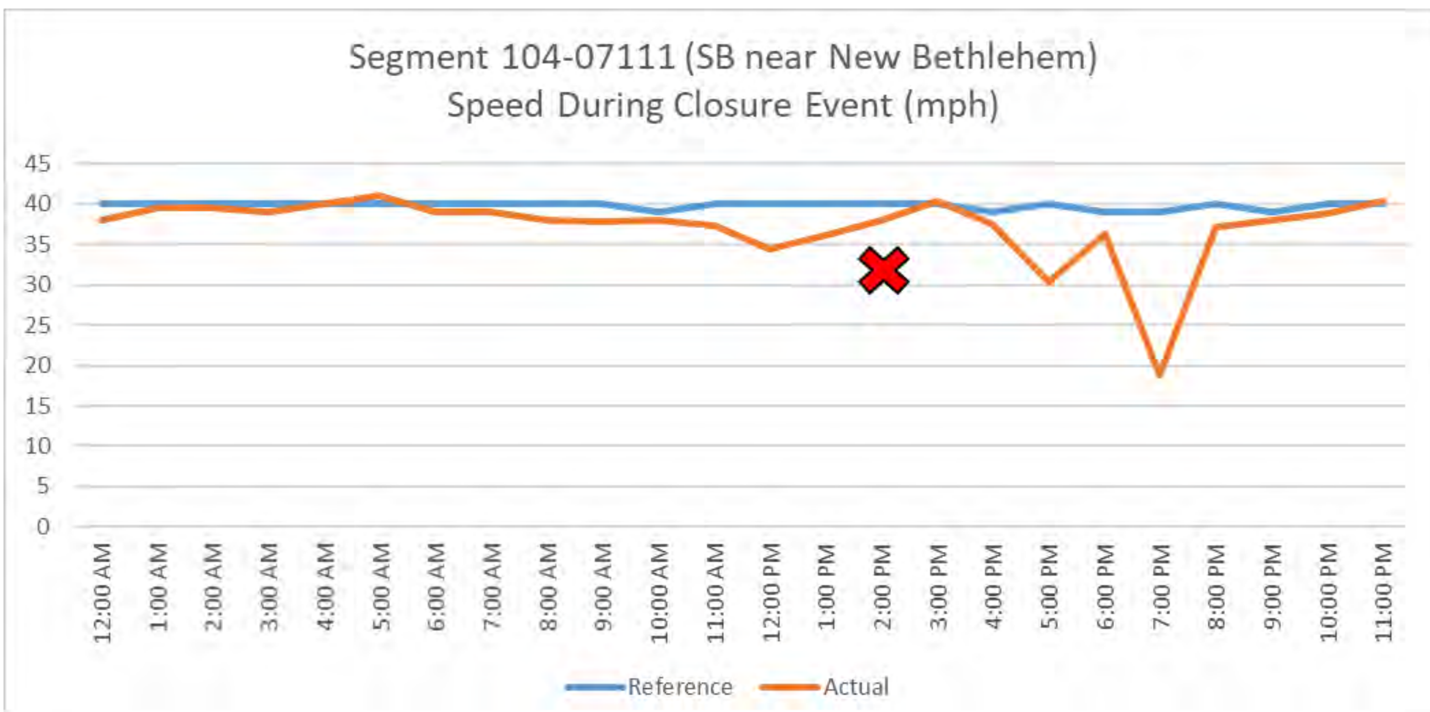
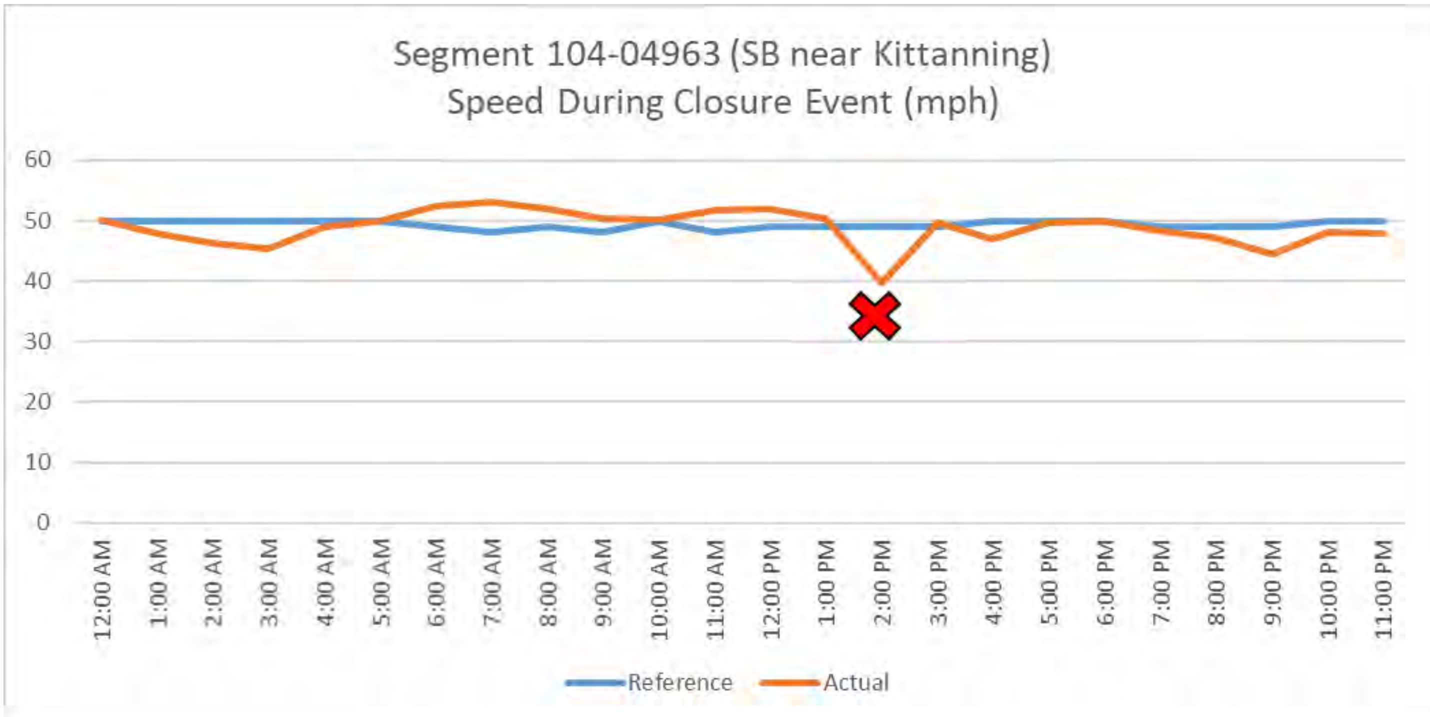


*Exhibit 27 - Southbound Route 28 Speed Effects during I-80 Closure (Near Kittanning)*

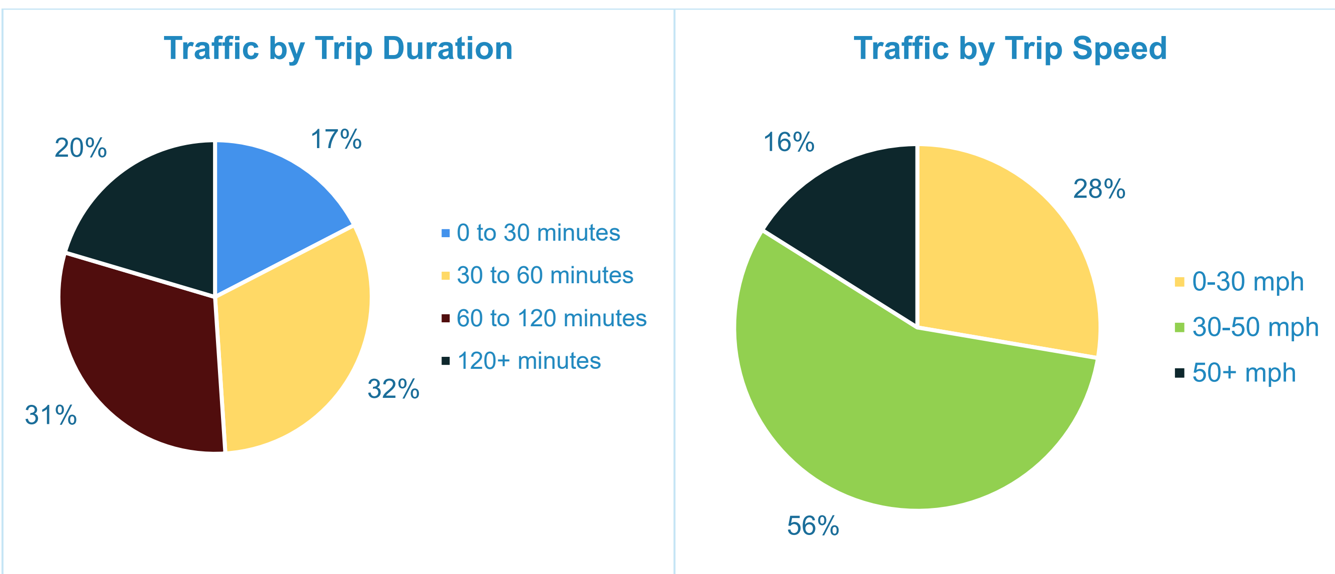


### Streetlight Data

Streetlight is a big-data company that provides roadway analytics from anonymized Bluetooth and cellular device information. The data can be analyzed by transportation planners to examine travel behavior and traveler demographics. Streetlight provides data for personal and commercial travel types. It also provides some information on multimodal travel including bicyclists and pedestrians. Access to the Streetlight data service was provided by the Southwestern Pennsylvania Commission's subscription in support of the Route 28 Corridor Study.

The data was analyzed to understand existing travel conditions on the Route 28 corridor, such as the lengths of trips. **EXHIBIT 27** shows general characteristics of all trips over the 40-mile length of the study corridor. More than half of the trips on the corridor are over 60 minutes in duration, with a large number of trips over 120 minutes. This trip duration includes commercial vehicle traffic, which may have hauling routes along the corridor or destined northward to Forest, Elk or Venango counties. Trip lengths correspond with the trip duration, with a majority of trips longer than 30 miles. More than half of the travel speeds are between 30 and 50mph, with approximately 16% traveling 50 to 70mph.

***Exhibit 28 - Trip Characteristics***




*Who does the Route 28 corridor serve?* **EXHIBIT 28** shows the geographic spread of the home locations of travelers. The cluster shows that travelers on this 40-mile section of the Route 28 corridor primarily live and work in areas adjacent to the corridor to the east and west. There are fewer home locations of Route 28 travelers north of I-80. The cluster of home locations stretches as far southwest as Pittsburgh, with a few isolated clusters focused primarily in places that are accessible via Route 28, I-80, I-79, US 422, and US 322 such as Youngstown, Erie, Altoona, and State College. The public survey conducted for this study was targeted to the zip codes surrounding the corridor and advertised on the Southwestern Pennsylvania Commission's social media pages.

*Where are people going on the Route 28 corridor, and at what levels of frequency?* **EXHIBIT 29** uses a point in the middle of the corridor to show all personal trips passing through this point on a weekday and their origins and destinations. This map highlights a distinct diagonal pattern of trips that follows the trajectory of the corridor. There is a large geographic catchment area in the northeast counties (Forest, Elk, Warren, McKean, Clearfield, Cameron) for Route 28 traffic destined to Kittanning and Pittsburgh, as well as hauling, tourist-related traffic for outdoors activities to the northeast counties.

Exhibit 29 - Home Grids for Route 28 Corridor Travelers

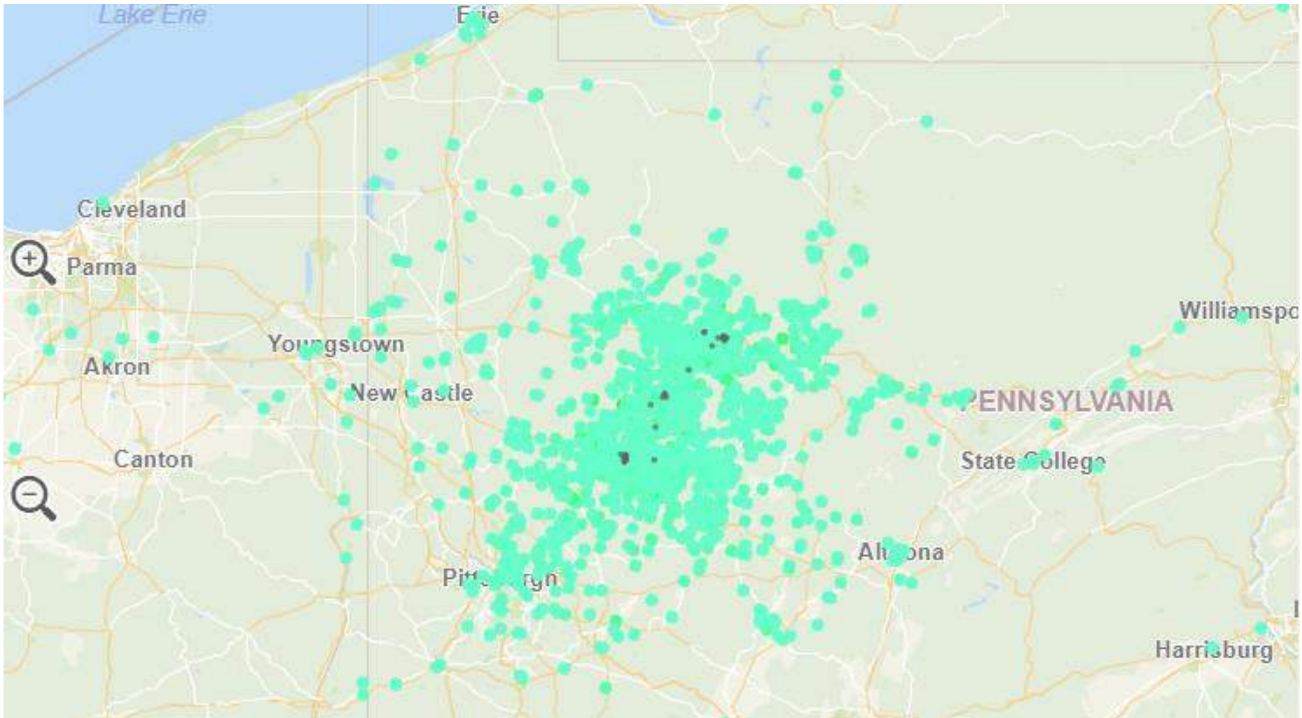
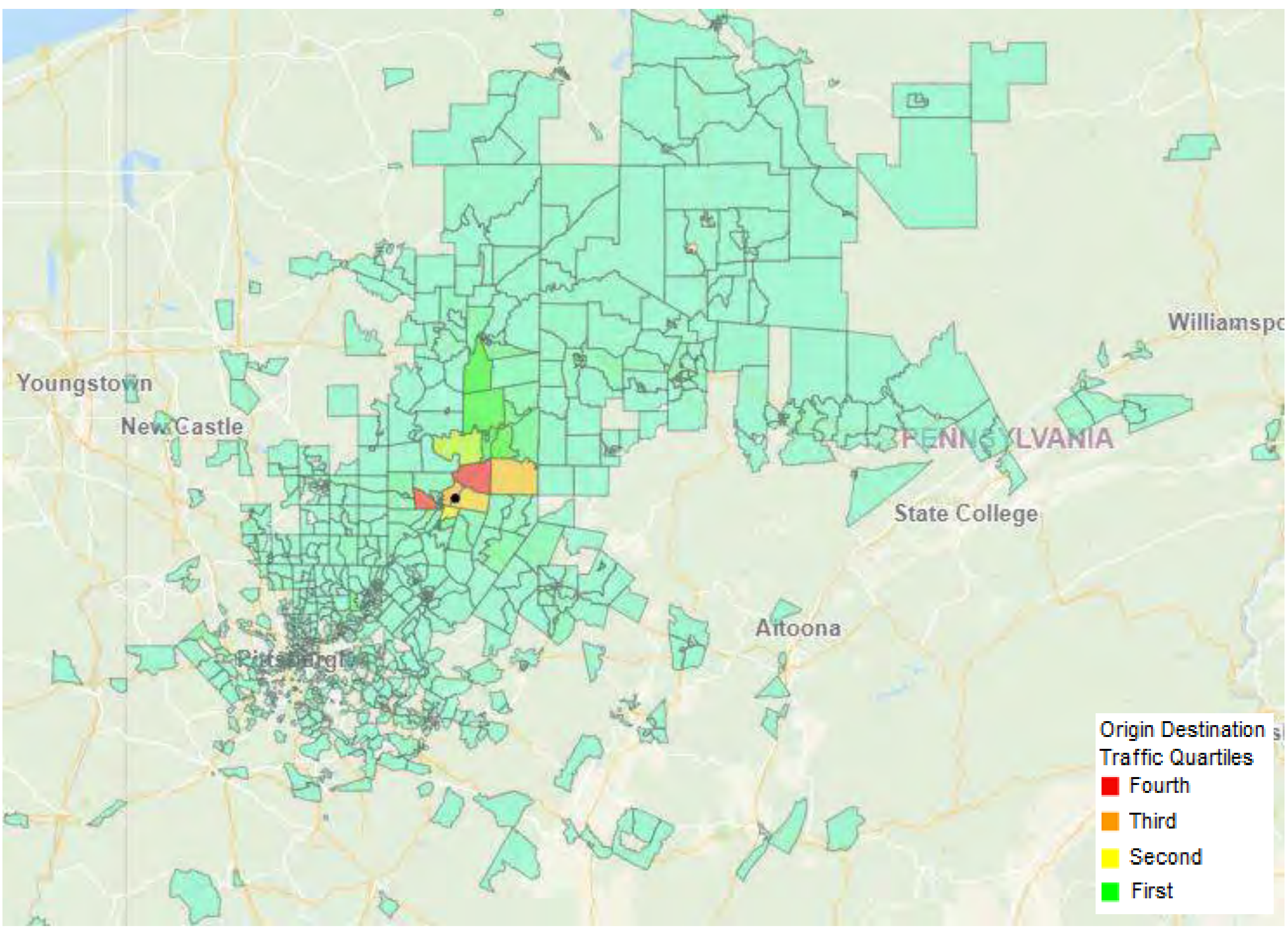


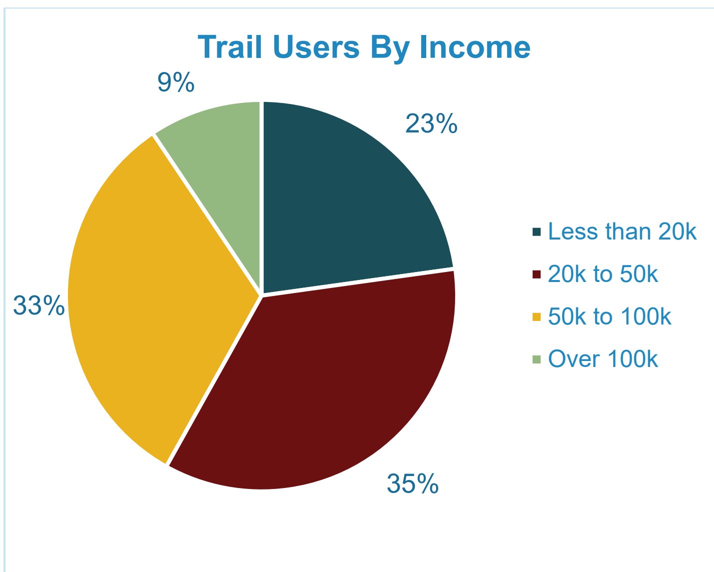

Exhibit 30 - Origin-Destination Heat Map (Weekdays)



*How are people using the multimodal facilities on the corridor?* The Open Street Map alignment data for the Redbank Valley Trail and Armstrong County Trail were imported to understand bicycle and pedestrian usage of the trail system (**Exhibit 30**). A point in New Bethlehem was chosen to see a snapshot of the trail user demographics and trip characteristics. **Exhibit 31** shows the education, family status, and income levels of trail users. **Exhibit 32** shows the trip duration characteristics of the trips on the trail.

The largest proportion of trips on the corridor are 45-60 minutes in length, which reveals a tremendous benefit to public health in the communities that it serves. The length of the trail and access available to users along the Route 28 Corridor provides a great regional recreational asset.

***Exhibit 31 - Redbank Valley Trail (New Bethlehem) User Demographics***



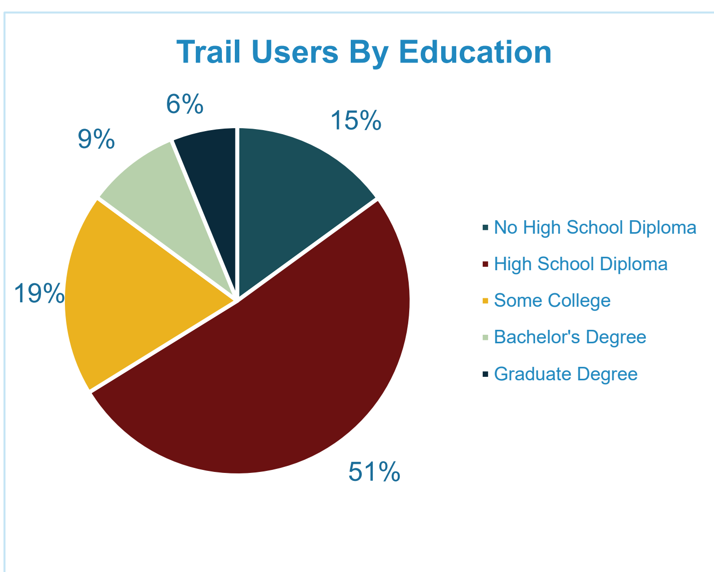
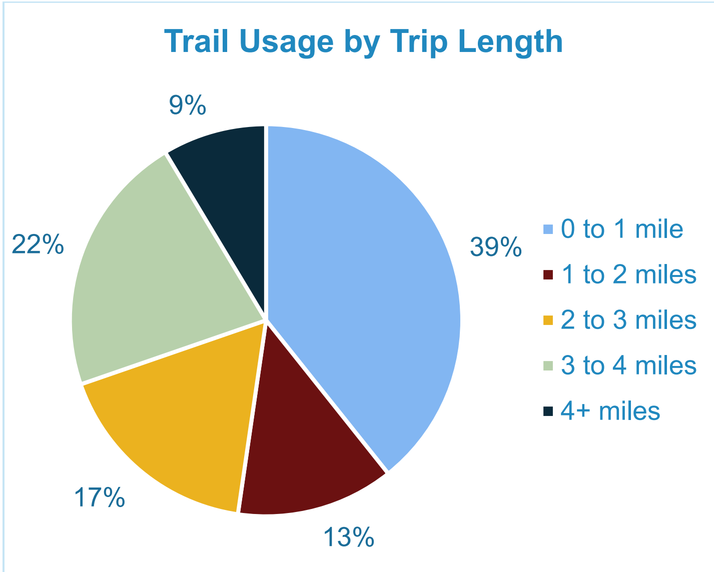
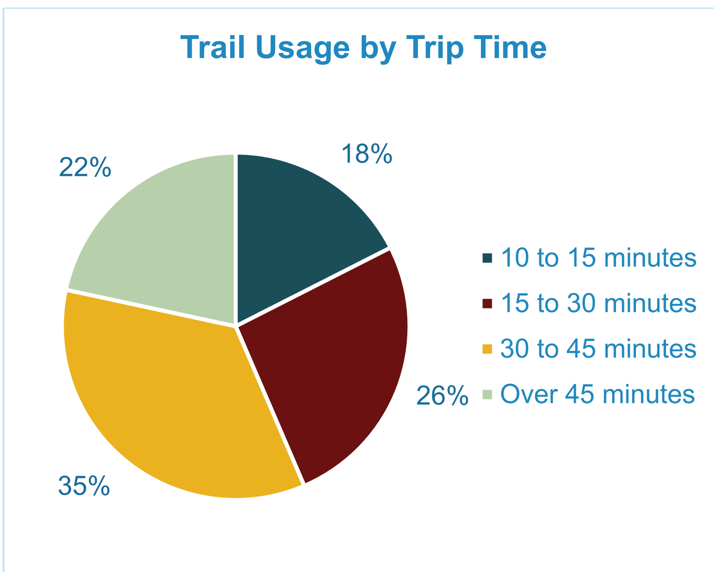



*Exhibit 32 - Redbank Valley Trail (New Bethlehem) Trip Characteristics*



Streetlight data was used to examine the distribution of trips passing a point near the intersection of Route 28 and South Main Street in Brookville. It shows traffic coming from approximately Williamsport and Brookville in the east, from areas slightly north of the I-80 interchange such as Sigel and Brockway down through Kittanning and Pittsburgh. Applying a filter to the proportion of traffic shows the popular destinations of traffic past this point. Approximately 15% of trips passing this point are destined to Kittanning (**EXHIBIT 34**). Approximately 4% of trips passing this intersection are destined to Pittsburgh (**EXHIBIT 35**). This finding shows that the corridor primarily serves demand to Kittanning and communities along the Route 28 corridor, rather than functioning currently as a regional through route.

***Exhibit 33 - Distribution of Traffic Passing a Point On Route 28 near South Main St Brookville (Filtered by 15%)***

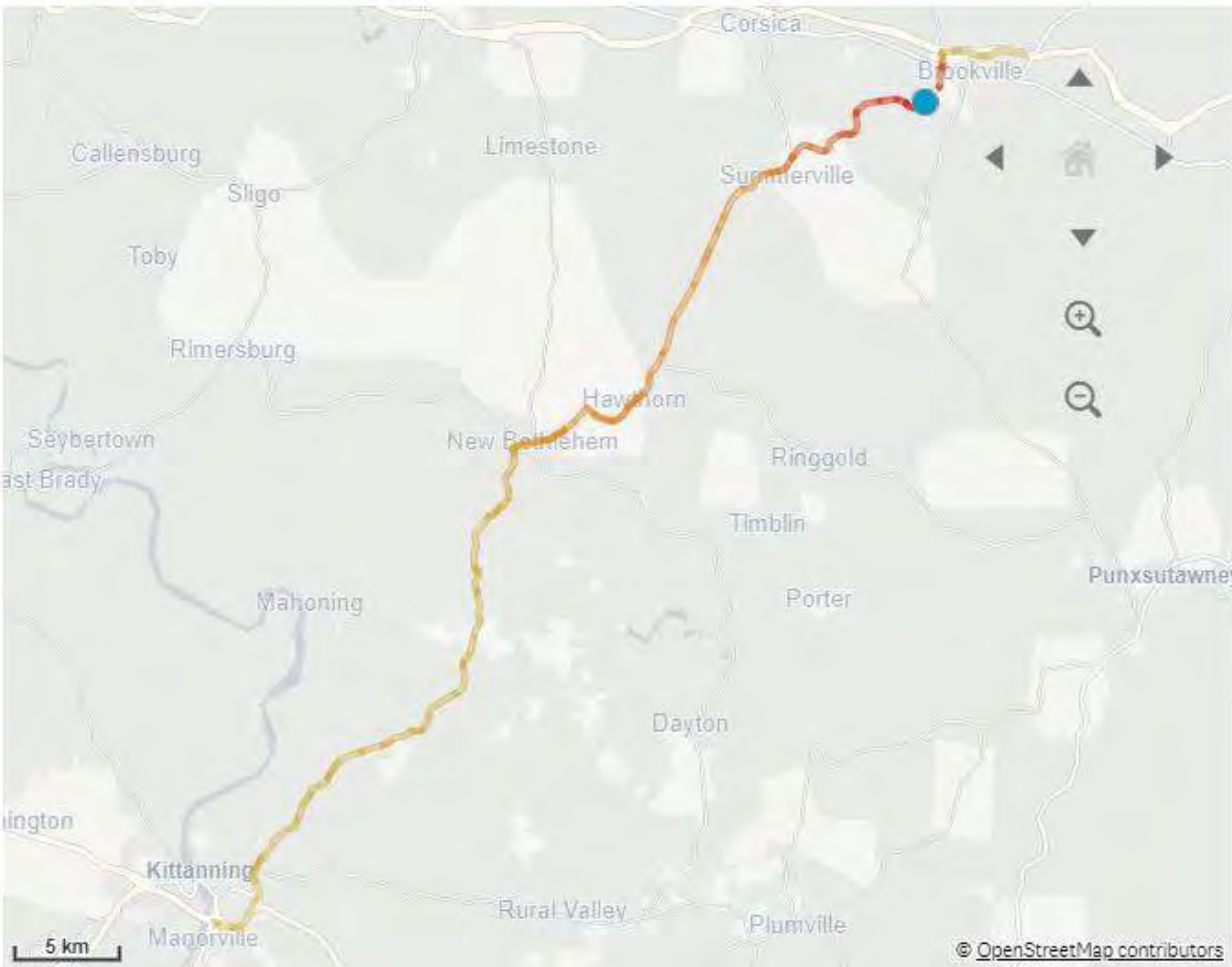


*Exhibit 34 - Distribution of Traffic Passing a Point On Route 28 near South Main St Brookville (Filtered by 4%)*

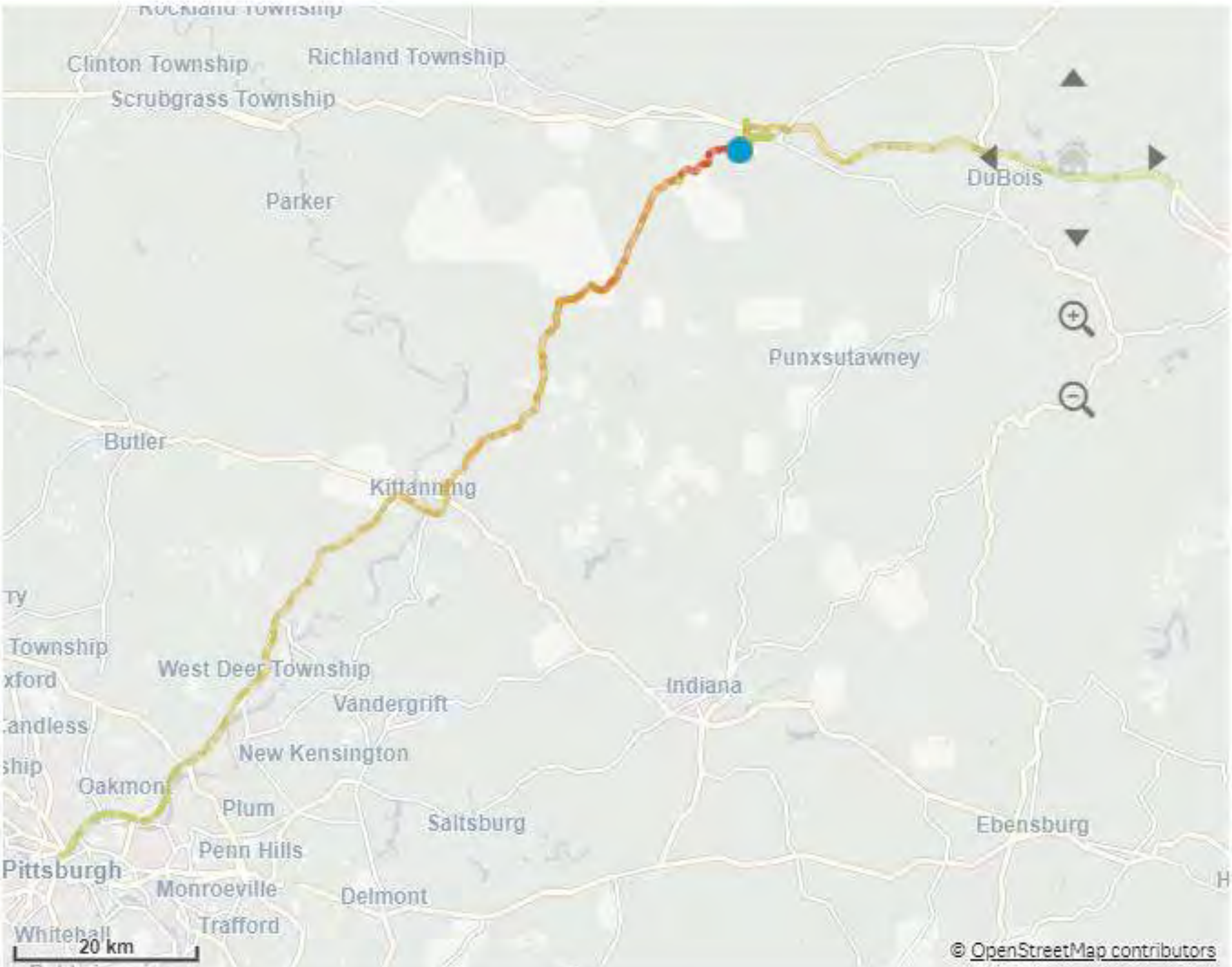
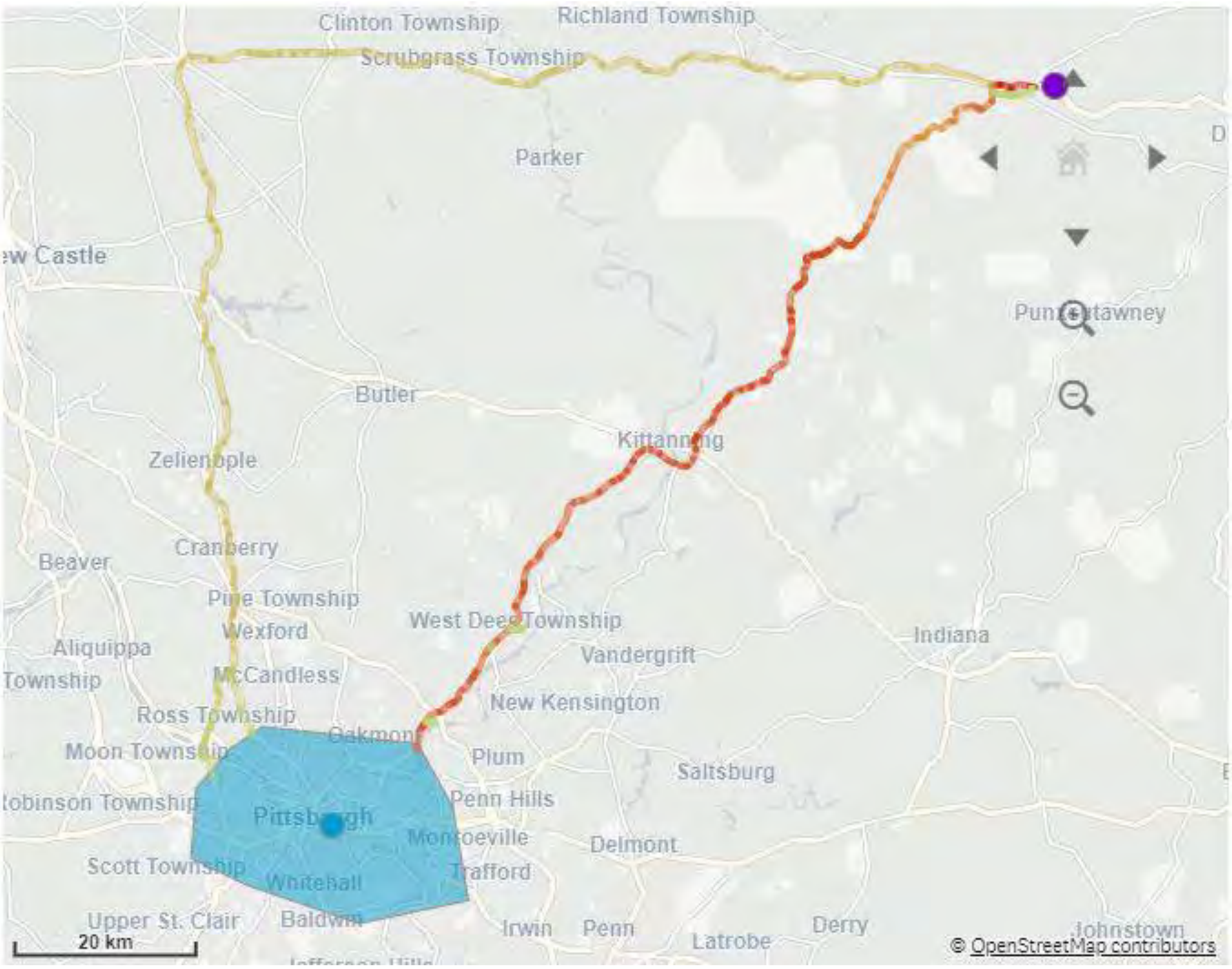


**EXHIBIT 36** shows a Top Route from Pittsburgh to a point east of Brookville. It highlights two main routes: the Route 28 corridor, and the I-79 to I-80 corridor. The Streetlight Index is a proportional approximation of traffic along the route. The Streetlight Index for the Route 28 corridor (80.6 miles, 1h 31m) is 65 versus an index of 26 for I-79 to I-80 (118 miles, 1h 50m). This shows that Route 28 is approximately three times more popular than I-79 to I-80 for this origin-destination zone pair. The reverse is also true. The trip southbound from Brookville to Pittsburgh shows Route 28 almost four times more popular with an index of 87 compared to I-80 to I-79 with an index of 23. However, we do not currently observe a significant amount of through traffic on this route because there is not significant demand between these two points. For example, about 4% of traffic passing South Main Street near Brookville is destined to/from Pittsburgh. Most trips were destined adjacent to the along the Route 28 Corridor or Kittanning.

*Exhibit 35 - Top Routes from Pittsburgh to Brookville*




In summary, the Streetlight data for the Route 28 corridor confirms the understanding that a majority of trips on the corridor are longer distance trips that service residences, business, and industry in the vicinity of the 40-mile corridor and beyond, into the rural counties in the northeast. It also indicates that Route 28 is a preferred route for the regional connection from Pittsburgh to I-80, though geometric constraints and economic conditions may play a role in the low demand between the two points currently.

## Safety Analysis

### Methodology

The most recent five years of available crash data (2013 to 2017) were compiled from the Pennsylvania Crash Information Tool (PCIT). Information relating to vehicle crash type, injury severity, weather conditions, time of day, seasonality, illumination, and roadway condition were analyzed to identify crash patterns and locations where the overall crash and fatality rates are higher than the statewide average.

The Department of Transportation defines a "reportable crash" as those that involve a fatality, injury, or require towing of one or more vehicles. Therefore, the crash system includes data from those "reportable" incidents only. The segments encompass approximately 40 miles of roadway network along Route 28 from Kittanning to I-80.

### Crash History Analysis

Analysis of the crash data along the Route 28 corridor identified 291 reported motor vehicle crashes within the five-year period 2013 to 2017. Reported crash cluster patterns and trends are summarized below.

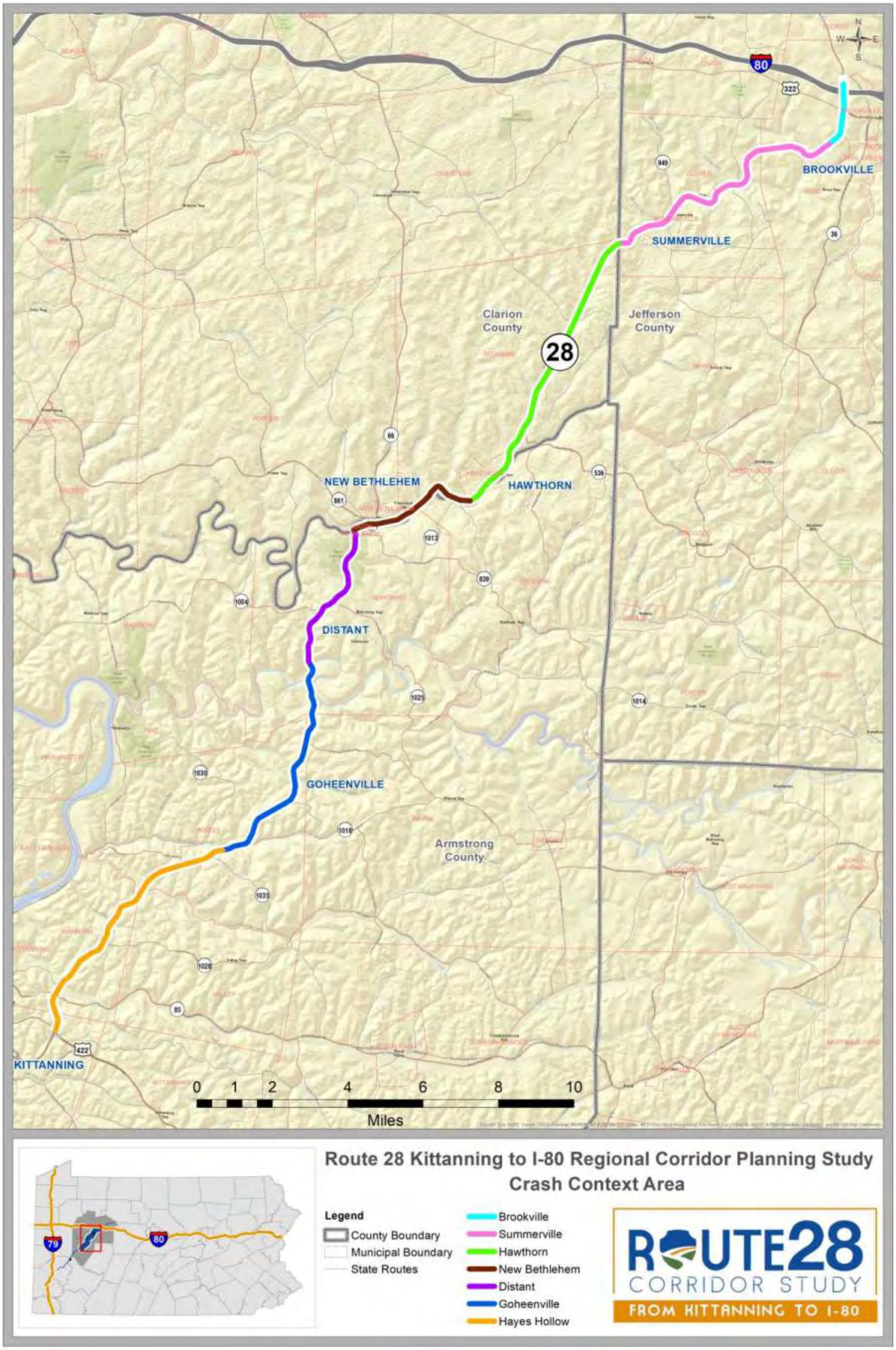
To drill down into the crash patterns, sub-segments of the corridor were chosen for analysis among different land use and transportation contexts. **EXHIBIT 37** shows the crash frequency analysis from south to north along the corridor. **EXHIBIT 37** shows the boundaries. From south to north, these included:

- Hayes Hollow area from US 422 through SR 85 to SR 1035 (Oscar Road)
- Goheenville area from SR 1018 to the Mahoning Creek
- Distant area from the Mahoning Creek to the 15mph curve south of South Bethlehem
- New Bethlehem area from the 15mph curve in South Bethlehem to west of SR 1013
- Hawthorn area from SR 1013 through SR 536 Mayport Road to Sandy Flat Road
- Summerville area from Sandy Flat Road to south of South Main Street
- Brookville area from South Main Street through US 322 to the I-80 ramps

***Exhibit 36 – Geographic Context of Overall Crash Frequency***

| Context | Length | Crashes | Percent | Crashes/Mile |
|---|---|---|---|---|
| Hayes Hollow | 7.2 | 96 | 33% | 13.3 |
| New Bethlehem | 3.7 | 36 | 12% | 9.7 |
| Summerville | 7.3 | 63 | 22% | 8.7 |
| Goheenville | 6.2 | 37 | 13% | 6.0 |
| Hawthorn | 8.0 | 44 | 15% | 5.5 |
| Brookville | 1.7 | 7 | 2% | 4.1 |
| Distant | 4.1 | 8 | 3% | 2.0 |
| Total | 38.2 | 291 | 100% | - |

*Exhibit 37 – Crashes by Context Area*



A general safety analysis of the entire corridor existing conditions was prepared to examine crash contributing factors and details such as location, type, severity, time of day, weather, seasonality, and illumination type. The crash location information shows that of the 291 reported crashes, 232 (80 percent) occurred at a mid-segment location, 56 (19 percent) occurred at an intersection, and remaining 3 crashes are identified as other types (1 percent) (**EXHIBIT 39**). The primary crash type observed involved vehicles hitting fixed objects (40 percent), angle crashes (20 percent), and rear-end crashes (14 percent) (**EXHIBIT 39**).

Approximately 5 percent of the crashes involved serious to fatal injuries (**EXHIBIT 40**). Overnight and mid-day were the highest time periods for crashes, with 70 percent of the daily crashes combined (**EXHIBIT 42**). 74 percent of crashes occurring during no adverse weather conditions (**EXHIBIT 42**). Winter and fall were the highest seasons for crashes at around 63 percent combined (**EXHIBIT 44**). 61 percent of crashes occurring in the daylight (**EXHIBIT 45**).

***Exhibit 38 – Crash Location Breakdown***

| Crash Location | Number of Crashes | Percentage |
|---|---:|---:|
| Mid-segment | 232 | 80% |
| Intersection (Four-way, Multi-Leg, T, Y) | 56 | 19% |
| Other | 3 | 1% |
| Total | 291 | 100% |

***Exhibit 39 – Crash Type Breakdown***

| Type of Crash | Number of Crashes | Percentage |
|---|---:|---:|
| Hit fixed object | 117 | 40% |
| Angle | 59 | 20% |
| Rear-end | 41 | 14% |
| Other or unknown | 37 | 13% |
| Non-Collision | 16 | 5% |
| Head-on | 10 | 3% |
| Sideswipe (same dir) | 4 | 1% |
| Sideswipe (opp dir) | 4 | 1% |
| Hit pedestrian | 3 | 1% |
| Total | 291 | 100% |

***Exhibit 40 – Crash Severity Breakdown***

| Crash Severity | Number of Crashes | Percentage |
|---|---:|---:|
| Not injured | 154 | 53% |
| Minor Injury | 53 | 18% |
| Possible Injury | 46 | 16% |
| Unknown injury | 15 | 5% |
| Serious Injury | 14 | 5% |
| Unknown if injured | 5 | 2% |
| Fatal Injury | 4 | 1% |
| Total | 291 | 100% |

### *Exhibit 41 – Crash Time of Day Breakdown*

| Crash Time | Number of Crashes | Percentage |
|---|---|---|
| Overnight | 119 | 41% |
| Mid-Day | 71 | 24% |
| PM Peak | 59 | 20% |
| AM Peak | 42 | 14% |
| Total | 291 | 100% |

### *Exhibit 42 – Crash Weather Condition Breakdown*

| Weather Condition | Number of Crashes | Percentage |
|---|---|---|
| No adverse conditions | 208 | 71% |
| Snow | 37 | 13% |
| Rain | 35 | 12% |
| Fog | 6 | 2% |
| Sleet (hail) | 2 | 1% |
| Unknown | 2 | 1% |
| Other | 1 | 0% |
| Rain and fog | 0 | 0% |
| Sleet and fog | 0 | 0% |
| Total | 291 | 100% |

### *Exhibit 43 – Crash Seasonality Breakdown*

| Season | Number of Crashes | Percentage |
|---|---|---|
| Fall | 83 | 29% |
| Winter | 74 | 25% |
| Summer | 69 | 24% |
| Spring | 65 | 22% |
| Total | 291 | 100% |

### *Exhibit 44 – Crash Illumination Type Breakdown*

| Illumination Condition | Number of Crashes | Percentage |
|---|---|---|
| Daylight | 160 | 55% |
| Dark - no street lights | 102 | 35% |
| Dark - street lights | 18 | 6% |
| Dawn | 7 | 2% |
| Dusk | 2 | 1% |
| Dark - unknown | 1 | 0% |
| Other | 1 | 0% |
| Total | 291 | 100% |

## Crash Rate Comparison

An annualized crash rate for each segment was calculated for the five-year period for comparison to the Pennsylvania statewide average crash rate. The crash data was converted to an annual crashes per 100 million vehicle miles traveled by segment for comparison to the most recent available crash information from PennDOT, *2017 Pennsylvania Crash Facts and Statistics*. The crash rate was calculated by dividing the annual crash frequency by the current average annual daily traffic and segment distance found in PennDOT's Roadway Inventory Management System (RIMS) data. For comparison, Pennsylvania's 2017 overall statewide crash rate was 126.8 crashes per hundred million vehicle-miles of travel; the 2017 statewide fatality rate was 1.12 fatalities per hundred million vehicle-miles of travel.

The corridor had higher than statewide average rates of fatalities on three segments – in the vicinity between Kittanning and Goheenville and near Hawthorn (**EXHIBIT 45**). There were four fatal crashes reported in the period from 2013-2017. Of those, three were head-on collisions, and one was a hit fixed object collision. All occurred during dry roadway conditions, 3 were in daylight. One included a heavy vehicle. Three of the crashes were in 2015, and one was in 2013. There was no pattern in the time of day or location.

The other higher-than-statewide-average crash frequency on the corridor is hit fixed object collisions. There are two major segments for high Hit Fixed Object type crashes, between Goheenville and Distant, and between Summerville and Brookville (**EXHIBIT 46**). Geometric constraints may play a factor in these types of collisions.

Of the 291 crashes, 153 closed a lane of traffic (53%) for some period of time. Of those, 34 (12%) were reported as requiring a traffic detour. On average, each of the detours were in place for three hours.

There were three pedestrian-involved crashes, two of which occurred in downtown New Bethlehem and one on a segment of Route 28 near Shannondale Road where there are no pedestrian facilities **(EXHIBIT 50**). There were four crashes involving school buses, one including a loaded school bus in the AM peak hour with three injuries and 34 people involved. Two of the school bus collisions were rear end accidents, both of which occurred around the curve north of Summerville between Coder Road and Seldom Seen Road, including the one with the loaded school bus (**EXHIBIT 51**). Limited sight distance and speeds seem to be contributing factors in this area.

The outreach to project stakeholders and the public identified key segments and intersections as potential safety concerns. The crash patterns and history at these locations were further analyzed to determine if a correctable pattern of collisions could be identified. The crash patterns were analyzed in the following insets:

**EXHIBIT 47** shows:

- Mayport Road SR 536 – At this location, there were two angle and one hit fixed object crash in the five year period.
- Sloan Hill Road / Mechling Road – At this location, there was one hit fixed object, one angle, and one head on collision. This inset also shows the Lower Hayes Road area locally known as the Hayes Dip. There were no crashes reported at this location in the five-year period.
- SR 85 – At this location, there were two rear end collisions, two hit fixed object, and two angle collisions. Rear end and angle collisions are common at signalized intersections.

**EXHIBIT 48** shows:

- 15 mph curve leading into South Bethlehem – at this location, there were two hit fixed object crashes.
- 45mph curve between New Bethlehem and Hawthorn – at this location, there was one hit fixed object crash. There is a cluster of crashes at the location of the Redbank Valley Trail crossing just to the south of this curve. Though there are no reported pedestrian hits. It is unclear from the data whether these were near-misses with bicyclists and pedestrians, or if these were run-off-the-road crashes due to the geometry of the roadway.
- Distant – at this location, there was only one hit fixed object crash.

**EXHIBIT 49** shows:

- South Main Street – at this location, there were no crashes.
- Broad at Wood Street and greater New Bethlehem – in this area, there are few crashes. There were two pedestrian-involved accidents downtown.
- SR 1035 (Oscar Road) – at this location, there are a few hit fixed object crashes nearby and one rear end on SR 28.

## PennDOT Safety Screening

SPC provided a PennDOT rates were compared. PennDOT conducts a statewide inventory of observed crashes versus predicted crashes based on roadway geometry and the Highway Safety Manual. Through this process, PennDOT identifies roadway segments with observed crashes greater than the predicted amount of crashes. These are identified as areas with excess crashes. **EXHIBIT 52** shows segments along the Route 28 corridor that have been identified as areas of potential excess crashes. This identification may provide insight on locations where crashes are occurring more frequently than predicted, thus enabling engineers to identify correctable design features.

## Safety Summary

The project-specific crash history analysis comparison against the statewide average rate coupled with PennDOT's predictive safety screening processes help the project team to identify areas with correctable safety features. The statistical patterns generally support concern areas that were identified by the steering committee, public, and stakeholders. In most cases, geometric constraints including horizontal and vertical curvature and poor sight distance may contribute to the high Hit Fixed Object crash type found on the winding curves of the corridor. The safety information is accounted for in the evaluation matrix and used to develop the purpose and need for certain improvement concepts.

### *Exhibit 45 – Crash History Comparison (Fatalities)*

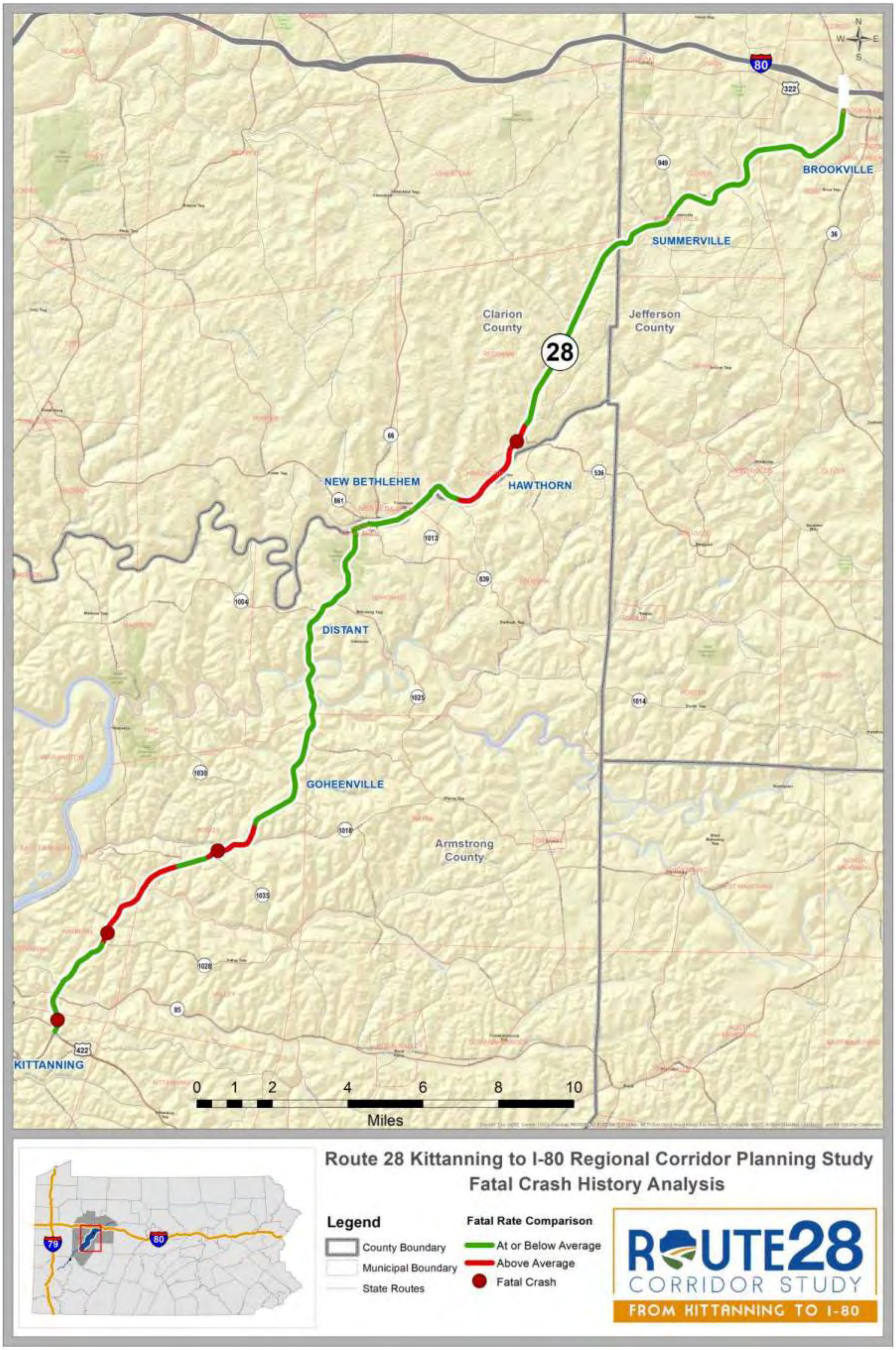


*Exhibit 46 – Crash History Comparison (Hit Fixed Object)*

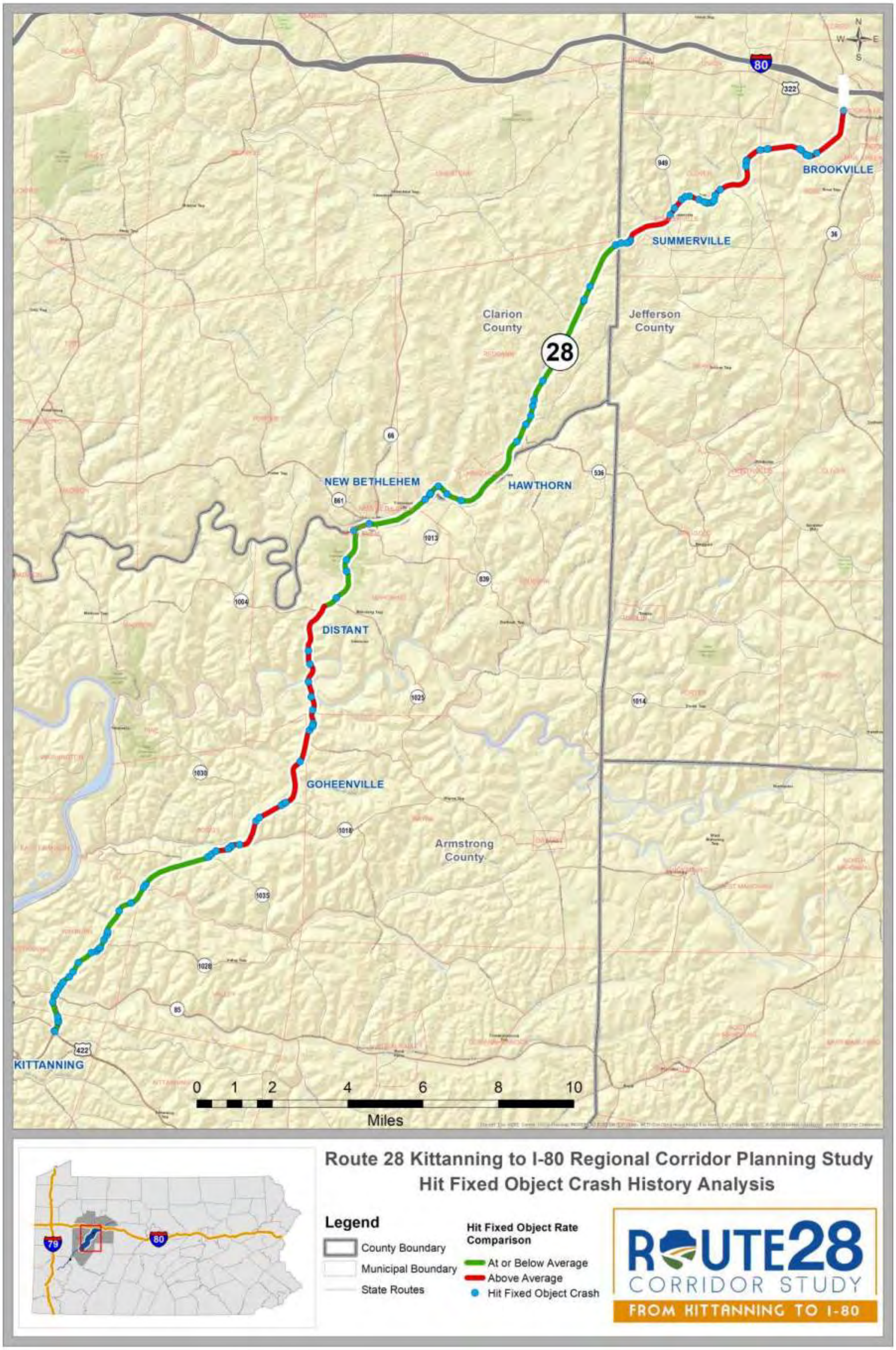


*Exhibit 47 - Crash History Collision Type Analysis (Insets 1)*

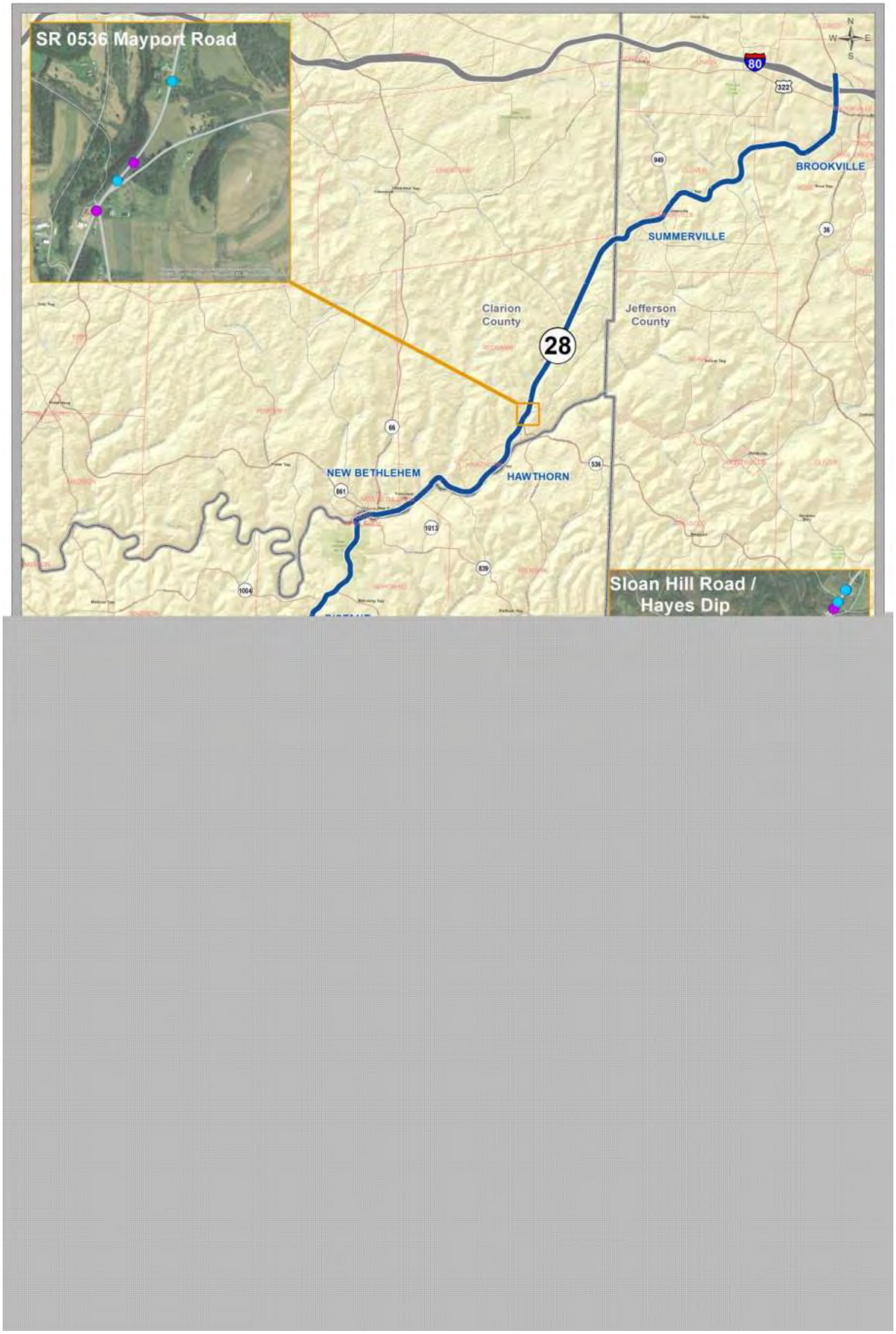


*Exhibit 48 - Crash History Collision Type Analysis (Insets 2)*

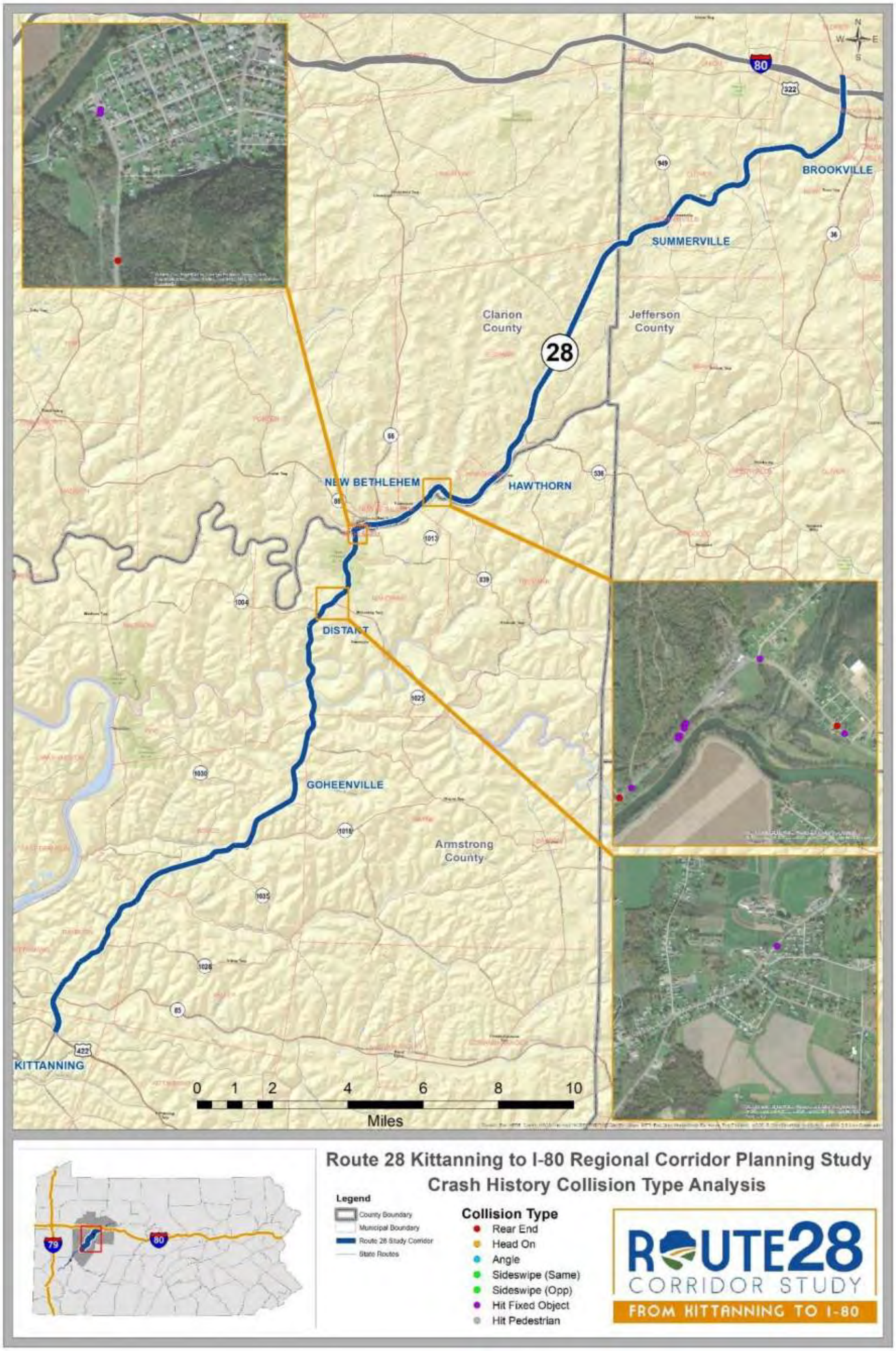


*Exhibit 49 - Crash History Collision Type Analysis (Insets 3)*

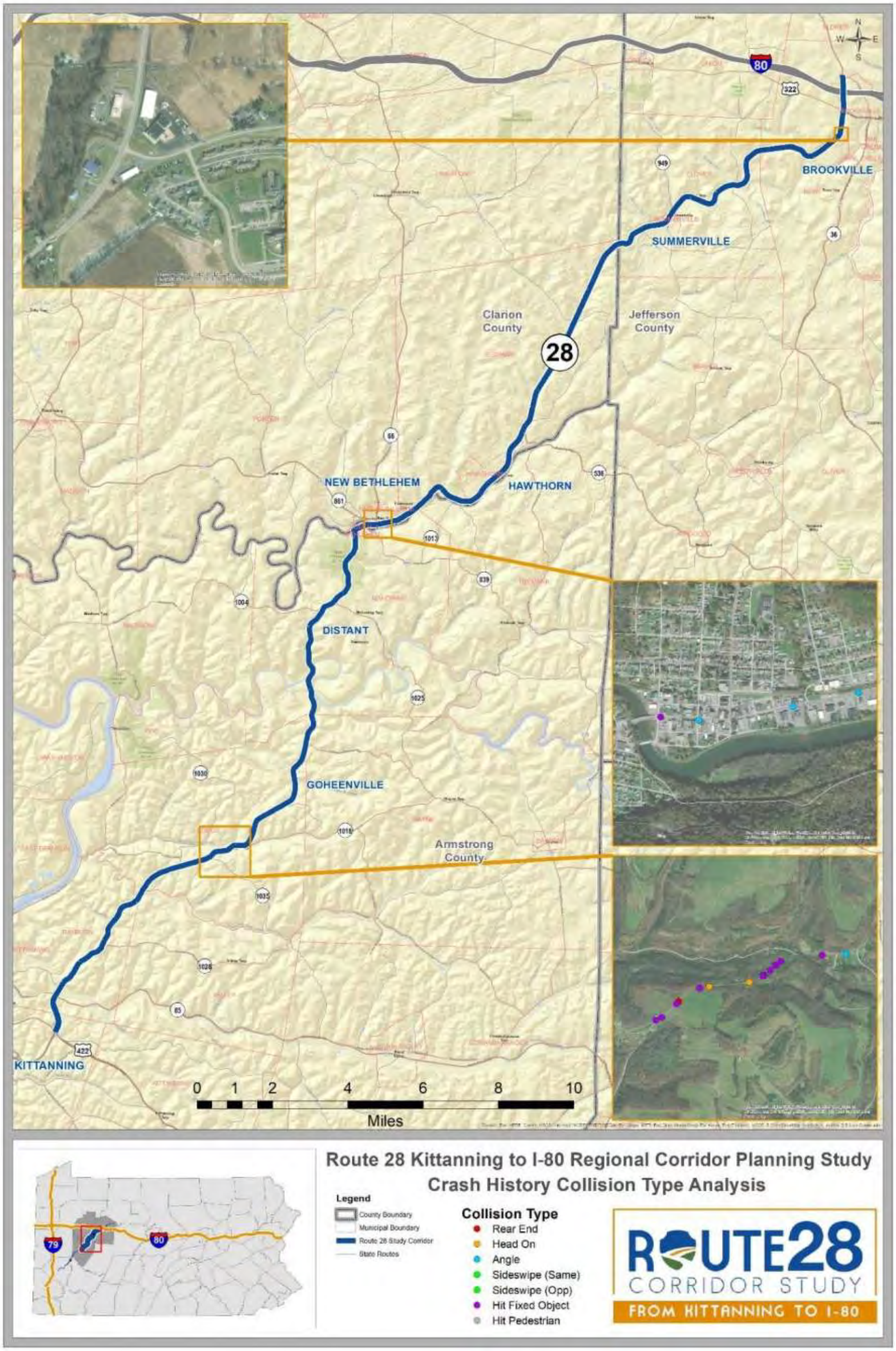


*Exhibit 50 – Crashes Involving a Pedestrian*

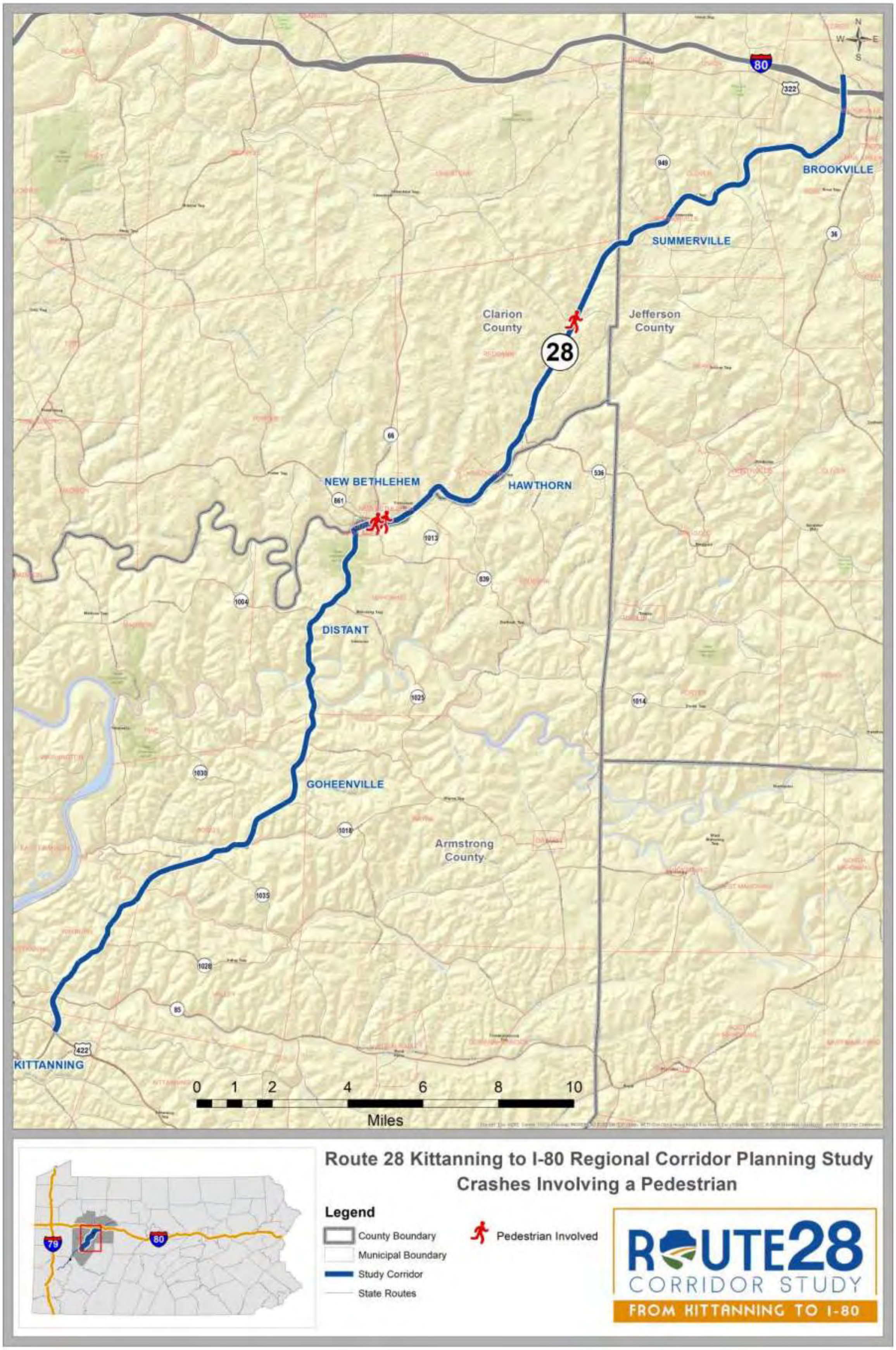


*Exhibit 51 – Crashes Involving a School Bus*

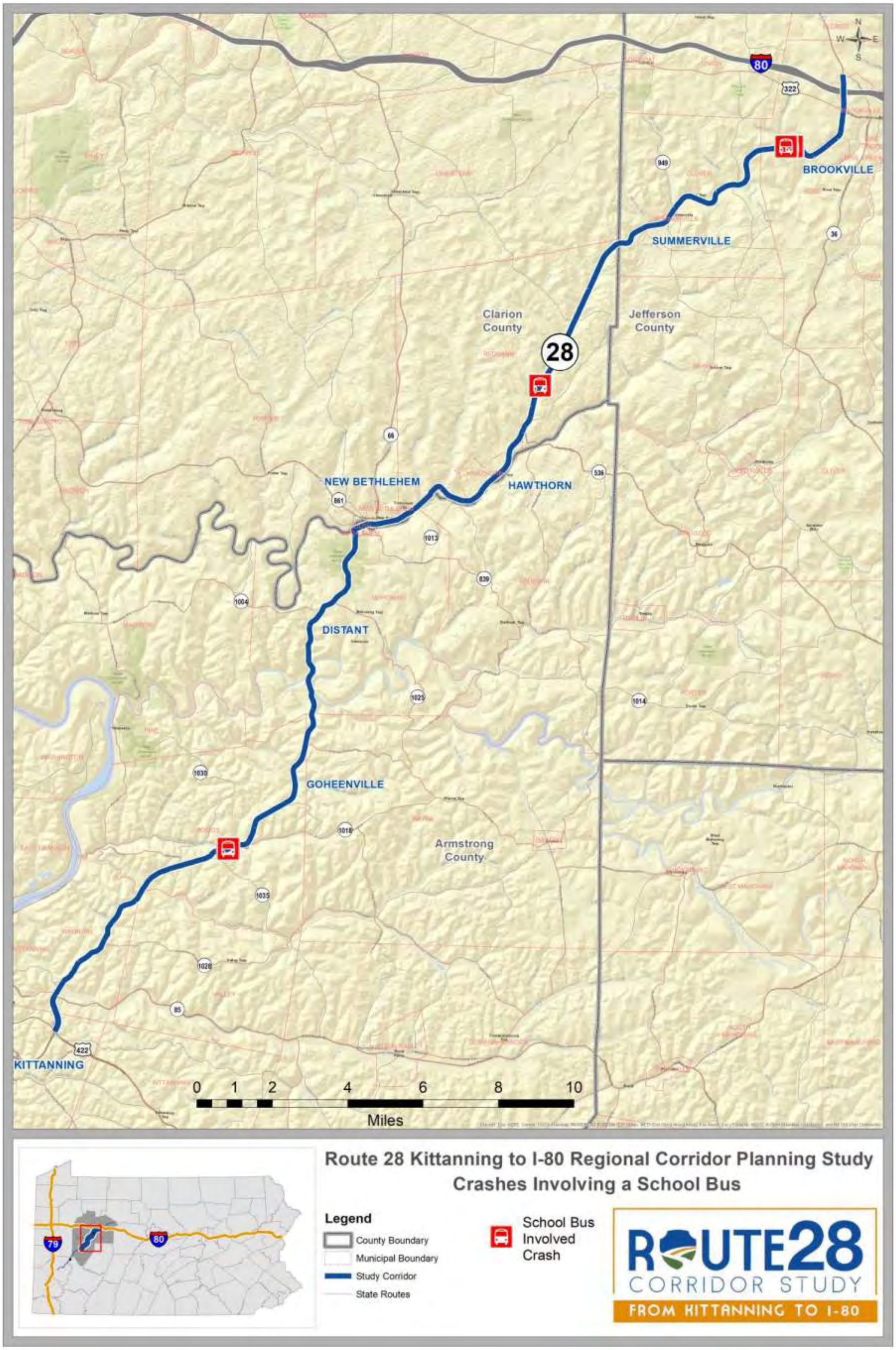
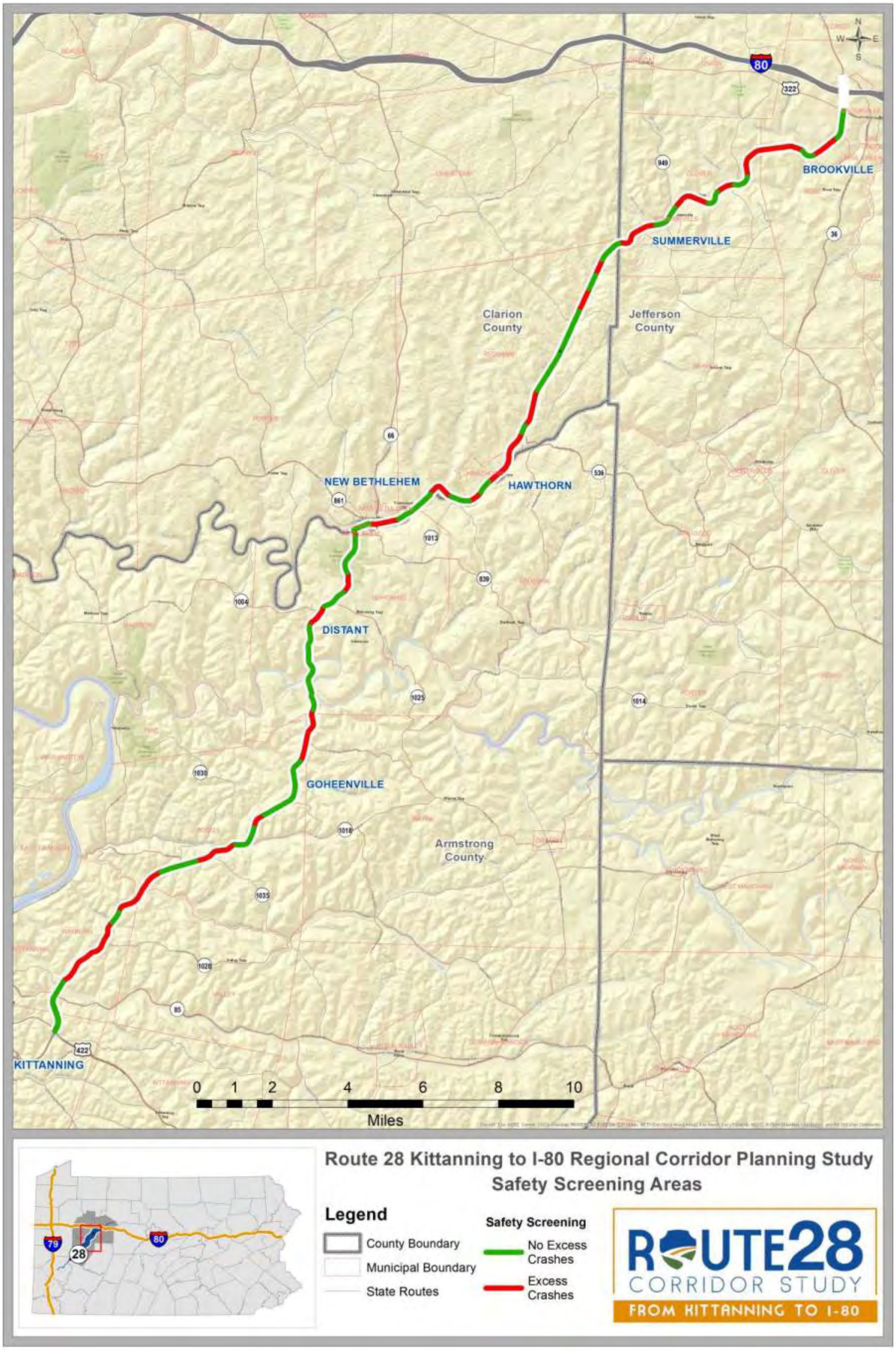


*Exhibit 52 – PennDOT Safety Screening Segments*



## Multimodal Facilities

While the Route 28 corridor today primarily serves passenger car and commercial freight traffic, the corridor also serves pockets of multimodal activity surrounding communities and areas like Distant, South Bethlehem, New Bethlehem, Redbank Valley High School, the Redbank Valley Trail, and Hawthorn. This section describes the land use context and multimodal facilities in each of these areas.

### Distant


Distant is a primarily residential community with homes with close setbacks and driveways directly accessing Route 28. There are also agricultural uses nearby including Bostonia Farms. The speed limit in Distant is reduced from 55 mph coming up Hogback Hill to 40 mph through town. Distant is home to pedestrian-generating stores such as Sweet Delights ice cream and a Dollar General which was built in recent years. There is approximately 1000 feet of sidewalk on the north side of Route 28 from the SR 1004 intersection to a residential endpoint approximately 200 feet west of Sweet Delights on the opposite side of the roadway. The Dollar General is approximately 1000 feet further east. There are no marked crosswalks or ADA-compliant curb ramps in this area. The sidewalk is narrow but in overall good condition without significant heaving, cracking, or overgrowth. A general inventory of Distant's multimodal facilities and pedestrian generators is shown in **EXHIBIT 54**.

### South Bethlehem

Rounding the 15mph curve going northbound on Route 28 entering South Bethlehem, sidewalks begin and are located on both sides of the roadway through a traditional residential street grid. Many of the sidewalks and curb ramps are narrow, heaved due to tree roots, overgrown with grass, cracked, and have no curb ramps. In one instance, there is a step at the ramp. There are no marked crosswalks or pedestrian crossing signs in this area. West of the curve, there is a pedestrian bridge over the Redbank Creek which provides an official access point to the Redbank Valley Trail. This access is not signed from the roadway or connected to the community by sidewalk. At the intersection with SR 839 / Putneyville Road, there are three curb ramps with detectable warning surfaces. A general inventory of South Bethlehem's multimodal facilities and pedestrian generators is shown in **EXHIBIT 55**.

### New Bethlehem

The bridge over Redbank Creek crossing into New Bethlehem from South Bethlehem has sidewalks and curb ramps on both sides. In downtown New Bethlehem, there is a walkable street grid with sidewalks on both sides of the street, recently updated curb ramps with detectable warning surfaces, mid-block pedestrian crossings, and parking on both sides of the street. The speed limit in this segment is reduced to 25 mph. Sidewalk on the north side of the roadway ends around Keck Avenue near the Smucker's facility, but continues on the south side of the corridor toward the Library and mini-mall. A general inventory of New Bethlehem's multimodal facilities and pedestrian generators is shown in **EXHIBIT 56**.

## Library and Redbank Valley High School

Heading north on Route 28, the speed limit is 35mph towards the plaza, which has a Riverside grocery store, Burger King, a plaza with restaurants, and the New Bethlehem Public Library. The sidewalk continues on to the Redbank Valley High School football field and main building. Across the street from the high school's main entrance is a cluster of small businesses including a chiropractor and a Subway restaurant. There is one marked pedestrian crossing across Route 28 near the main entrance, and signs for "no parking". Parking in the business lots around dismissal time is a problem for these businesses. Student dismissal was a concern for stakeholders, as large numbers of students cross to be picked up, and walkers cross the street to use the rail trail which leads back to their homes in the heart of downtown New Bethlehem. The sidewalk ends at the edge of the Redbank Valley High School property approximately 900 feet east of the high school crosswalk. A general inventory of this area's multimodal facilities and pedestrian generators is shown in **Exhibit 57**.


## Redbank Valley Trail Crossing

Heading north away from the High School, the speed limit picks up again to 45 mph near M&S Meats. The building density in this area decreases and the roadway curvature resumes. Approximately 0.75 miles east of the last sidewalk, the Redbank Valley Trail crosses the Route 28 corridor at an angle between two horizontal curves. There is signage for trail ahead and what remains of a marked crossing. Stakeholder interviews indicated that the trail is under Public Utility Commission (PUC) jurisdiction, and that the PUC responded to complaints about the location of the crossing by removing the crosswalk striping. An aerial view of the trail crossing location at Route 28 is shown in **Exhibit 58**.

### Hawthorn

In Hawthorn, approximately 0.5 mi of sidewalk network is present on the northern side of Route 28 from Yost to E 1st Street. The Redbank Valley Trail runs is visible from Route 28 and runs parallel to the roadway in this area at approximately 15 to 50 feet away, but there are no marked crossings across Route 28. This area was reported as a hot spot for canoe and kayak activity in the summer months due to the accessibility of the Redbank Creek in the area. Hawthorn is also home to Redbank Valley Municipal Park, where the Clarion County Fair is held each year, and also has camp sites, shelters, and RV hookups. North of this area, Route 28 and the Redbank Valley Trail diverge as the trail follows the river. Fishbasket Indian Town historical marker in this area depicts where Native Americans settled on the river. A general inventory of Hawthorn's multimodal facilities and pedestrian generators is shown in **EXHIBIT 59**.

The crash analysis revealed four school bus-involved crashes, three pedestrian-involved crashes, and no bicycle-involved crashes. Two of the pedestrian-involved crashes were in downtown New Bethlehem at midblock locations.

Another mode that is prevalent on the corridor are ATVs. Popular ATV trails cross the corridor and frequent poker runs are a large regional tourism draw.

*Exhibit 53 – Redbank Valley Trail System*

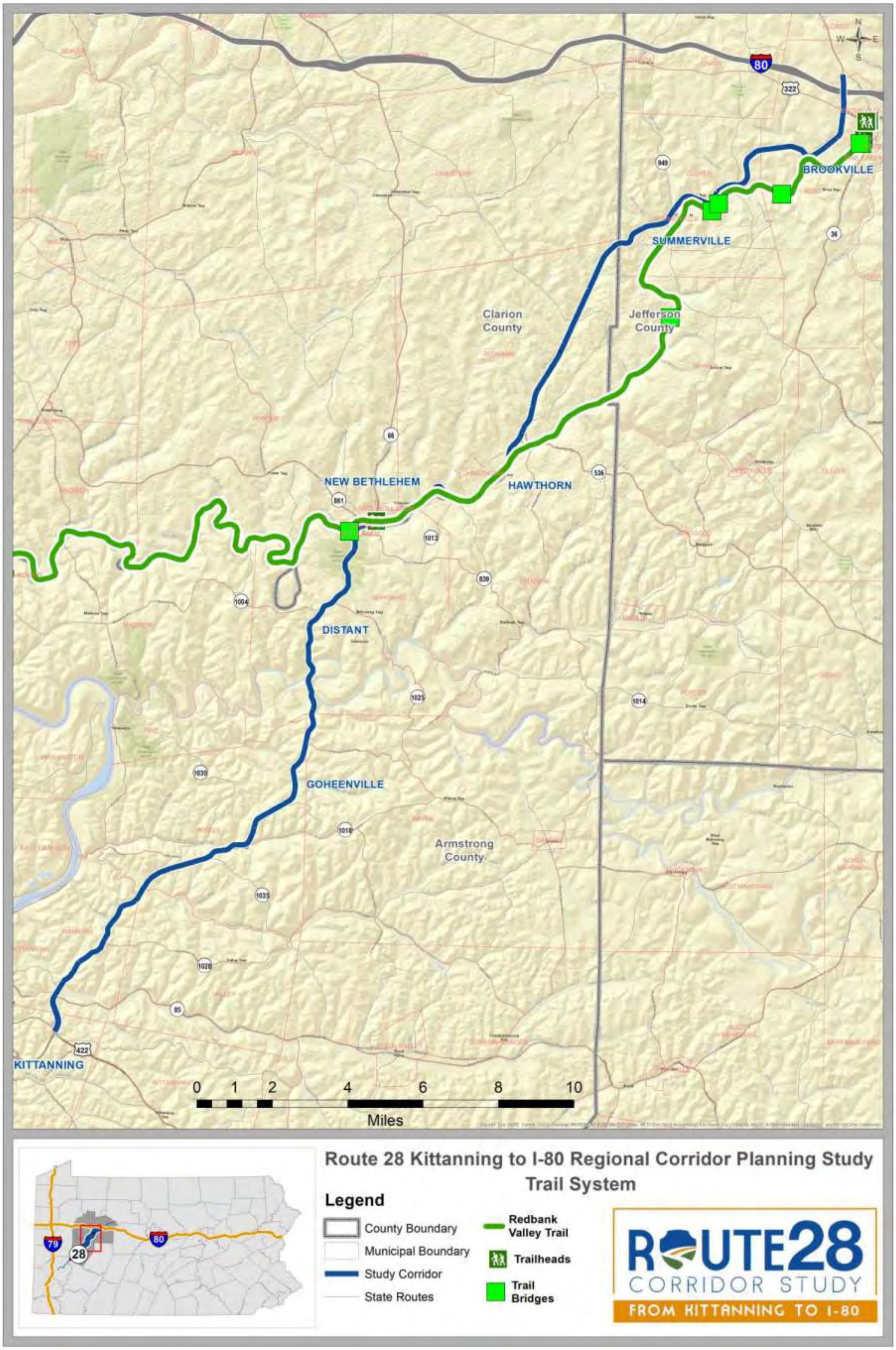


*Exhibit 54 - Multimodal Facilities (Distant)*

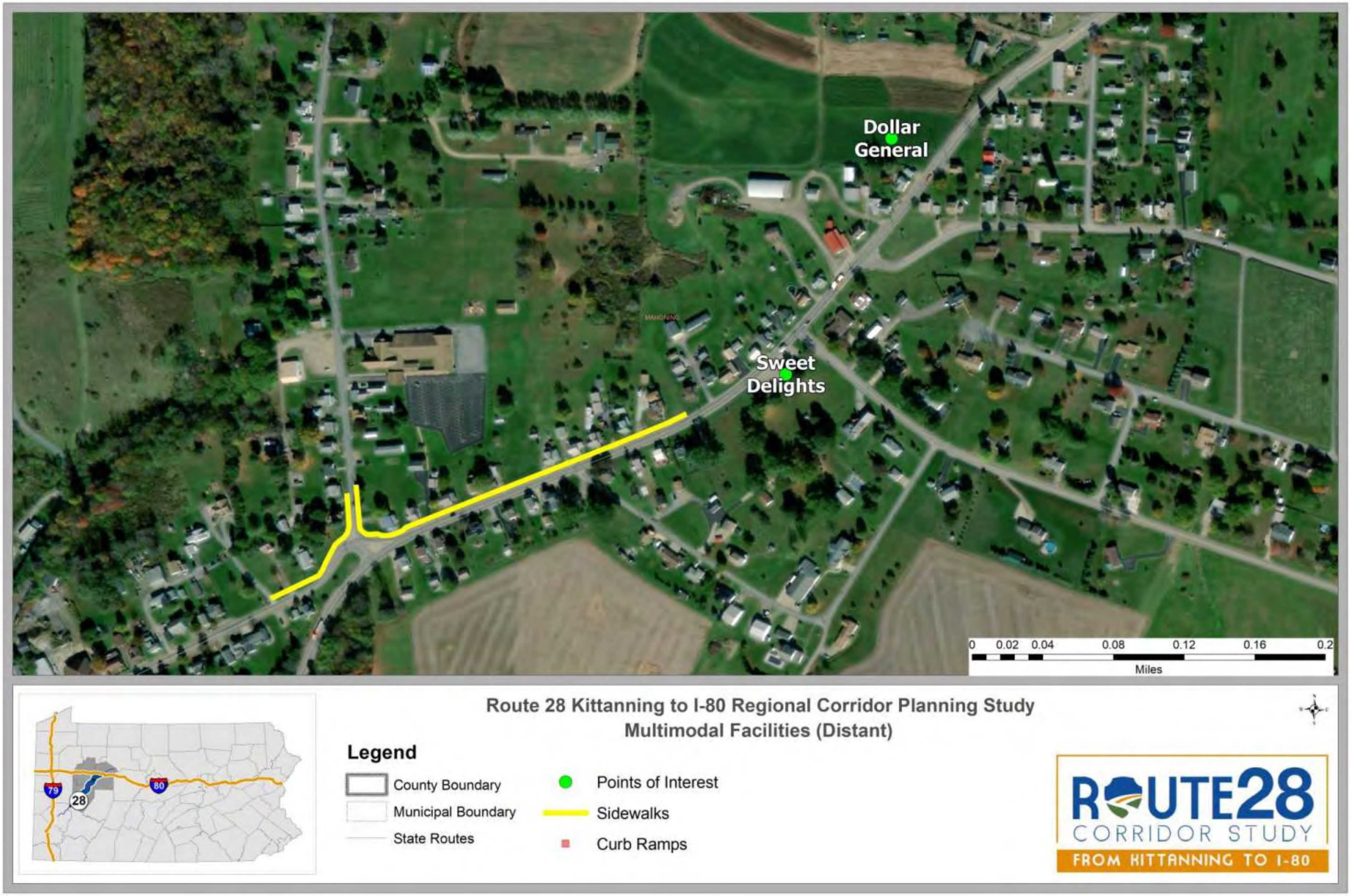


*Exhibit 55 – Multimodal Facilities (South Bethlehem)*

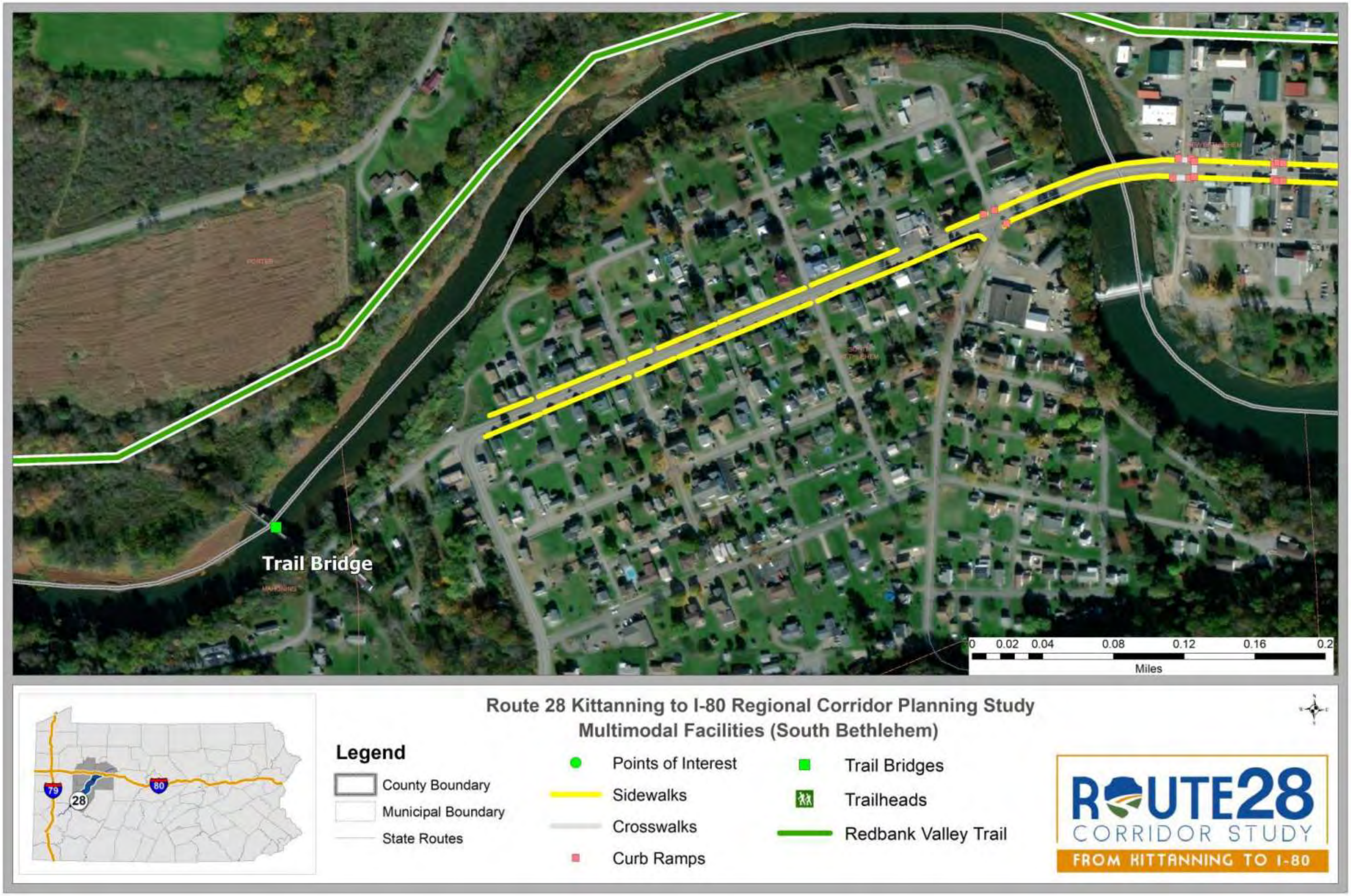


***Exhibit 56 - Multimodal Facilities (New Bethlehem)***

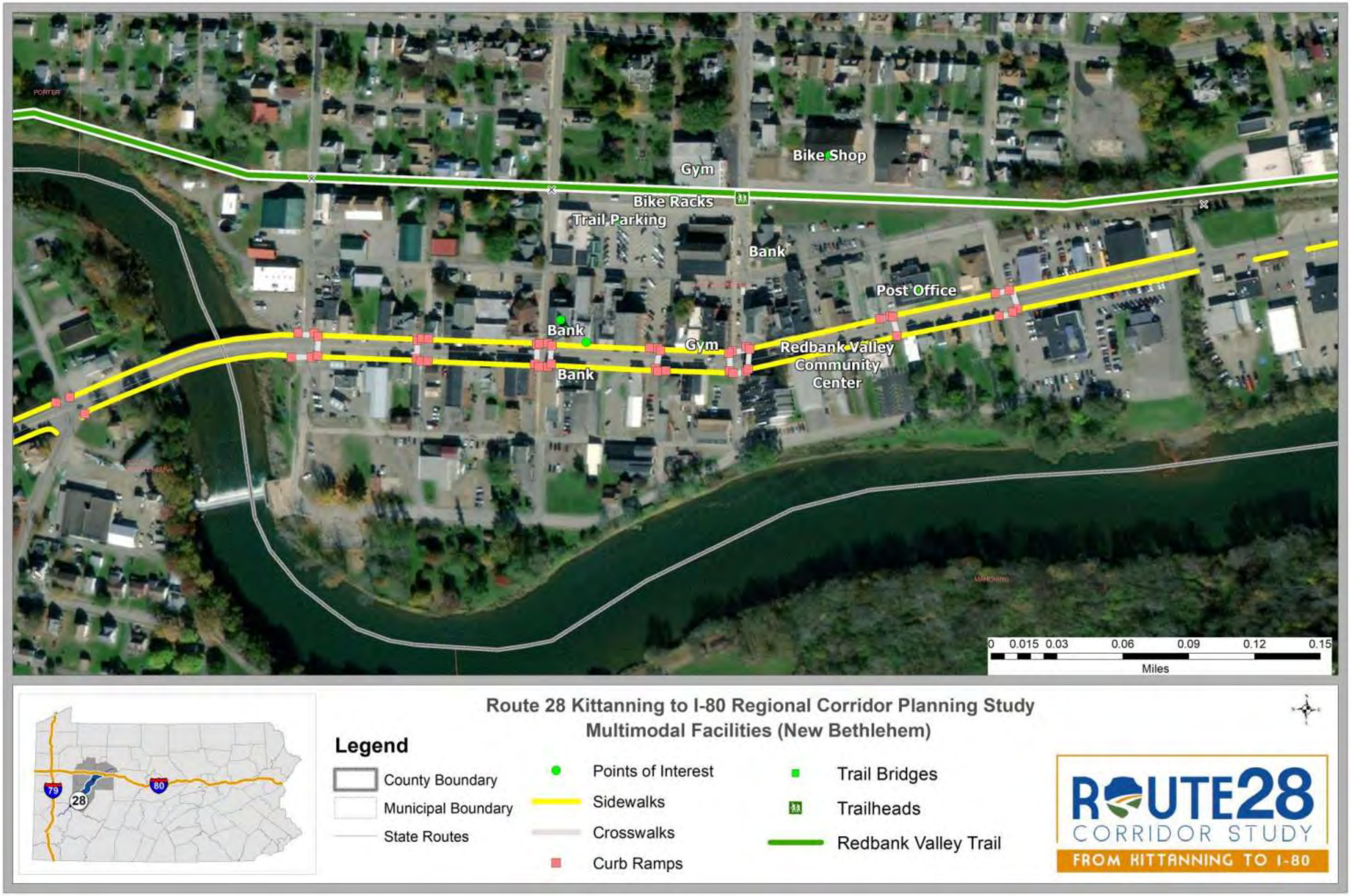


*Exhibit 57 – Multimodal Facilities (New Bethlehem Plaza and High School Area)*

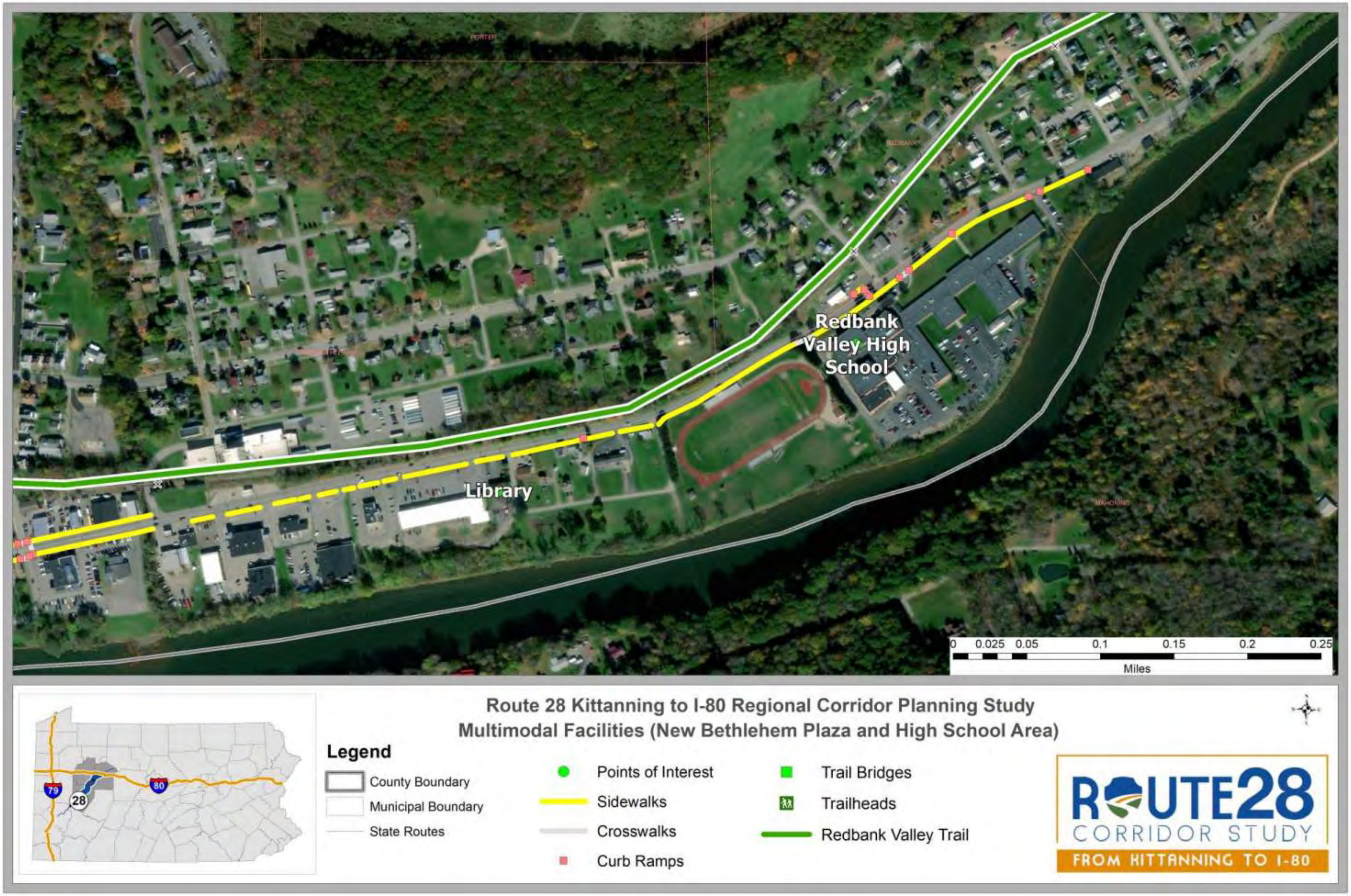


*Exhibit 58 - Multimodal Facilities (Redbank Valley Trail Crossing of Route 28)*

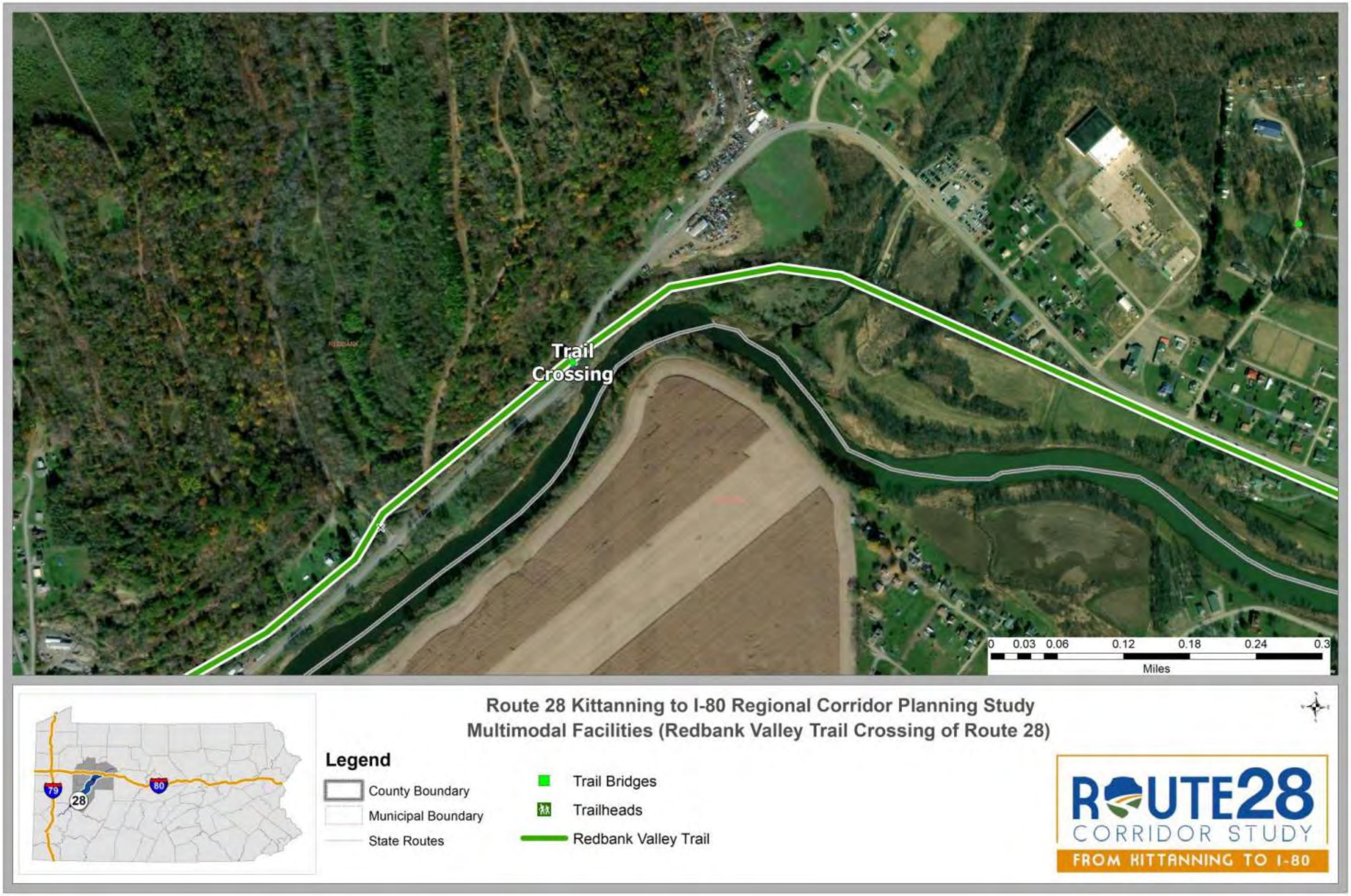
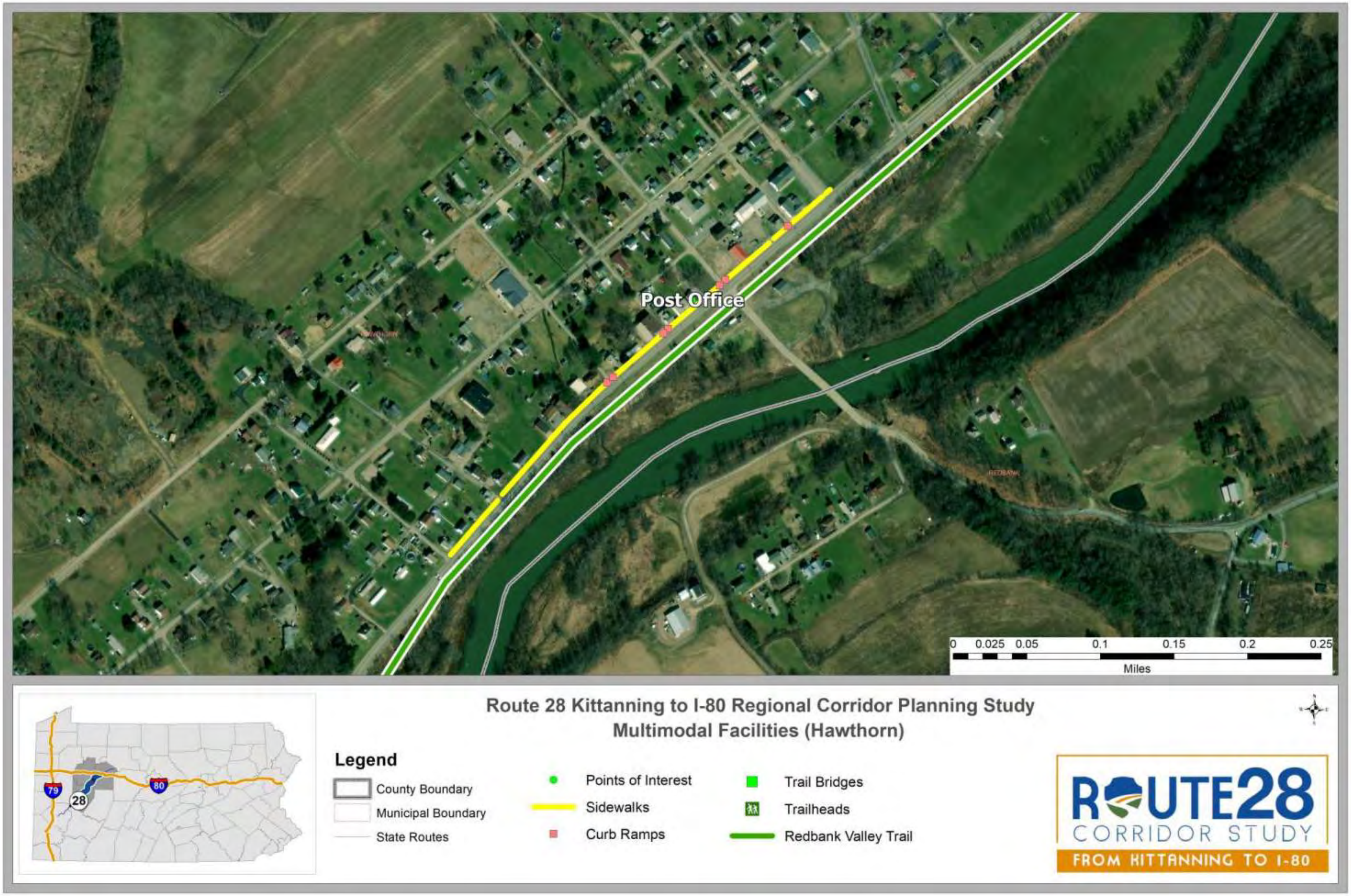


*Exhibit 59 - Multimodal Facilities (Hawthorn)*



## Geometric Considerations

### Design Criteria

The RT 28 Corridor has a functional classification of Regional Arterial. The Area System designation is Rural. There are five speed limit changes noted through the study area; 25 MPH, 35 MPH, 40 MPH, 45 MPH, and 55 MPH. Design Criteria charts considering new construction were developed the corridor following guidance found in PennDOT Publication 13M Design Manual Part 2 Highway Design. The design criteria data was used as a basis for comparison to the existing Route 28 Study Corridor roadway geometry and widths. These tables and related charts can be found in **APPENDIX C**.

### Typical Sections

The typical section is consistent throughout the corridor. In general, the lane width is about 11' but can vary between 10' to 12' in width. The shoulders vary between 3' to 9' in width though the corridor. Most of the shoulders are 6' in width or less and only in a few locations near major intersections do they get wider.

### Horizontal and Vertical Geometry

Existing horizontal radii through the corridor were weighted against the current design criteria. Speeds up to 40 MPH were limited to a maximum super elevation rate of 6%. For the higher speed limits 45 MPH & 55 MPH a slightly higher maximum super elevation rate of 8% is permitted with shoulder rounding. Based on these values the minimum design horizontal radii are shown in **EXHIBIT 60**. There are currently 18 notable areas with horizontal radii less than that current recommended design values (**EXHIBIT 61** and **EXHIBIT 62**).

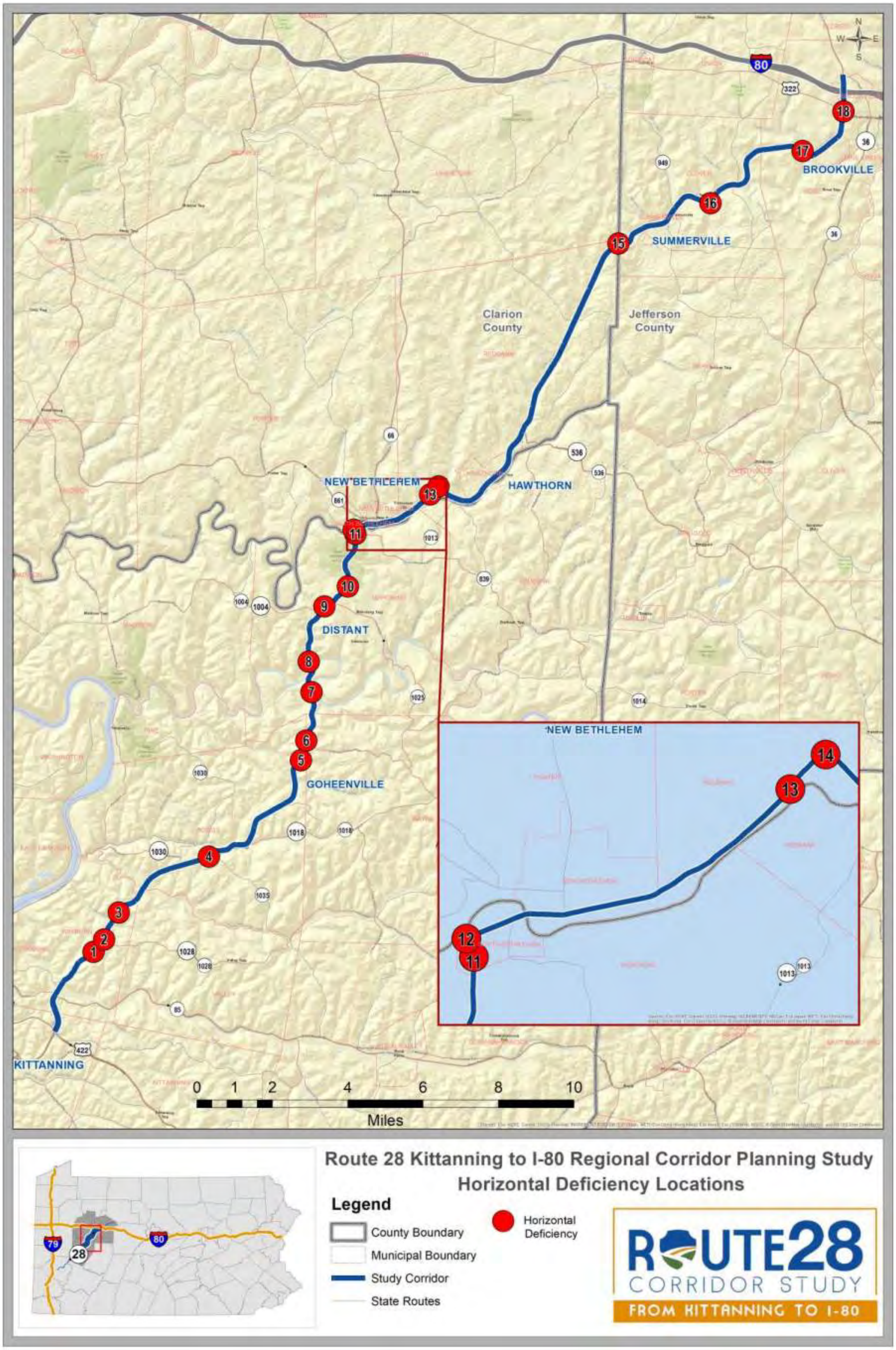
***Exhibit 60 – Design Chart Horizontal Radii***

| Speed | Minimum Horizontal Radius (ft) |
|---|---|
| 25 MPH | 144 |
| 35 MPH | 340 |
| 40 MPH | 485 |
| 45 MPH | 587 |
| 55 MPH | 960 |

*Exhibit 61 – Areas with Horizontal Radii Less Than Current Recommended Design Value*

| ID | Existing Radius (ft) | Speed | Min Radius (ft) For Speed | Location or Nearest Cross Street |
|---|---|---|---|---|
| 1 | 700 | 55 MPH | > 960 | Jaraly Lane |
| 2 | 600 | 55 MPH | > 960 | Iron Bridge Road / Lower Hayes Road |
| 3 | 903 | 55 MPH | > 960 | Mechling Road |
| 4 | 600 | 55 MPH | > 960 | SR 1035 (Oscar Road) |
| 5 | 600 | 55 MPH | > 960 | W. Caldwell Road/ Kuhns Road |
| 6 | 650 | 55 MPH | > 960 | Calhoun School Road |
| 7 | 450 | 55 MPH | > 960 | T602 (Tipple Road) |
| 8 | 500 | 55 MPH | > 960 | Wadding Road |
| 9 | 45 | 25 MPH | > 144 | SR 1004 (Madison Road) / Kohlersburg Road |
| 10 | 600 | 55 MPH | > 960 | Golf Link Road |
| 11 | 250 | 35 MPH | > 340 | South Street |
| 12 | 75 | 35 MPH | > 340 | South New Bethlehem; N Main/ W Broad |
| 13 | 350 | 45 MPH | > 587 | Red Bank Valley Trail Crossing |
| 14 | 450 | 45 MPH | > 587 | TR921 |
| 15 | 700 | 55 MPH | > 960 | Sandy Flat Road |
| 16 | 780 | 55 MPH | > 960 | Moore Road |
| 17 | 900 | 55 MPH | > 960 | Seneca Trail / Seldom Seen Road |
| 18 | 80 | 35 MPH | > 340 | US 322 |

## *Exhibit 62 – Areas of Horizontal Deficiency*

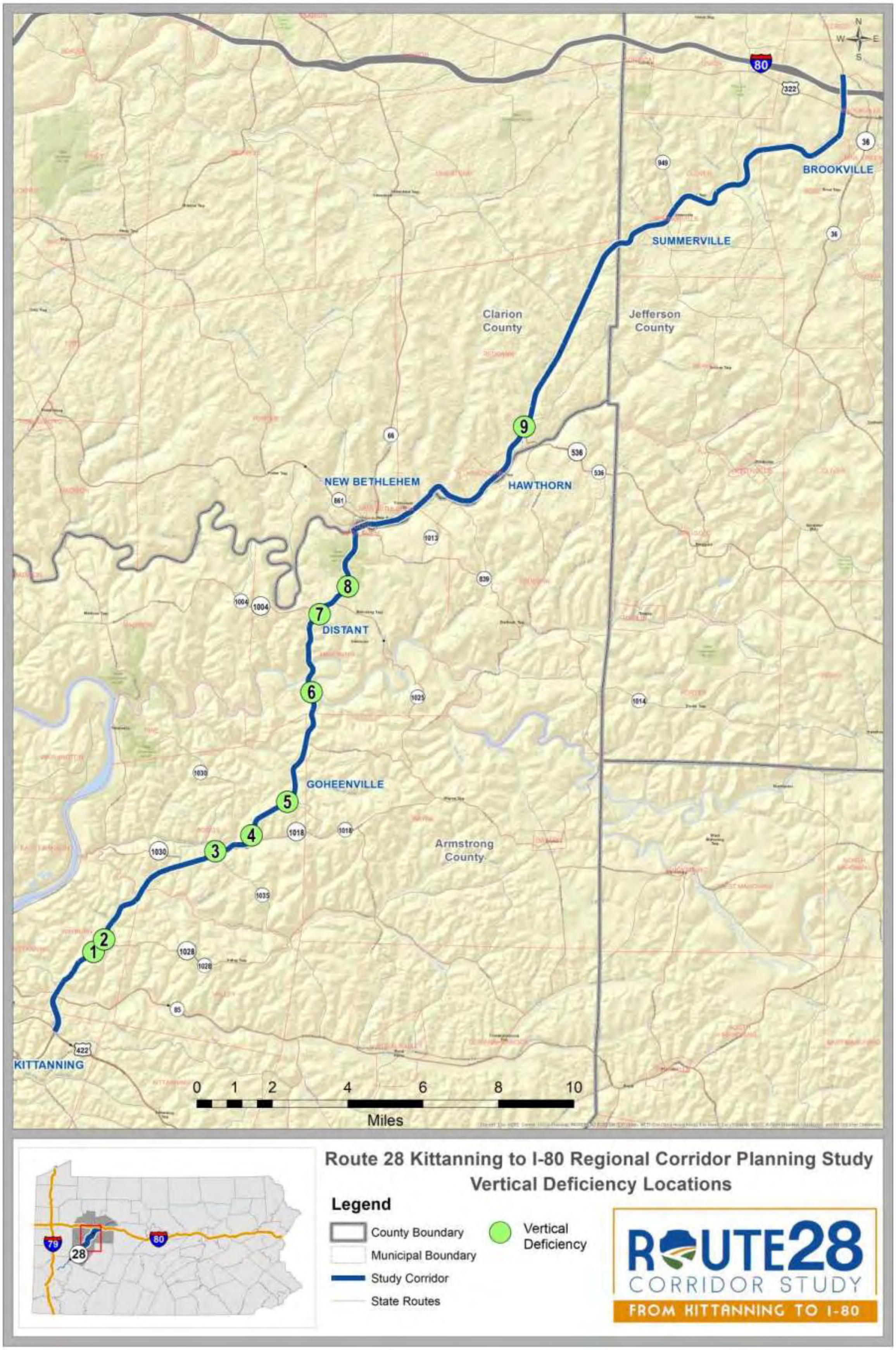


Existing vertical grades vary throughout the corridor. Many roadway sections have grades exceeding the desired current design maximum vertical grades of 5% (55 MPH) or 6% (up to 45 MPH). Excessive vertical grades not only make maintaining speeds difficult for larger truck traffic but also can limit sight distance for passing or entering roadways at intersections. In examining the corridor there are 10 notable areas with vertical grades exceeding the current maximum design grade (**Exhibit 63** and **Exhibit 64**).

***Exhibit 63 – Area with Vertical Grades Exceeding Maximum Design Grade***

| ID | Existing Grade (%) | Speed | Max Grade (%) For Speed | Location or Nearest Cross Street |
|---|---|---|---|---|
| 1 | 7.6-8.4 | 55 MPH | 5 | Jaraly Lane |
| 2 | 7.7-9.0 | 55 MPH | 5 | Iron Bridge Road |
| 3 | 8.9 | 55 MPH | 5 | SR 1035 (Oscar Road) |
| 4 | 8.8 | 55 MPH | 5 | SR 1018 |
| 5 | 7.3-8.5 | 55 MPH | 5 | SR 1027 |
| 6 | 7.1-9.2 | 55 MPH | 5 | T602 (Tipple Road) |
| 7 | 6.9-8.8 | 40 MPH | 6 | Near Distant, PA |
| 8 | 6.5-7.6 | 55 MPH | 5 | Golf Link Road |
| 9 | 6.8 | 55 MPH | 5 | SR 0536 (Mayport Road) |

## Exhibit 64 – Vertical Deficiency



## Community Outreach

Public and stakeholder outreach is a critical component of understanding the local perspective of needs and opportunities along the Route 28 corridor.

### Stakeholder Outreach

The Steering Committee identified key stakeholders including county commissioners, municipal leaders, business owners, freight haulers, school district staff, emergency service providers, and state police. Stakeholder meetings were held on February 26, 2020 in three locations to get a broad geographic spread of comments, and for ease of attendance. The morning meeting was held at the Jefferson County Conservation District office in Brookville, the afternoon meeting at the Redbank Valley Public Library in New Bethlehem, and the evening meeting at the Belmont Complex in Kittanning. Attendee list and meeting minutes can be found in **APPENDIX D**. Areas of concern identified through the stakeholder interviews were summarized into 24 unique locations and mapped in

**Exhibit** 65.

## Public Survey


In order to collect broad public input on the current conditions of the Route 28 Corridor from Kittanning to I-80, the study team utilized an online WikiMap survey. The survey was available at https://wikimapping.com/Route-28-Corridor-Study-Kittanning-to-I-80.html from Friday, February 7 through Friday, March 6, 2020. The Steering Committee member organizations promoted the survey through a press release, emails, and social media. Direct links to the mapping survey were also available on the study website (www.Route28CorridorStudy.com).

The interactive map allowed users to place points on a map of the corridor to identify areas of concern or opportunities for improvement related to vehicular, freight, bicycle, and pedestrian traffic. Each mode included targeted survey questions to collect specific details about the concern or opportunity. A copy of all survey questions is included in **Appendix E.**

During the course of the survey period, 305 total points were placed by 151 unique users. A majority (269) of points were related to vehicular traffic. Nineteen (19) were related to freight; ten (10) related to pedestrians; and seven (7) related to bicycles. There were 730 log-ins to the WikiMap site which includes visitors who entered the site multiple times and those who entered the site but did not complete the surveys.

Areas of concern were summarized into 31 unique locations and mapped in **Exhibit 66**. The survey points revealed common areas of concern, some of which were corridor-wide. In each survey by travel mode, the public was prompted to select from several options for “What about this location causes you concern?”

**Exhibit 67** displays the frequency of concerns for each mode. While each mode varied slightly in the options, the most common concerns were roadway safety; vehicle speeds, slow moving vehicles, intersection sight distance, and visibility of pedestrians and bicycles on the roadway.

The concerns highlighted by the Key Stakeholder interviews and the public survey comments aligned with the goals set out by the Study Team and Steering Committee early in the study process. Concerns and comments focused on the safety of the corridor, citing intersections with poor sight distance and speed differentials; the importance of ensuring connectivity of the corridor with other destinations and regions; and the improvement of operations by reducing congestion, especially when the corridor is used as a detour route. Public input was also vital to give local perspective and insight into corridor use related to special events which the study team cannot gather in other ways.

Both the stakeholders and general public identified specific concern locations which often overlapped with each other and with locations identified by other study analysis. The concerns and comments from the stakeholders and the general public were compiled with data and analysis of different aspects of the corridor and contributed to the identification of study concern areas which will be further studied during the next phases of the study.

*Exhibit 65 – Stakeholder Concern Locations*

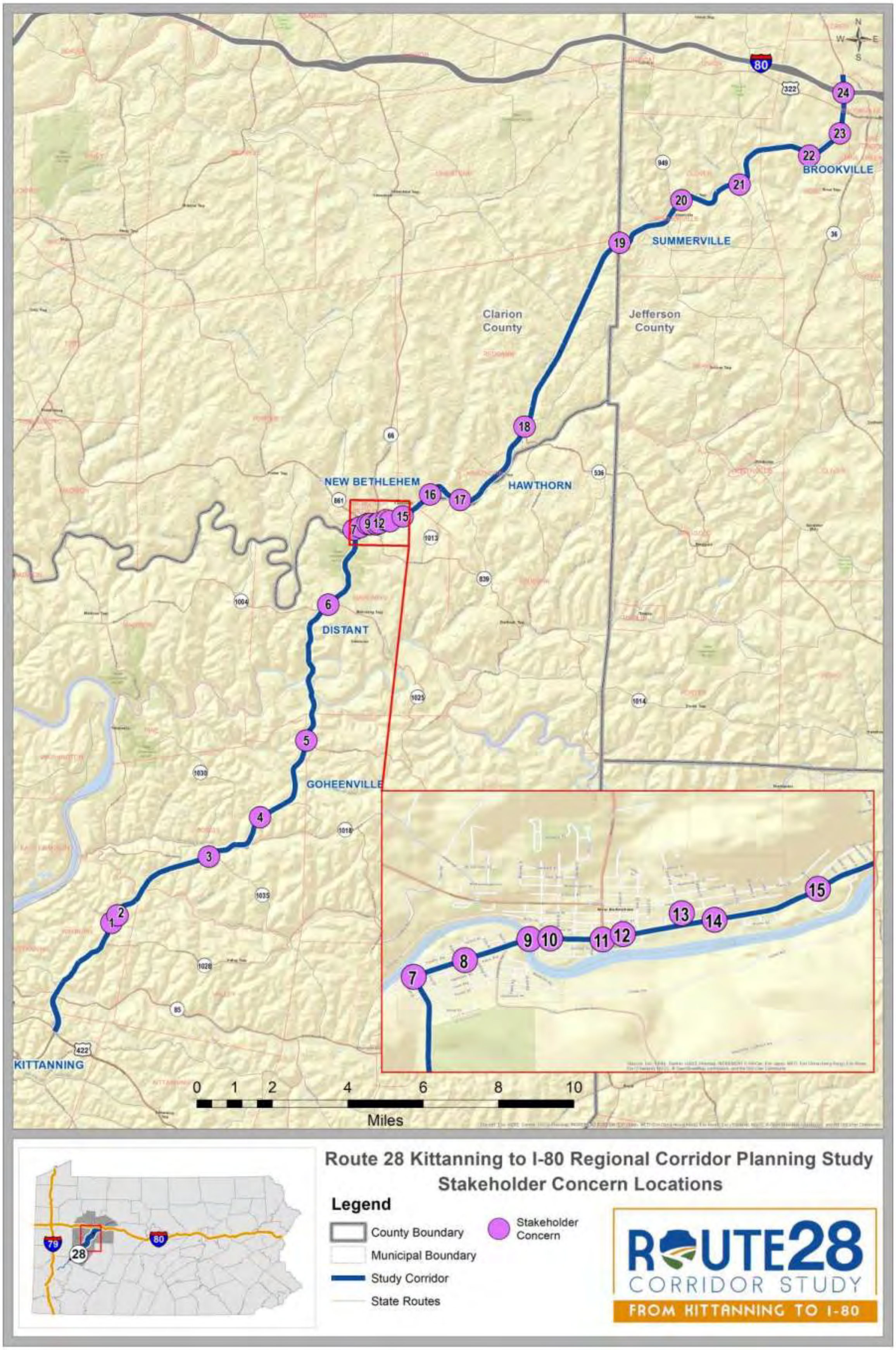


*Exhibit 66 – Public Survey Concern Locations*

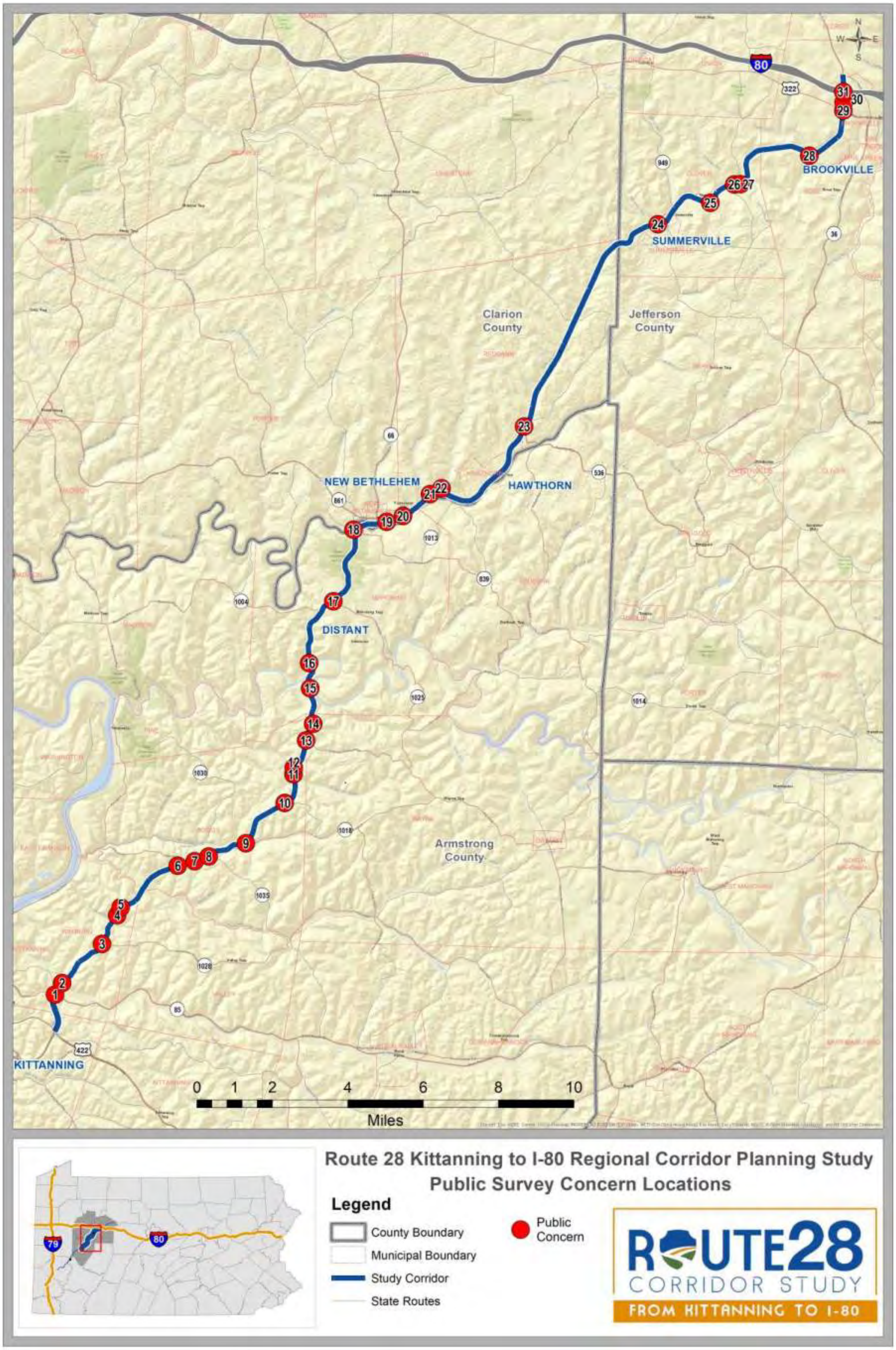
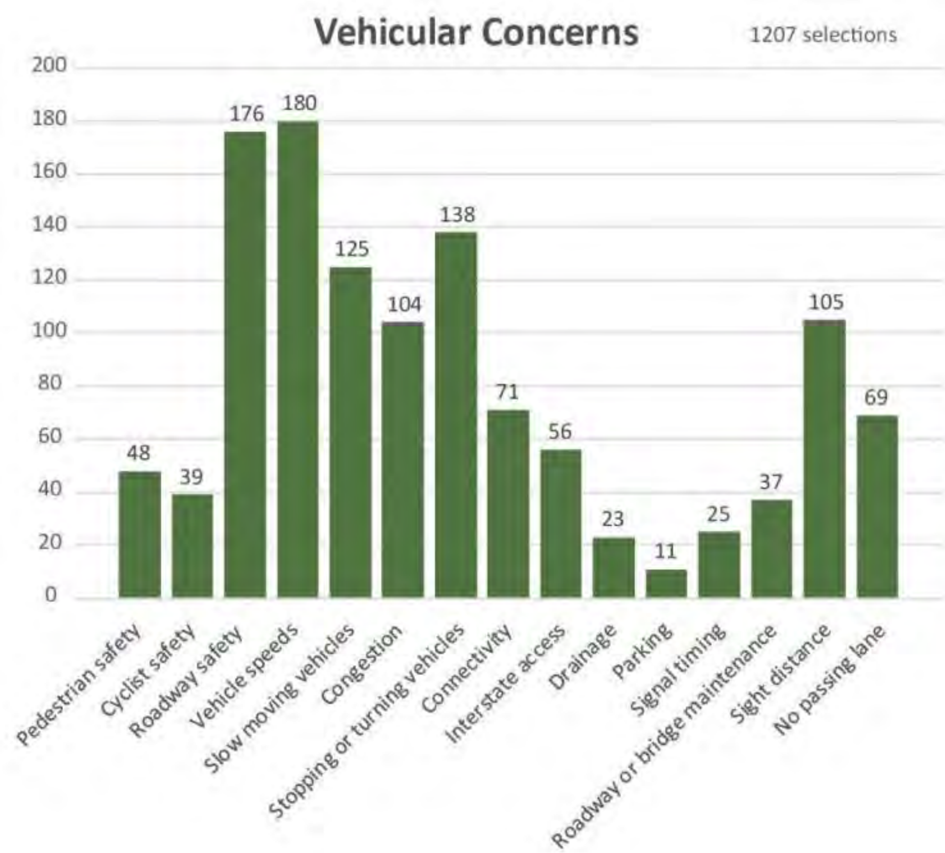
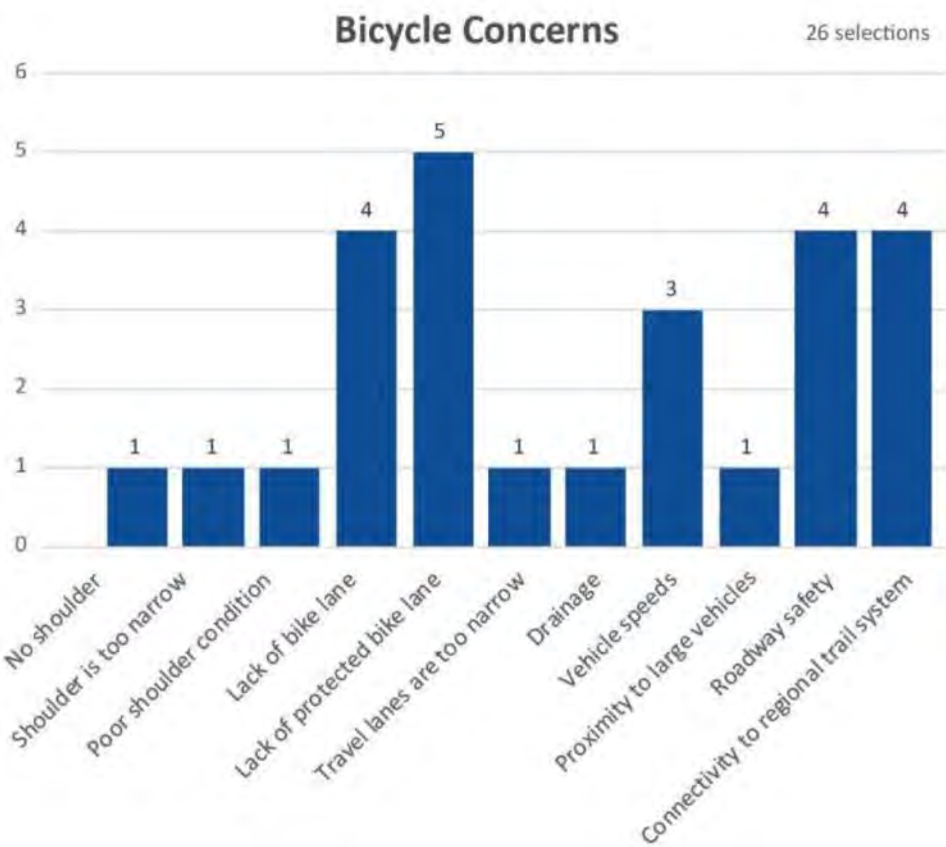
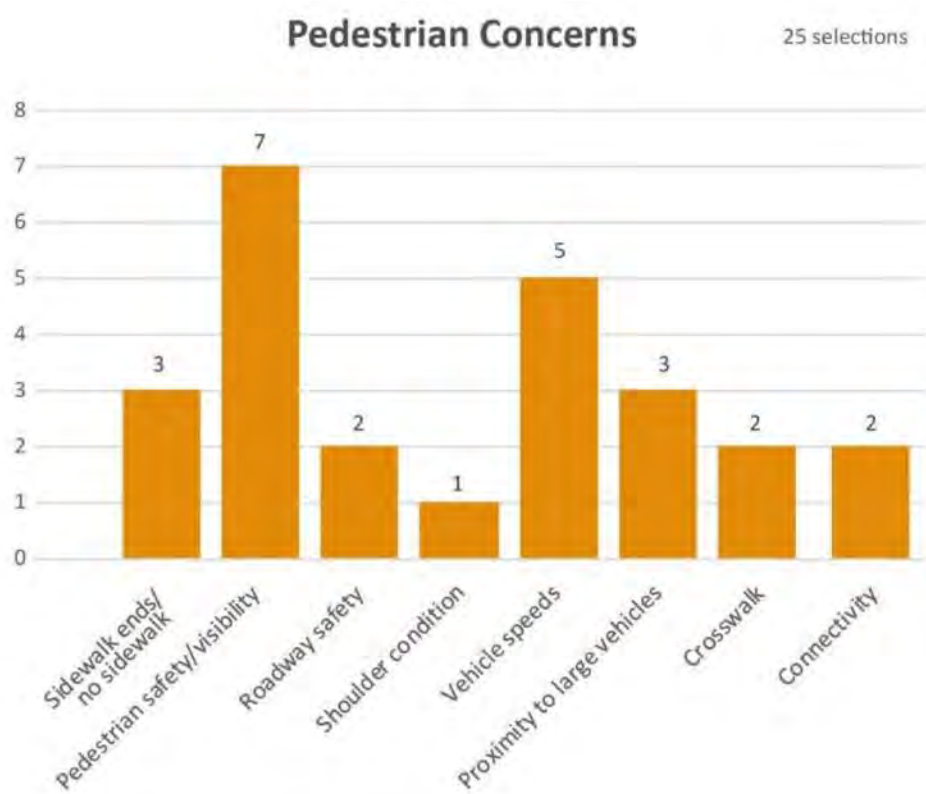
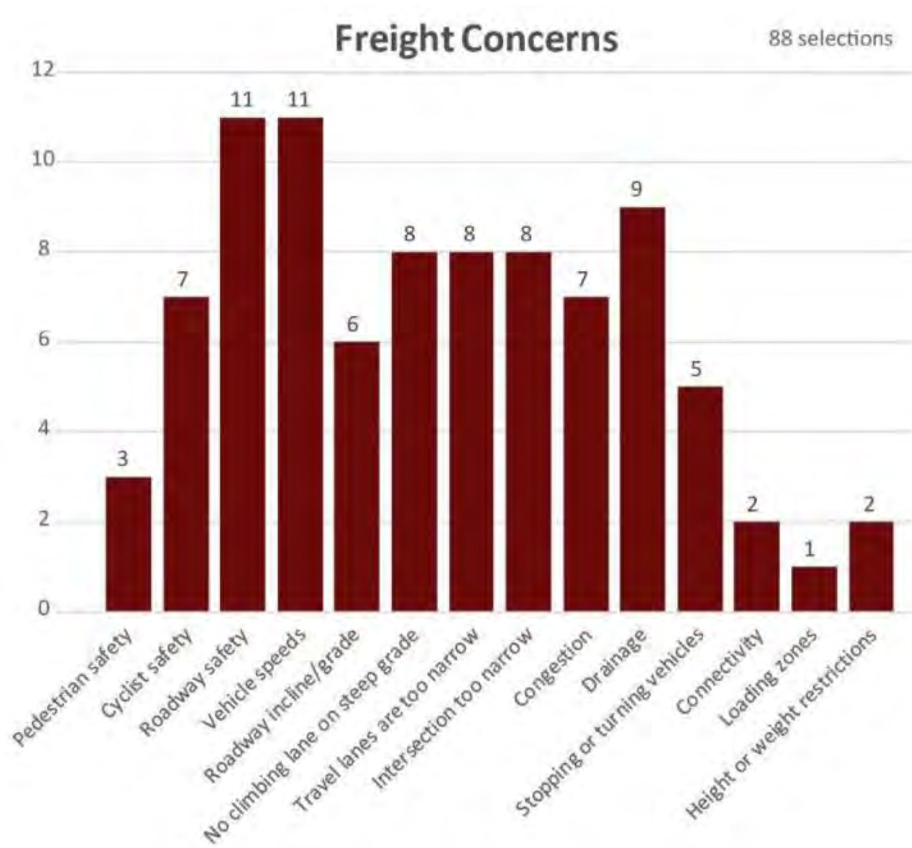


***Exhibit 67 – Summary of Public Survey Concern by Mode***




Pedestrian Concerns
25 selections
8
7
6
5
4
3
2
1
0
3
7
2
1
5
3
2
2
Sidewalk ends/ no sidewalk
Pedestrian safety/visibility
Roadway safety
Shoulder condition
Vehicle speeds
Proximity to large vehicles
Crosswalk
Connectivity


Freight Concerns
88 selections
12
10
8
6
4
2
0
3
7
11
11
6
8
8
8
7
9
5
2
1
2
Pedestrian safety
Cyclist safety
Roadway safety
Vehicle speeds
Roadway incline/grade
No climbing lane on steep grade
Travel lanes are too narrow
Intersection too narrow
Congestion
Drainage
Stopping or turning vehicles
Connectivity
Loading zones
Height or weight restrictions

## Field Observations

### Field View

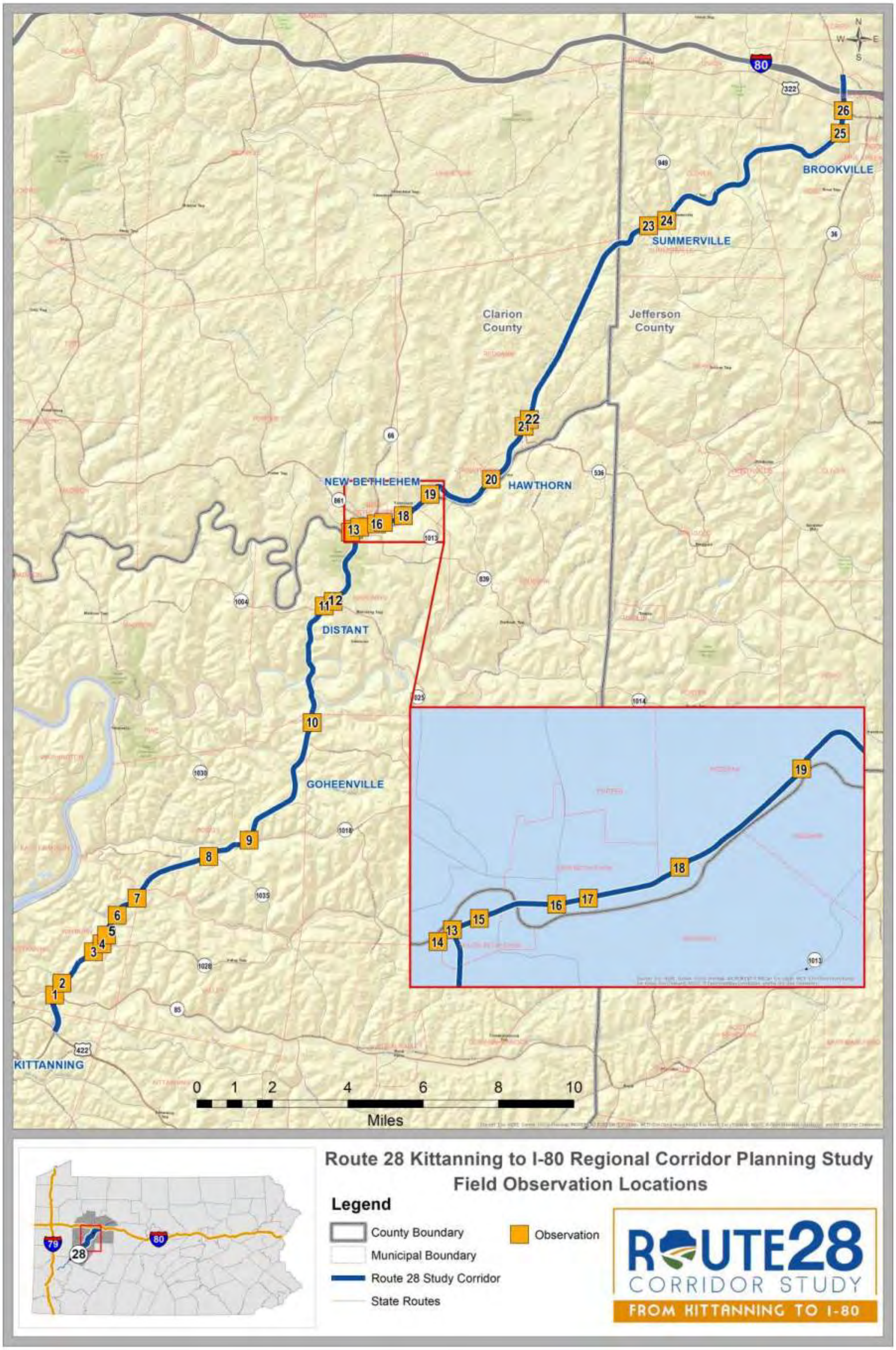
Field observations were conducted on January 13th, 2020 to gather photographs, observations, and key measurements of current corridor conditions. Refer to **APPENDIX F** for detailed notes and images. The examined areas were identified by the Steering Committee or through desktop research prior to field work. In general, many of these locations identified by the Steering Committee have limited sight distance due to the horizontal and vertical curvature of the roadway. There are also locations of tight geometry that are difficult for large vehicles to navigate, with evidence of overtracking and sign hits throughout the corridor. Speed differentials were noticeable, with a spectrum ranging from speeding in excess of the 55mph posted speed limit, aggressive passing behavior, while other vehicles were traveling 10-15mph below the speed limit.

**EXHIBIT 68** shows the locations of observations, which included:

- Redbank Valley Trail
- Downtown New Bethlehem
- 15mph Curve in South Bethlehem
- Distant
- Signage
- Trucks and freight
- Retroreflectivity
- Speeds
- Sight Distance and Geometry at:
  - Sloan Hill Road
  - SR 1035 (Oscar Road)
  - SR 1004 (Kohlersburg/Madison Road)
  - SR 1025 (Putneyville Road)
  - SR 0536 (Mayport Road)
  - South Main Street
  - SR 1028 (Anderson Creek Road)
  - Poverty Hill Road
  - Toadtown Road/Anderson Road/Creek Street
- SR 28 guiderail erosion at various locations



*Exhibit 68 – Field Observation Locations*



## Conclusion

This Existing Conditions Report is a culmination of data research including previous studies, field observations, surveys of stakeholders and public input. The corridor geometry was examined to compare the existing conditions against current roadway design criteria standards. Traffic operations were observed and modeled through the project area to identify any areas of substandard traffic flow. All collected data was weighed equally and utilized to identify specific areas of concern throughout the corridor.

These areas were compiled into a single list and assigned a priority based on the number of categories where the location was found. The areas that received the highest priority will be further evaluated in the future conditions portion of this study.

The study team will develop conceptual improvements to address the safety, geometric and operational concerns at these locations. Conceptual improvements will be organized into short-, medium- and long-term improvements which can be programmed and implemented by the appropriate agency as resources and funding allow.

# APPENDIX A

## Cost Estimate

| | Michael Baker's 1994 Study | | McCormick Taylor's 2020 Study Update | |
|---|---|---|---|---|
| **Item** | **Cost/Mile (1994)** | **35 Miles (1994)** | **Cost/Mile (2020)** | **35 Miles (2020)** |
| Clearing and Grubbing | $150,000 | $5,250,000 | $150,000 [1a] | $5,250,000 |
| Roadway Excavation | $3,000,000 | $105,000,000 | $3,567,000 [2a] | $124,845,000 |
| Pavement, Shoulders, Curbs | $3,200,000 | $112,000,000 | $4,460,000 [3a] | $156,100,000 |
| Drainage | $900,000 | $31,500,000 | $1,200,000 [4a] | $42,000,000 |
| Guiderail and Barrier | $70,000 | $2,450,000 | $132,000 [5a] | $4,620,000 |
| Right-of-Way Fence | $110,000 | $3,850,000 | $158,400 [6a] | $5,544,000 |
| Landscaping | $130,000 | $4,550,000 | $217,545 [7a] | $7,614,075 |
| Temporary Traffic Control | $210,000 | $7,350,000 | $351,418 [8a] | $12,299,630 |
| Utility Relocations | $200,000 | $7,000,000 | $334,684 [9a] | $11,713,940 |
| Bridges, Box and Arch Culverts | $3,900,000 | $136,500,000 | $6,526,331 [10a] | $228,421,585 |
| Signalization and Signing | $30,000 | $1,050,000 | $50,203 [11a] | $1,757,105 |
| Pavement Markings and Delineators | $20,000 | $700,000 | $33,469 [12a] | $1,171,415 |
| Erosion and Sedimentation Control | $250,000 | $8,750,000 | $418,355 [13a] | $14,642,425 |
| Miscellaneous | $400,000 | $14,000,000 | $669,368 [14a] | $23,427,880 |
| Mobilization/Field Office | $450,000 | $15,750,000 | $753,039 [15a] | $26,356,365 |
| Stormwater Management | - | - | $418,355 [16a] | $14,642,425 |
| **Subtotal** | | $455,700,000 | | $680,405,845 |
| Design Engineering (10%) | | $45,570,000 | | $68,040,585 [17a] |
| Construction Engineering (5%) | | $22,785,000 | (10%) | $68,040,585 [18a] |
| **Subtotal** | | $524,055,000 | | $816,487,014 |
| Right-of-Way | | $26,202,750 | | $40,824,351 [19a] |
| **TOTAL** | | $550,257,750 | | $857,311,365 |

1a. Assume same lump sum cost per mile from previous Baker Study

$150,000 per mile x 35 miles = $5,250,000

2a. $240 per CY

Assume added pavement widening of 38 ft (2 x 11ft lanes + 2 x 8ft shoulders = 38 ft)
Assume pavement depth of 2ft
Assume excavation cost will also include potential for rock excavation, any geotechnical treatments or shoring as needed

$240 per cy x 1 cy / 27 cf x 38 ft x 2 ft x 5280 ft / mile = $3,566,933.33 ~ use $3,567,000 per mile

$3,567,000 per mile x 35 miles = $124,845,000

3a. $200 per SY

Assume pavement will include all paving materials, subbase, underdrain, curb or barrier if needed
Assume added pavement width of 38 ft (2 x 11ft lanes + 2 x 8ft shoulders = 38 ft)

$200 x 1sy / 9 ft x 38 ft x 5280 ft / mile = $4,458,666.66 ~ use $4,460,000 per mile

$4,460,000 per mile x 35 miles = $156,100,000

4a. $ 100 per LF of pipe on each side of the road, 1 inlet every 150 lf on each side of road

5280 / 150 = 35.2 inlets per mile ~ use 36 inlets each side x 2 = 72 inlets x $2000/ inlet = $144,000

$100 / lf x 2 sides x 5280 ft = $1,056,000

$ 1,056,000 + $144,000 = $1,200,000 cost per mile x 35 miles = $42,000,000

5a. $25 per LF$25 x 5280 ft / mile = $132,000 x 35 miles = $4,620,000

6a. $30 per LF $30 x 5280 lf / mile = $158,400 x 35 miles = $5,544,000

7a. to 15a. Escalation of cost at a rate of 2% per year for 26 years.

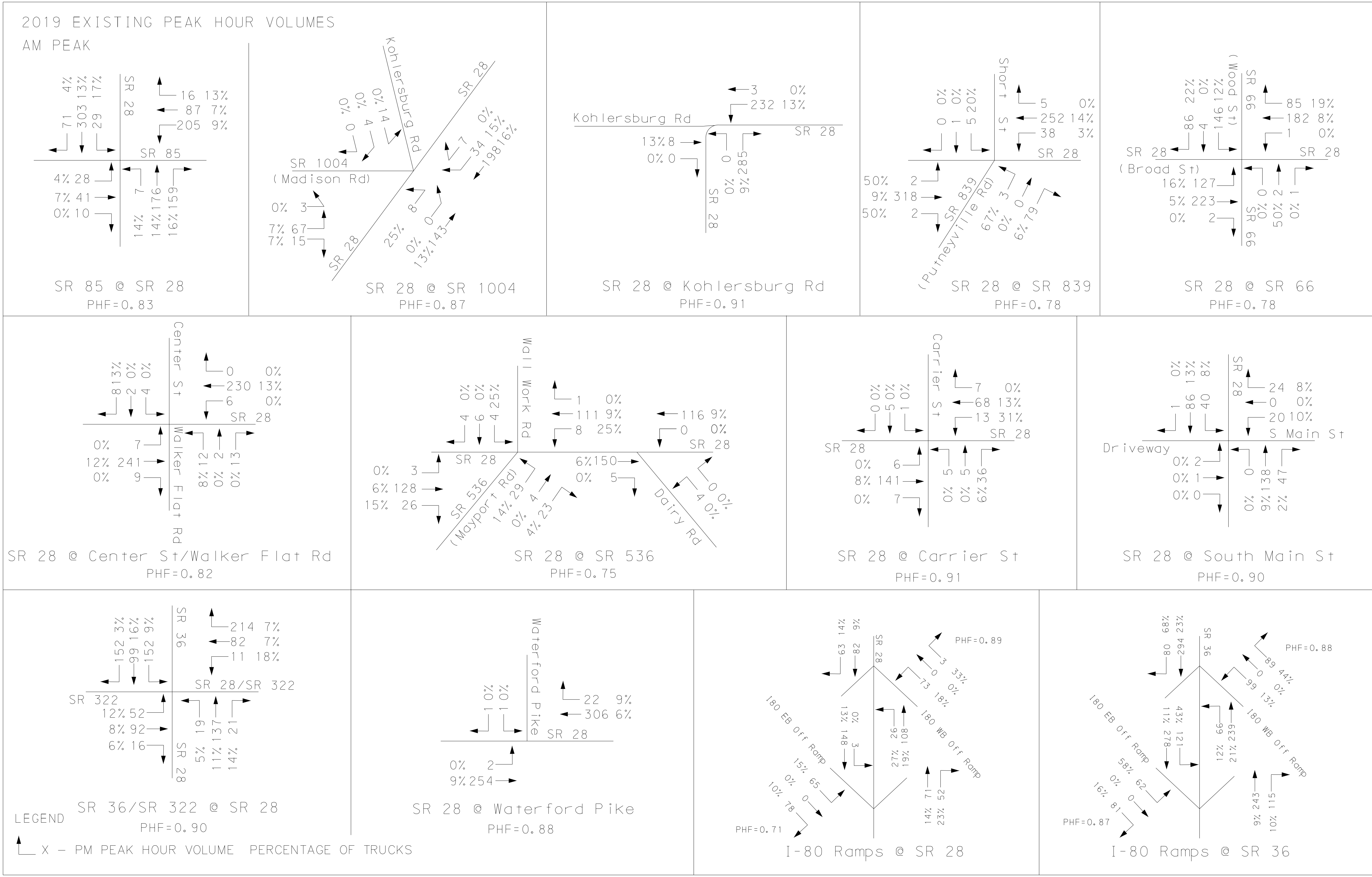
16a. Used same amount as Erosion and Sedimentation Control.

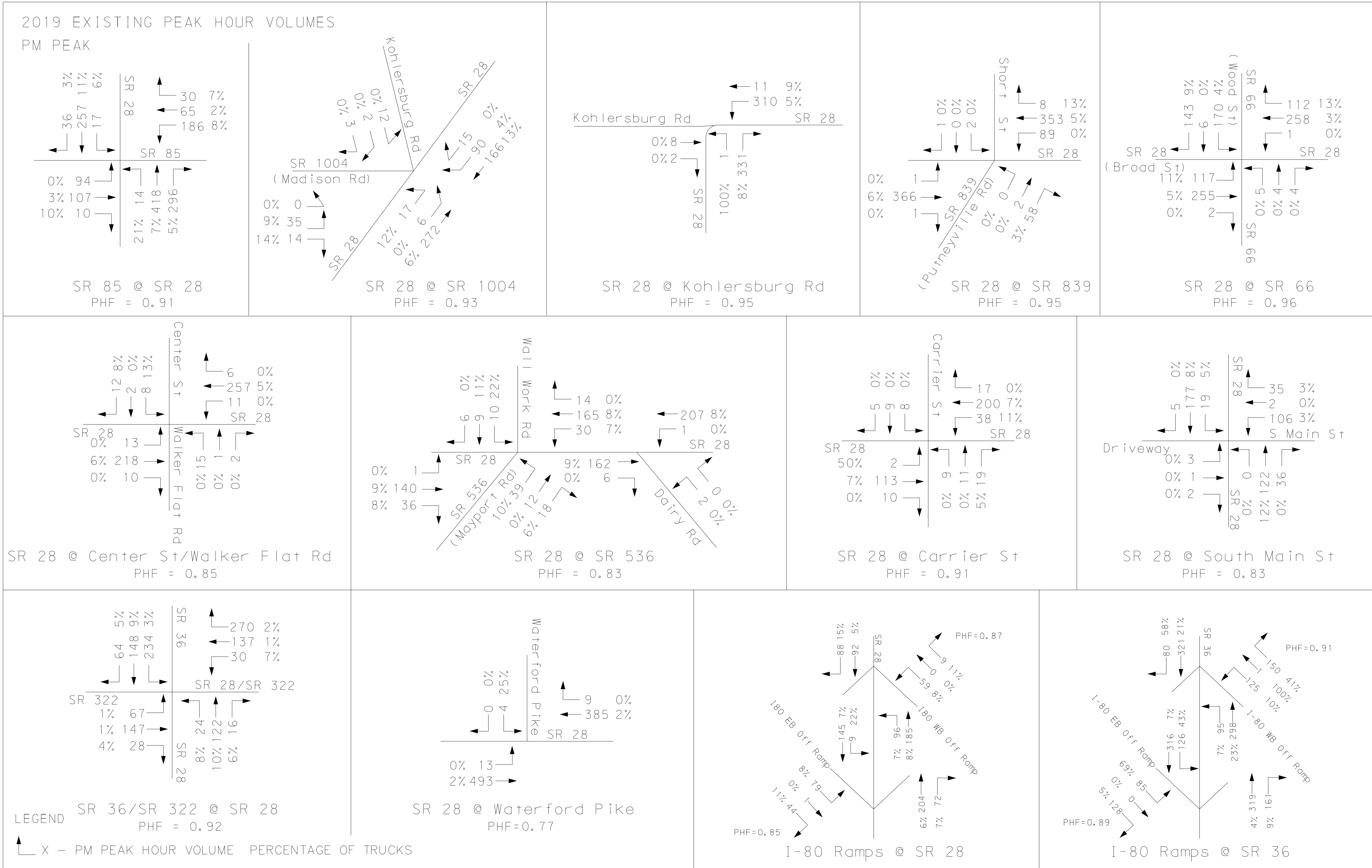
17a. 10% of first subtotal construction costs

18a. 10% of first subtotal construction costs

19a. 5% of second subtotal construction costs

# APPENDIX B
## Highway Capacity Analysis


2019 EXISTING PEAK HOUR VOLUMES
AM PEAK
SR 85 @ SR 28
PHF=0.83
SR 28 @ SR 1004
PHF=0.87
SR 1004 (Madison Rd)
Kohlersburg Rd
SR 28 @ Kohlersburg Rd
PHF=0.91
SR 28 @ SR 839
PHF=0.78
Short St
SR 839 (Putneyville Rd)
SR 28 @ SR 66
PHF=0.78
SR 66 (Wood St)
SR 28 (Broad St)
SR 28 @ Center St/Walker Flat Rd
PHF=0.82
SR 28 @ SR 536
PHF=0.75
Wall Work Rd
SR 536 (Mayport Rd)
Dairy Rd
SR 28 @ Carrier St
PHF=0.91
SR 28 @ South Main St
PHF=0.90
Driveway
S Main St
SR 36/SR 322 @ SR 28
PHF=0.90
SR 28 @ Waterford Pike
PHF=0.88
I-80 Ramps @ SR 28
PHF=0.89
PHF=0.71
I80 EB Off Ramp
I80 WB Off Ramp
I-80 Ramps @ SR 36
PHF=0.88
PHF=0.87
LEGEND
X - PM PEAK HOUR VOLUME PERCENTAGE OF TRUCKS


2019 EXISTING PEAK HOUR VOLUMES
PM PEAK
SR 85 @ SR 28
PHF = 0.91
SR 28 @ SR 1004
PHF = 0.93
SR 28 @ Kohlersburg Rd
PHF = 0.95
SR 28 @ SR 839
PHF = 0.95
SR 28 @ SR 66
PHF = 0.96
SR 28 @ Center St/Walker Flat Rd
PHF = 0.85
SR 28 @ SR 536
PHF = 0.83
SR 28 @ Carrier St
PHF = 0.91
SR 28 @ South Main St
PHF = 0.83
SR 36/SR 322 @ SR 28
PHF = 0.92
SR 28 @ Waterford Pike
PHF=0.77
I-80 Ramps @ SR 28
PHF=0.87
PHF=0.85
I-80 Ramps @ SR 36
PHF=0.91
PHF=0.89
Kohlersburg Rd
SR 1004
(Madison Rd)
Short St
SR 839
(Putneyville Rd)
SR 66
(Wood St)
(Broad St)
Center St
Walker Flat Rd
Wall Work Rd
SR 536
(Mayport Rd)
Dairy Rd
Carrier St
S Main St
Driveway
SR 36
SR 322
SR 28/SR 322
Waterford Pike
180 EB Off Ramp
180 WB Off Ramp
I-80 EB Off Ramp
I-80 WB Off Ramp
LEGEND
X - PM PEAK HOUR VOLUME PERCENTAGE OF TRUCKS

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 28 | 41 | 10 | 205 | 87 | 16 | 7 | 176 | 159 | 29 | 303 | 71 |
| Future Volume (veh/h) | 28 | 41 | 10 | 205 | 87 | 16 | 7 | 176 | 159 | 29 | 303 | 71 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1632 | 1593 | 1593 | 1529 | 1555 | 1555 | 1672 | 1672 | 1646 | 1247 | 1299 | 1299 |
| Adj Flow Rate, veh/h | 34 | 49 | 0 | 247 | 105 | 0 | 8 | 212 | 0 | 35 | 365 | 0 |
| Peak Hour Factor | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 | 0.83 |
| Percent Heavy Veh, % | 4 | 7 | 7 | 9 | 7 | 7 | 14 | 14 | 16 | 17 | 13 | 13 |
| Cap, veh/h | 42 | 90 | | 276 | 337 | | 6 | 622 | | 33 | 492 | |
| Arrive On Green | 0.03 | 0.06 | 0.00 | 0.19 | 0.22 | 0.00 | 0.00 | 0.37 | 0.00 | 0.03 | 0.38 | 0.00 |
| Sat Flow, veh/h | 1554 | 1593 | 0 | 1456 | 1555 | 0 | 1593 | 1672 | 1395 | 1188 | 1299 | 0 |
| Grp Volume(v), veh/h | 34 | 49 | 0 | 247 | 105 | 0 | 8 | 212 | 0 | 35 | 365 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1554 | 1593 | 0 | 1456 | 1555 | 0 | 1593 | 1672 | 1395 | 1188 | 1299 | 0 |
| Q Serve(g_s), s | 1.7 | 2.3 | 0.0 | 12.9 | 4.4 | 0.0 | 0.3 | 7.1 | 0.0 | 2.2 | 19.0 | 0.0 |
| Cycle Q Clear(g_c), s | 1.7 | 2.3 | 0.0 | 12.9 | 4.4 | 0.0 | 0.3 | 7.1 | 0.0 | 2.2 | 19.0 | 0.0 |
| Prop In Lane | 1.00 | | 0.00 | 1.00 | | 0.00 | 1.00 | | 1.00 | 1.00 | | 0.00 |
| Lane Grp Cap(c), veh/h | 42 | 90 | | 276 | 337 | | 6 | 622 | | 33 | 492 | |
| V/C Ratio(X) | 0.81 | 0.54 | | 0.89 | 0.31 | | 1.32 | 0.34 | | 1.07 | 0.74 | |
| Avail Cap(c_a), veh/h | 418 | 275 | | 395 | 337 | | 273 | 1035 | | 193 | 771 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 37.8 | 35.9 | 0.0 | 30.9 | 25.7 | 0.0 | 38.9 | 17.7 | 0.0 | 38.0 | 21.0 | 0.0 |
| Incr Delay (d2), s/veh | 29.4 | 5.0 | 0.0 | 16.9 | 0.5 | 0.0 | 280.3 | 1.2 | 0.0 | 91.6 | 7.7 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.0 | 1.0 | 0.0 | 5.5 | 1.6 | 0.0 | 0.6 | 2.6 | 0.0 | 1.4 | 6.1 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 67.3 | 40.9 | 0.0 | 47.8 | 26.3 | 0.0 | 319.2 | 18.8 | 0.0 | 129.6 | 28.7 | 0.0 |
| LnGrp LOS | E | D | | D | C | | F | B | | F | C | |
| Approach Vol, veh/h | | 83 | A | | 352 | A | | 220 | A | | 400 | A |
| Approach Delay, s/veh | | 51.7 | | | 41.4 | | | 29.7 | | | 37.5 | |
| Approach LOS | | D | | | D | | | C | | | D | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 8.5 | 36.7 | 21.6 | 11.4 | 7.9 | 37.2 | 9.1 | 23.9 |
| Change Period (Y+Rc), s | * 5.8 | 7.1 | 6.3 | 6.5 | 7.1 | 7.1 | 6.5 | 6.5 |
| Max Green Setting (Gmax), s | * 13 | 48.9 | 21.7 | 14.0 | 13.9 | 46.9 | 21.5 | 14.0 |
| Max Q Clear Time (g_c+I1), s | 4.2 | 9.1 | 14.9 | 4.3 | 2.3 | 21.0 | 3.7 | 6.4 |
| Green Ext Time (p_c), s | 0.0 | 6.1 | 0.4 | 0.1 | 0.0 | 9.2 | 0.0 | 0.1 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 38.3 |
| HCM 6th LOS | D |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.
Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

| Intersection | |
|---|---|
| Int Delay, s/veh | 3 |

| Movement | NBL | NBT | SBT | SBR | SEL | SER |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 8 | 143 | 198 | 0 | 81 | 19 |
| Future Vol, veh/h | 8 | 143 | 198 | 0 | 81 | 19 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 7 | -6 | - | 0 | - |
| Peak Hour Factor | 87 | 87 | 87 | 87 | 87 | 87 |
| Heavy Vehicles, % | 25 | 13 | 16 | 0 | 6 | 5 |
| Mvmt Flow | 9 | 164 | 228 | 0 | 93 | 22 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 228 | 0 | - | 0 | 410 | 228 |
| Stage 1 | - | - | - | - | 228 | - |
| Stage 2 | - | - | - | - | 182 | - |
| Critical Hdwy | 4.9 | - | - | - | 8.1 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.46 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.46 | - |
| Follow-up Hdwy | 3.5 | - | - | - | 3 | 3.4 |
| Pot Cap-1 Maneuver | 841 | - | - | 0 | 563 | 785 |
| Stage 1 | - | - | - | 0 | 932 | - |
| Stage 2 | - | - | - | 0 | 981 | - |
| Platoon blocked, % | | - | - | | | |
| Mov Cap-1 Maneuver | 841 | - | - | - | 556 | 785 |
| Mov Cap-2 Maneuver | - | - | - | - | 556 | - |
| Stage 1 | - | - | - | - | 921 | - |
| Stage 2 | - | - | - | - | 981 | - |

| Approach | NB | SB | SE |
|---|---|---|---|
| HCM Control Delay, s | 0.5 | 0 | 12.6 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBL | NBT | SELn1 | SBT |
|---|---|---|---|---|
| Capacity (veh/h) | 841 | - | 589 | - |
| HCM Lane V/C Ratio | 0.011 | - | 0.195 | - |
| HCM Control Delay (s) | 9.3 | 0 | 12.6 | - |
| HCM Lane LOS | A | A | B | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.7 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.2 |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 8 | 1 | 1 | 285 | 232 | 3 |
| Future Vol, veh/h | 8 | 1 | 1 | 285 | 232 | 3 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | - | - | - | - | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 8 | - | - | -4 | -2 | - |
| Peak Hour Factor | 91 | 91 | 91 | 91 | 91 | 91 |
| Heavy Vehicles, % | 13 | 0 | 0 | 9 | 13 | 0 |
| Mvmt Flow | 9 | 1 | 1 | 313 | 255 | 3 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 572 | 257 | 258 | 0 | - | 0 |
| Stage 1 | 257 | - | - | - | - | - |
| Stage 2 | 315 | - | - | - | - | - |
| Critical Hdwy | 8.13 | 7 | 4.3 | - | - | - |
| Critical Hdwy Stg 1 | 7.13 | - | - | - | - | - |
| Critical Hdwy Stg 2 | 7.13 | - | - | - | - | - |
| Follow-up Hdwy | 3 | 3.1 | 3 | - | - | - |
| Pot Cap-1 Maneuver | 415 | 785 | 980 | - | - | - |
| Stage 1 | 801 | - | - | - | - | - |
| Stage 2 | 731 | - | - | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | 415 | 785 | 980 | - | - | - |
| Mov Cap-2 Maneuver | 415 | - | - | - | - | - |
| Stage 1 | 800 | - | - | - | - | - |
| Stage 2 | 731 | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 13.4 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 980 | - | 438 | - | - |
| HCM Lane V/C Ratio | 0.001 | - | 0.023 | - | - |
| HCM Control Delay (s) | 8.7 | 0 | 13.4 | - | - |
| HCM Lane LOS | A | A | B | - | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.1 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 2 | 318 | 2 | 38 | 252 | 5 | 3 | 0 | 79 | 5 | 1 | 1 |
| Future Vol, veh/h | 2 | 318 | 2 | 38 | 252 | 5 | 3 | 0 | 79 | 5 | 1 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | 120 | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | -5 | - | - | 3 | - | - | -7 | - | - | 7 | - |
| Peak Hour Factor | 78 | 78 | 78 | 78 | 78 | 78 | 78 | 78 | 78 | 78 | 78 | 78 |
| Heavy Vehicles, % | 50 | 9 | 50 | 3 | 14 | 0 | 67 | 0 | 6 | 20 | 0 | 0 |
| Mvmt Flow | 3 | 408 | 3 | 49 | 323 | 6 | 4 | 0 | 101 | 6 | 1 | 1 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 329 | 0 | 0 | 411 | 0 | 0 | 841 | 843 | 410 | 890 | 841 | 326 |
| Stage 1 | - | - | - | - | - | - | 416 | 416 | - | 424 | 424 | - |
| Stage 2 | - | - | - | - | - | - | 425 | 427 | - | 466 | 417 | - |
| Critical Hdwy | 4.3 | - | - | 4.3 | - | - | 6.37 | 5.1 | 5.56 | 8.7 | 7.9 | 6.9 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 5.37 | 4.1 | - | 7.7 | 6.9 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 5.37 | 4.1 | - | 7.7 | 6.9 | - |
| Follow-up Hdwy | 3 | - | - | 3 | - | - | 3 | 4 | 3.1 | 3 | 4 | 3.1 |
| Pot Cap-1 Maneuver | 926 | - | - | 867 | - | - | 377 | 420 | 732 | 198 | 219 | 713 |
| Stage 1 | - | - | - | - | - | - | 763 | 700 | - | 575 | 501 | - |
| Stage 2 | - | - | - | - | - | - | 756 | 695 | - | 534 | 506 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 926 | - | - | 867 | - | - | 357 | 394 | 732 | 163 | 206 | 713 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 357 | 394 | - | 163 | 206 | - |
| Stage 1 | - | - | - | - | - | - | 760 | 697 | - | 573 | 472 | - |
| Stage 2 | - | - | - | - | - | - | 710 | 655 | - | 458 | 504 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.1 | 1.2 | 11 | 24.9 |
| HCM LOS | | | B | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 705 | 926 | - | - | 867 | - | - | 190 |
| HCM Lane V/C Ratio | 0.149 | 0.003 | - | - | 0.056 | - | - | 0.047 |
| HCM Control Delay (s) | 11 | 8.9 | 0 | - | 9.4 | - | - | 24.9 |
| HCM Lane LOS | B | A | A | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 0.5 | 0 | - | - | 0.2 | - | - | 0.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 127 | 223 | 2 | 1 | 182 | 85 | 1 | 2 | 1 | 146 | 4 | 86 |
| Future Volume (veh/h) | 127 | 223 | 2 | 1 | 182 | 85 | 1 | 2 | 1 | 146 | 4 | 86 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1418 | 1557 | 1557 | 1519 | 1519 | 1519 | 1028 | 1028 | 1028 | 1685 | 1685 | 1685 |
| Adj Flow Rate, veh/h | 163 | 286 | 3 | 1 | 233 | 109 | 1 | 3 | 1 | 187 | 5 | 110 |
| Peak Hour Factor | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 | 0.78 |
| Percent Heavy Veh, % | 16 | 5 | 5 | 8 | 8 | 8 | 50 | 50 | 50 | 0 | 0 | 0 |
| Cap, veh/h | 464 | 803 | 8 | 69 | 297 | 139 | 113 | 194 | 56 | 334 | 22 | 141 |
| Arrive On Green | 0.12 | 0.52 | 0.50 | 0.28 | 0.30 | 0.28 | 0.27 | 0.29 | 0.29 | 0.27 | 0.29 | 0.27 |
| Sat Flow, veh/h | 1350 | 1538 | 16 | 1 | 979 | 456 | 106 | 674 | 195 | 777 | 78 | 490 |
| Grp Volume(v), veh/h | 163 | 0 | 289 | 343 | 0 | 0 | 5 | 0 | 0 | 302 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1350 | 0 | 1554 | 1436 | 0 | 0 | 975 | 0 | 0 | 1345 | 0 | 0 |
| Q Serve(g_s), s | 3.9 | 0.0 | 5.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.3 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 3.9 | 0.0 | 5.8 | 11.8 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 11.1 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 0.01 | 0.00 | | 0.32 | 0.20 | | 0.20 | 0.62 | | 0.36 |
| Lane Grp Cap(c), veh/h | 464 | 0 | 811 | 477 | 0 | 0 | 344 | 0 | 0 | 472 | 0 | 0 |
| V/C Ratio(X) | 0.35 | 0.00 | 0.36 | 0.72 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.64 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 579 | 0 | 1387 | 886 | 0 | 0 | 618 | 0 | 0 | 873 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 8.6 | 0.0 | 7.4 | 17.0 | 0.0 | 0.0 | 13.5 | 0.0 | 0.0 | 17.7 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.5 | 0.0 | 0.3 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.4 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.0 | 0.0 | 1.6 | 3.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.4 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 9.0 | 0.0 | 7.7 | 19.1 | 0.0 | 0.0 | 13.5 | 0.0 | 0.0 | 19.1 | 0.0 | 0.0 |
| LnGrp LOS | A | A | A | B | A | A | B | A | A | B | A | A |
| Approach Vol, veh/h | | 452 | | | 343 | | | 5 | | | 302 | |
| Approach Delay, s/veh | | 8.1 | | | 19.1 | | | 13.5 | | | 19.1 | |
| Approach LOS | | A | | | B | | | B | | | B | |
| Timer - Assigned Phs | 1 | 2 | | 4 | | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 11.5 | 21.0 | | 20.2 | | 32.5 | | 20.2 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | | 6.0 | | 6.0 | | 6.0 | | | | |
| Max Green Setting (Gmax), s | 10.0 | 30.0 | | 30.0 | | 46.0 | | 30.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 5.9 | 13.8 | | 2.2 | | 7.8 | | 13.1 | | | | |
| Green Ext Time (p_c), s | 0.2 | 1.2 | | 0.0 | | 1.1 | | 1.1 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 14.6 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.2 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 7 | 241 | 9 | 6 | 230 | 1 | 12 | 2 | 13 | 4 | 2 | 8 |
| Future Vol, veh/h | 7 | 241 | 9 | 6 | 230 | 1 | 12 | 2 | 13 | 4 | 2 | 8 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 1 | - | - | -1 | - | - | 9 | - | - | -3 | - |
| Peak Hour Factor | 82 | 82 | 82 | 82 | 82 | 82 | 82 | 82 | 82 | 82 | 82 | 82 |
| Heavy Vehicles, % | 0 | 12 | 0 | 0 | 13 | 0 | 8 | 0 | 0 | 0 | 0 | 13 |
| Mvmt Flow | 9 | 294 | 11 | 7 | 280 | 1 | 15 | 2 | 16 | 5 | 2 | 10 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 281 | 0 | 0 | 305 | 0 | 0 | 619 | 613 | 300 | 622 | 618 | 281 |
| Stage 1 | - | - | - | - | - | - | 318 | 318 | - | 295 | 295 | - |
| Stage 2 | - | - | - | - | - | - | 301 | 295 | - | 327 | 323 | - |
| Critical Hdwy | 4.9 | - | - | 4.9 | - | - | 8.1 | 8.3 | 6.4 | 8.1 | 5.9 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 7.98 | 7.3 | - | 5.5 | 4.9 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 7.98 | 7.3 | - | 5.5 | 4.9 | - |
| Follow-up Hdwy | 3.5 | - | - | 3.5 | - | - | 3 | 4 | 3.4 | 3 | 4 | 3.4 |
| Pot Cap-1 Maneuver | 802 | - | - | 785 | - | - | 382 | 302 | 713 | 379 | 452 | 732 |
| Stage 1 | - | - | - | - | - | - | 675 | 561 | - | 862 | 706 | - |
| Stage 2 | - | - | - | - | - | - | 696 | 580 | - | 832 | 690 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 802 | - | - | 785 | - | - | 368 | 294 | 713 | 361 | 441 | 732 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 368 | 294 | - | 361 | 441 | - |
| Stage 1 | - | - | - | - | - | - | 666 | 553 | - | 850 | 698 | - |
| Stage 2 | - | - | - | - | - | - | 677 | 574 | - | 799 | 680 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.3 | 0.2 | 13.3 | 12.1 |
| HCM LOS | | | B | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 468 | 802 | - | - | 785 | - | - | 527 |
| HCM Lane V/C Ratio | 0.07 | 0.011 | - | - | 0.009 | - | - | 0.032 |
| HCM Control Delay (s) | 13.3 | 9.5 | 0 | - | 9.6 | 0 | - | 12.1 |
| HCM Lane LOS | B | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.2 | 0 | - | - | 0 | - | - | 0.1 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.6 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 3 | 128 | 26 | 8 | 111 | 1 | 29 | 4 | 23 | 4 | 6 | 4 |
| Future Vol, veh/h | 3 | 128 | 26 | 8 | 111 | 1 | 29 | 4 | 23 | 4 | 6 | 4 |
| Conflicting Peds, #/hr | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 6 | - | - | -2 | - | - | -3 | - | - | 12 | - |
| Peak Hour Factor | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| Heavy Vehicles, % | 0 | 6 | 15 | 25 | 9 | 0 | 14 | 0 | 4 | 25 | 0 | 0 |
| Mvmt Flow | 4 | 171 | 35 | 11 | 148 | 1 | 39 | 5 | 31 | 5 | 8 | 5 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 151 | 0 | 0 | 206 | 0 | 0 | 374 | 370 | 189 | 388 | 387 | 151 |
| Stage 1 | - | - | - | - | - | - | 197 | 197 | - | 173 | 173 | - |
| Stage 2 | - | - | - | - | - | - | 177 | 173 | - | 215 | 214 | - |
| Critical Hdwy | 4.9 | - | - | 4.9 | - | - | 8.1 | 5.9 | 6.4 | 8.1 | 8.9 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 5.64 | 4.9 | - | 8.75 | 7.9 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 5.64 | 4.9 | - | 8.75 | 7.9 | - |
| Follow-up Hdwy | 3.5 | - | - | 3.5 | - | - | 3 | 4 | 3.4 | 3 | 4 | 3.4 |
| Pot Cap-1 Maneuver | 900 | - | - | 857 | - | - | 602 | 599 | 826 | 587 | 425 | 869 |
| Stage 1 | - | - | - | - | - | - | 956 | 766 | - | 846 | 677 | - |
| Stage 2 | - | - | - | - | - | - | 978 | 782 | - | 777 | 632 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 899 | - | - | 857 | - | - | 581 | 587 | 826 | 552 | 417 | 868 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 581 | 587 | - | 552 | 417 | - |
| Stage 1 | - | - | - | - | - | - | 951 | 762 | - | 841 | 667 | - |
| Stage 2 | - | - | - | - | - | - | 947 | 770 | - | 739 | 629 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.2 | 0.6 | 11.1 | 12 |
| HCM LOS | | | B | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 662 | 899 | - | - | 857 | - | - | 533 |
| HCM Lane V/C Ratio | 0.113 | 0.004 | - | - | 0.012 | - | - | 0.035 |
| HCM Control Delay (s) | 11.1 | 9 | 0 | - | 9.3 | 0 | - | 12 |
| HCM Lane LOS | B | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.4 | 0 | - | - | 0 | - | - | 0.1 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 6 | 141 | 7 | 13 | 68 | 7 | 5 | 5 | 36 | 1 | 5 | 1 |
| Future Vol, veh/h | 6 | 141 | 7 | 13 | 68 | 7 | 5 | 5 | 36 | 1 | 5 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 2 | - | - | -2 | - |
| Peak Hour Factor | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| Heavy Vehicles, % | 0 | 8 | 0 | 31 | 13 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| Mvmt Flow | 7 | 155 | 8 | 14 | 75 | 8 | 5 | 5 | 40 | 1 | 5 | 1 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 83 | 0 | 0 | 163 | 0 | 0 | 283 | 284 | 159 | 303 | 284 | 79 |
| Stage 1 | - | - | - | - | - | - | 173 | 173 | - | 107 | 107 | - |
| Stage 2 | - | - | - | - | - | - | 110 | 111 | - | 196 | 177 | - |
| Critical Hdwy | 4.9 | - | - | 4.9 | - | - | 8.1 | 6.9 | 6.46 | 8.1 | 6.1 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.5 | 5.9 | - | 5.7 | 5.1 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.5 | 5.9 | - | 5.7 | 5.1 | - |
| Follow-up Hdwy | 3.5 | - | - | 3.5 | - | - | 3 | 4 | 3.4 | 3 | 4 | 3.4 |
| Pot Cap-1 Maneuver | 956 | - | - | 891 | - | - | 713 | 609 | 857 | 687 | 649 | 955 |
| Stage 1 | - | - | - | - | - | - | 943 | 745 | - | 1059 | 820 | - |
| Stage 2 | - | - | - | - | - | - | 1030 | 798 | - | 954 | 772 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 956 | - | - | 891 | - | - | 694 | 594 | 857 | 639 | 633 | 955 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 694 | 594 | - | 639 | 633 | - |
| Stage 1 | - | - | - | - | - | - | 935 | 739 | - | 1051 | 807 | - |
| Stage 2 | - | - | - | - | - | - | 1005 | 785 | - | 896 | 766 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.3 | 1.3 | 9.8 | 10.5 |
| HCM LOS | | | A | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 798 | 956 | - | - | 891 | - | - | 666 |
| HCM Lane V/C Ratio | 0.063 | 0.007 | - | - | 0.016 | - | - | 0.012 |
| HCM Control Delay (s) | 9.8 | 8.8 | 0 | - | 9.1 | 0 | - | 10.5 |
| HCM Lane LOS | A | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.2 | 0 | - | - | 0 | - | - | 0 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 2 | 1 | 1 | 20 | 1 | 24 | 1 | 138 | 47 | 40 | 86 | 1 |
| Future Vol, veh/h | 2 | 1 | 1 | 20 | 1 | 24 | 1 | 138 | 47 | 40 | 86 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 2 | - | - | -1 | - | - | 1 | - | - | -1 | - |
| Peak Hour Factor | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| Heavy Vehicles, % | 0 | 0 | 0 | 10 | 0 | 8 | 0 | 9 | 2 | 8 | 13 | 0 |
| Mvmt Flow | 2 | 1 | 1 | 22 | 1 | 27 | 1 | 153 | 52 | 44 | 96 | 1 |

| Major/Minor | Minor2 | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 380 | 392 | 97 | 367 | 366 | 179 | 97 | 0 | 0 | 205 | 0 | 0 |
| Stage 1 | 185 | 185 | - | 181 | 181 | - | - | - | - | - | - | - |
| Stage 2 | 195 | 207 | - | 186 | 185 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.5 | 6.9 | 6.4 | 7 | 6.3 | 6.18 | 4.3 | - | - | 4.3 | - | - |
| Critical Hdwy Stg 1 | 6.5 | 5.9 | - | 6 | 5.3 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.5 | 5.9 | - | 6 | 5.3 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3 | 4 | 3.1 | 3 | 4 | 3.1 | 3 | - | - | 3 | - | - |
| Pot Cap-1 Maneuver | 634 | 524 | 1019 | 682 | 577 | 922 | 1112 | - | - | 1022 | - | - |
| Stage 1 | 927 | 735 | - | 956 | 761 | - | - | - | - | - | - | - |
| Stage 2 | 914 | 718 | - | 950 | 758 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | | - | - |
| Mov Cap-1 Maneuver | 593 | 499 | 1019 | 655 | 550 | 922 | 1112 | - | - | 1022 | - | - |
| Mov Cap-2 Maneuver | 593 | 499 | - | 655 | 550 | - | - | - | - | - | - | - |
| Stage 1 | 926 | 701 | - | 955 | 760 | - | - | - | - | - | - | - |
| Stage 2 | 885 | 717 | - | 904 | 723 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 10.8 | 10 | 0 | 2.7 |
| HCM LOS | B | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1112 | - | - | 629 | 771 | 1022 | - | - |
| HCM Lane V/C Ratio | 0.001 | - | - | 0.007 | 0.065 | 0.043 | - | - |
| HCM Control Delay (s) | 8.2 | 0 | - | 10.8 | 10 | 8.7 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | 0 | 0.2 | 0.1 | - | - |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 52 | 92 | 16 | 11 | 82 | 214 | 19 | 137 | 21 | 152 | 99 | 152 |
| Future Volume (veh/h) | 52 | 92 | 16 | 11 | 82 | 214 | 19 | 137 | 21 | 152 | 99 | 152 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1665 | 1665 | 1665 | 2078 | 2078 | 2078 | 1707 | 1623 | 1623 | 1674 | 1575 | 1758 |
| Adj Flow Rate, veh/h | 58 | 102 | 0 | 12 | 91 | 0 | 21 | 152 | 0 | 169 | 110 | 0 |
| Peak Hour Factor | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Percent Heavy Veh, % | 8 | 8 | 8 | 7 | 7 | 7 | 5 | 11 | 11 | 9 | 16 | 3 |
| Cap, veh/h | 193 | 220 | | 115 | 385 | | 545 | 413 | | 586 | 544 | |
| Arrive On Green | 0.18 | 0.20 | 0.00 | 0.18 | 0.20 | 0.00 | 0.05 | 0.25 | 0.00 | 0.14 | 0.35 | 0.00 |
| Sat Flow, veh/h | 395 | 1100 | 0 | 112 | 1918 | 0 | 1626 | 1623 | 0 | 1594 | 1575 | 1490 |
| Grp Volume(v), veh/h | 160 | 0 | 0 | 103 | 0 | 0 | 21 | 152 | 0 | 169 | 110 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1494 | 0 | 0 | 2030 | 0 | 0 | 1626 | 1623 | 0 | 1594 | 1575 | 1490 |
| Q Serve(g_s), s | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 3.3 | 0.0 | 3.1 | 2.1 | 0.0 |
| Cycle Q Clear(g_c), s | 4.1 | 0.0 | 0.0 | 1.8 | 0.0 | 0.0 | 0.4 | 3.3 | 0.0 | 3.1 | 2.1 | 0.0 |
| Prop In Lane | 0.36 | | 0.00 | 0.12 | | 0.00 | 1.00 | | 0.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 379 | 0 | | 453 | 0 | | 545 | 413 | | 586 | 544 | |
| V/C Ratio(X) | 0.42 | 0.00 | | 0.23 | 0.00 | | 0.04 | 0.37 | | 0.29 | 0.20 | |
| Avail Cap(c_a), veh/h | 990 | 0 | | 1292 | 0 | | 1256 | 1315 | | 1138 | 1276 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 15.5 | 0.0 | 0.0 | 14.6 | 0.0 | 0.0 | 10.6 | 13.2 | 0.0 | 9.0 | 9.9 | 0.0 |
| Incr Delay (d2), s/veh | 1.1 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.8 | 0.0 | 0.4 | 0.3 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.3 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.1 | 0.9 | 0.0 | 0.8 | 0.6 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 16.6 | 0.0 | 0.0 | 14.9 | 0.0 | 0.0 | 10.7 | 14.0 | 0.0 | 9.4 | 10.2 | 0.0 |
| LnGrp LOS | B | A | | B | A | | B | B | | A | B | |
| Approach Vol, veh/h | | 160 | A | | 103 | A | | 173 | A | | 279 | A |
| Approach Delay, s/veh | | 16.6 | | | 14.9 | | | 13.6 | | | 9.7 | |
| Approach LOS | | B | | | B | | | B | | | A | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 12.0 | 17.0 | | 14.2 | 8.1 | 20.9 | | 14.2 | | | | |
| Change Period (Y+Rc), s | 7.0 | 7.0 | | 6.5 | 7.0 | 7.0 | | 6.5 | | | | |
| Max Green Setting (Gmax), s | 20.0 | 34.0 | | 26.0 | 20.0 | 34.0 | | 26.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 5.1 | 5.3 | | 6.1 | 2.4 | 4.1 | | 3.8 | | | | |
| Green Ext Time (p_c), s | 0.7 | 0.7 | | 0.7 | 0.0 | 0.5 | | 0.4 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 12.9 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 62 | 1 | 81 | 0 | 0 | 0 | 0 | 243 | 115 | 121 | 278 | 0 |
| Future Volume (veh/h) | 62 | 1 | 81 | 0 | 0 | 0 | 0 | 243 | 115 | 121 | 278 | 0 |
| Initial Q (Qb), veh | 0 | 0 | 0 | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | | | | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1722 | 1949 | 1722 | | | | 0 | 1623 | 1623 | 1300 | 1755 | 0 |
| Adj Flow Rate, veh/h | 71 | 1 | 93 | | | | 0 | 279 | 132 | 139 | 320 | 0 |
| Peak Hour Factor | 0.87 | 0.87 | 0.87 | | | | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |
| Percent Heavy Veh, % | 16 | 0 | 16 | | | | 0 | 9 | 9 | 43 | 11 | 0 |
| Cap, veh/h | 186 | 3 | 148 | | | | 0 | 1250 | 576 | 568 | 2529 | 0 |
| Arrive On Green | 0.09 | 0.10 | 0.10 | | | | 0.00 | 0.61 | 0.60 | 0.03 | 0.25 | 0.00 |
| Sat Flow, veh/h | 1832 | 26 | 1459 | | | | 0 | 2132 | 945 | 1238 | 3423 | 0 |
| Grp Volume(v), veh/h | 72 | 0 | 93 | | | | 0 | 208 | 203 | 139 | 320 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1857 | 0 | 1459 | | | | 0 | 1542 | 1453 | 1238 | 1668 | 0 |
| Q Serve(g_s), s | 2.6 | 0.0 | 4.3 | | | | 0.0 | 4.3 | 4.5 | 2.5 | 5.2 | 0.0 |
| Cycle Q Clear(g_c), s | 2.6 | 0.0 | 4.3 | | | | 0.0 | 4.3 | 4.5 | 2.5 | 5.2 | 0.0 |
| Prop In Lane | 0.99 | | 1.00 | | | | 0.00 | | 0.65 | 1.00 | | 0.00 |
| Lane Grp Cap(c), veh/h | 189 | 0 | 148 | | | | 0 | 940 | 886 | 568 | 2529 | 0 |
| V/C Ratio(X) | 0.38 | 0.00 | 0.63 | | | | 0.00 | 0.22 | 0.23 | 0.24 | 0.13 | 0.00 |
| Avail Cap(c_a), veh/h | 244 | 0 | 192 | | | | 0 | 940 | 886 | 720 | 2529 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 | 0.33 | 0.33 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | | | | 0.00 | 1.00 | 1.00 | 0.97 | 0.97 | 0.00 |
| Uniform Delay (d), s/veh | 29.9 | 0.0 | 30.2 | | | | 0.0 | 6.2 | 6.4 | 3.8 | 8.3 | 0.0 |
| Incr Delay (d2), s/veh | 1.3 | 0.0 | 4.3 | | | | 0.0 | 0.5 | 0.6 | 0.2 | 0.1 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.1 | 0.0 | 1.5 | | | | 0.0 | 1.2 | 1.2 | 0.4 | 1.2 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 31.1 | 0.0 | 34.5 | | | | 0.0 | 6.7 | 7.0 | 4.0 | 8.4 | 0.0 |
| LnGrp LOS | C | A | C | | | | A | A | A | A | A | A |
| Approach Vol, veh/h | | 165 | | | | | | 411 | | | 459 | |
| Approach Delay, s/veh | | 33.0 | | | | | | 6.8 | | | 7.1 | |
| Approach LOS | | C | | | | | | A | | | A | |
| Timer - Assigned Phs | 1 | 2 | | 4 | | 6 | | | | | | |
| Phs Duration (G+Y+Rc), s | 10.4 | 47.7 | | 11.9 | | 58.1 | | | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | | * 5.8 | | 6.0 | | | | | | |
| Max Green Setting (Gmax), s | 13.0 | 31.0 | | * 8.2 | | 50.0 | | | | | | |
| Max Q Clear Time (g_c+I1), s | 4.5 | 6.5 | | 6.3 | | 7.2 | | | | | | |
| Green Ext Time (p_c), s | 0.3 | 7.2 | | 0.1 | | 7.0 | | | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 11.1 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 0 | 99 | 1 | 89 | 66 | 239 | 0 | 0 | 294 | 80 |
| Future Volume (veh/h) | 0 | 0 | 0 | 99 | 1 | 89 | 66 | 239 | 0 | 0 | 294 | 80 |
| Initial Q (Qb), veh | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | | | | 1398 | 2024 | 1398 | 1581 | 1455 | 0 | 0 | 1585 | 1585 |
| Adj Flow Rate, veh/h | | | | 112 | 1 | 101 | 75 | 272 | 0 | 0 | 334 | 91 |
| Peak Hour Factor | | | | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| Percent Heavy Veh, % | | | | 44 | 0 | 44 | 12 | 21 | 0 | 0 | 23 | 23 |
| Cap, veh/h | | | | 242 | 2 | 150 | 631 | 2024 | 0 | 0 | 1388 | 373 |
| Arrive On Green | | | | 0.11 | 0.13 | 0.13 | 0.14 | 1.00 | 0.00 | 0.00 | 0.59 | 0.58 |
| Sat Flow, veh/h | | | | 1911 | 17 | 1185 | 1506 | 2837 | 0 | 0 | 2426 | 630 |
| Grp Volume(v), veh/h | | | | 113 | 0 | 101 | 75 | 272 | 0 | 0 | 213 | 212 |
| Grp Sat Flow(s),veh/h/ln | | | | 1928 | 0 | 1185 | 1506 | 1382 | 0 | 0 | 1505 | 1471 |
| Q Serve(g_s), s | | | | 3.8 | 0.0 | 5.7 | 1.1 | 0.0 | 0.0 | 0.0 | 4.7 | 4.9 |
| Cycle Q Clear(g_c), s | | | | 3.8 | 0.0 | 5.7 | 1.1 | 0.0 | 0.0 | 0.0 | 4.7 | 4.9 |
| Prop In Lane | | | | 0.99 | | 1.00 | 1.00 | | 0.00 | 0.00 | | 0.43 |
| Lane Grp Cap(c), veh/h | | | | 244 | 0 | 150 | 631 | 2024 | 0 | 0 | 890 | 870 |
| V/C Ratio(X) | | | | 0.46 | 0.00 | 0.67 | 0.12 | 0.13 | 0.00 | 0.00 | 0.24 | 0.24 |
| Avail Cap(c_a), veh/h | | | | 361 | 0 | 222 | 742 | 2024 | 0 | 0 | 890 | 870 |
| HCM Platoon Ratio | | | | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | | | | 1.00 | 0.00 | 1.00 | 0.98 | 0.98 | 0.00 | 0.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | | | | 28.8 | 0.0 | 29.2 | 3.6 | 0.0 | 0.0 | 0.0 | 6.8 | 6.9 |
| Incr Delay (d2), s/veh | | | | 1.4 | 0.0 | 5.2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.6 | 0.7 |
| Initial Q Delay(d3),s/veh | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | | | | 1.7 | 0.0 | 1.6 | 0.2 | 0.0 | 0.0 | 0.0 | 1.3 | 1.4 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | | | | 30.2 | 0.0 | 34.4 | 3.7 | 0.1 | 0.0 | 0.0 | 7.4 | 7.6 |
| LnGrp LOS | | | | C | A | C | A | A | A | A | A | A |
| Approach Vol, veh/h | | | | | 214 | | | 347 | | | 425 | |
| Approach Delay, s/veh | | | | | 32.2 | | | 0.9 | | | 7.5 | |
| Approach LOS | | | | | C | | | A | | | A | |

| Timer - Assigned Phs | 1 | 2 | | 4 | | 6 |
|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 9.8 | 46.4 | | 13.8 | | 56.2 |
| Change Period (Y+Rc), s | 6.0 | 6.0 | | * 5.9 | | 6.0 |
| Max Green Setting (Gmax), s | 9.0 | 31.0 | | * 12 | | 46.0 |
| Max Q Clear Time (g_c+I1), s | 3.1 | 6.9 | | 7.7 | | 2.0 |
| Green Ext Time (p_c), s | 0.1 | 7.4 | | 0.3 | | 6.0 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 10.5 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.1 |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 2 | 254 | 306 | 22 | 1 | 1 |
| Future Vol, veh/h | 2 | 254 | 306 | 22 | 1 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | -9 | 9 | - | -10 | - |
| Peak Hour Factor | 88 | 88 | 88 | 88 | 88 | 88 |
| Heavy Vehicles, % | 0 | 9 | 6 | 9 | 0 | 0 |
| Mvmt Flow | 2 | 289 | 348 | 25 | 1 | 1 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 373 | 0 | - | 0 | 654 | 361 |
| Stage 1 | - | - | - | - | 361 | - |
| Stage 2 | - | - | - | - | 293 | - |
| Critical Hdwy | 4.3 | - | - | - | 4.4 | 5.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 3.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 3.4 | - |
| Follow-up Hdwy | 3 | - | - | - | 3 | 3.1 |
| Pot Cap-1 Maneuver | 894 | - | - | - | 700 | 802 |
| Stage 1 | - | - | - | - | 988 | - |
| Stage 2 | - | - | - | - | 1026 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 894 | - | - | - | 698 | 802 |
| Mov Cap-2 Maneuver | - | - | - | - | 698 | - |
| Stage 1 | - | - | - | - | 985 | - |
| Stage 2 | - | - | - | - | 1026 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.1 | 0 | 9.8 |
| HCM LOS | | | A |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 894 | - | - | - | 746 |
| HCM Lane V/C Ratio | 0.003 | - | - | - | 0.003 |
| HCM Control Delay (s) | 9 | 0 | - | - | 9.8 |
| HCM Lane LOS | A | A | - | - | A |
| HCM 95th %tile Q(veh) | 0 | - | - | - | 0 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 3.6 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 65 | 1 | 78 | 0 | 0 | 0 | 0 | 71 | 52 | 3 | 148 | 0 |
| Future Vol, veh/h | 65 | 1 | 78 | 0 | 0 | 0 | 0 | 71 | 52 | 3 | 148 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | Yield | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 16979 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | -3 | - | - | -2 | - | - | 1 | - | - | -1 | - |
| Peak Hour Factor | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 |
| Heavy Vehicles, % | 15 | 0 | 10 | 0 | 0 | 0 | 0 | 14 | 23 | 0 | 13 | 0 |
| Mvmt Flow | 92 | 1 | 110 | 0 | 0 | 0 | 0 | 100 | 73 | 4 | 208 | 0 |

| Major/Minor | Minor2 | | | | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 266 | 316 | 104 | | | | - | 0 | 0 | 100 | 0 | 0 |
| Stage 1 | 216 | 216 | - | | | | - | - | - | - | - | - |
| Stage 2 | 50 | 100 | - | | | | - | - | - | - | - | - |
| Critical Hdwy | 6.5 | 5.9 | 6.8 | | | | - | - | - | 4.3 | - | - |
| Critical Hdwy Stg 1 | 5.5 | 4.9 | - | | | | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.5 | 4.9 | - | | | | - | - | - | - | - | - |
| Follow-up Hdwy | 3 | 4 | 3.1 | | | | - | - | - | 3 | - | - |
| Pot Cap-1 Maneuver | 828 | 636 | 998 | | | | 0 | - | - | 1110 | - | 0 |
| Stage 1 | 943 | 754 | - | | | | 0 | - | - | - | - | 0 |
| Stage 2 | 1135 | 830 | - | | | | 0 | - | - | - | - | 0 |
| Platoon blocked, % | | | | | | | | - | - | | - | |
| Mov Cap-1 Maneuver | 825 | 0 | 998 | | | | - | - | - | 1110 | - | - |
| Mov Cap-2 Maneuver | 825 | 0 | - | | | | - | - | - | - | - | - |
| Stage 1 | 943 | 0 | - | | | | - | - | - | - | - | - |
| Stage 2 | 1130 | 0 | - | | | | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 10.1 | 0 | 0.2 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBR | EBLn1 | SBL | SBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 911 | 1110 | - |
| HCM Lane V/C Ratio | - | - | 0.223 | 0.004 | - |
| HCM Control Delay (s) | - | - | 10.1 | 8.3 | 0 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 0.9 | 0 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 73 | 1 | 3 | 26 | 108 | 0 | 0 | 82 | 63 |
| Future Vol, veh/h | 0 | 0 | 0 | 73 | 1 | 3 | 26 | 108 | 0 | 0 | 82 | 63 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | Yield |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 2 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | -3 | - | - | -1 | - | - | 7 | - | - | 0 | - |
| Peak Hour Factor | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 | 89 |
| Heavy Vehicles, % | 0 | 0 | 0 | 18 | 0 | 33 | 27 | 19 | 0 | 0 | 9 | 14 |
| Mvmt Flow | 0 | 0 | 0 | 82 | 1 | 3 | 29 | 121 | 0 | 0 | 92 | 71 |

| Major/Minor | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 225 | 271 | 61 | 92 | 0 | - | - | - | 0 |
| Stage 1 | 179 | 179 | - | - | - | - | - | - | - |
| Stage 2 | 46 | 92 | - | - | - | - | - | - | - |
| Critical Hdwy | 6.96 | 6.3 | 7.46 | 4.3 | - | - | - | - | - |
| Critical Hdwy Stg 1 | 5.96 | 5.3 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.96 | 5.3 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3 | 4 | 3.1 | 3 | - | - | - | - | - |
| Pot Cap-1 Maneuver | 852 | 649 | 1051 | 1117 | - | 0 | 0 | - | - |
| Stage 1 | 960 | 763 | - | - | - | 0 | 0 | - | - |
| Stage 2 | 1133 | 827 | - | - | - | 0 | 0 | - | - |
| Platoon blocked, % | | | | | - | | | - | - |
| Mov Cap-1 Maneuver | 828 | 0 | 1051 | 1117 | - | - | - | - | - |
| Mov Cap-2 Maneuver | 828 | 0 | - | - | - | - | - | - | - |
| Stage 1 | 933 | 0 | - | - | - | - | - | - | - |
| Stage 2 | 1133 | 0 | - | - | - | - | - | - | - |

| Approach | WB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 9.8 | 1.7 | 0 |
| HCM LOS | A | | |

| Minor Lane/Major Mvmt | NBL | NBT | WBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1117 | - | 835 | - | - |
| HCM Lane V/C Ratio | 0.026 | - | 0.104 | - | - |
| HCM Control Delay (s) | 8.3 | 0.1 | 9.8 | - | - |
| HCM Lane LOS | A | A | A | - | - |
| HCM 95th %tile Q(veh) | 0.1 | - | 0.3 | - | - |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 7.1 |
| Intersection LOS | A |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✥ | | | ↱ | | | ↰ | | | ↱ | |
| Traffic Vol, veh/h | 3 | 0 | 82 | 0 | 34 | 7 | 8 | 0 | 0 | 0 | 18 | 0 |
| Future Vol, veh/h | 3 | 0 | 82 | 0 | 34 | 7 | 8 | 0 | 0 | 0 | 18 | 0 |
| Peak Hour Factor | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 | 0.87 |
| Heavy Vehicles, % | 0 | 0 | 7 | 0 | 15 | 0 | 25 | 0 | 0 | 0 | 0 | 0 |
| Mvmt Flow | 3 | 0 | 94 | 0 | 39 | 8 | 9 | 0 | 0 | 0 | 21 | 0 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 1 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 1 | 1 | 1 |
| HCM Control Delay | 6.8 | 7.4 | 7.9 | 7.3 |
| HCM LOS | A | A | A | A |

| Lane | NBLn1 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|
| Vol Left, % | 100% | 4% | 0% | 0% |
| Vol Thru, % | 0% | 0% | 83% | 100% |
| Vol Right, % | 0% | 96% | 17% | 0% |
| Sign Control | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 8 | 85 | 41 | 18 |
| LT Vol | 8 | 3 | 0 | 0 |
| Through Vol | 0 | 0 | 34 | 18 |
| RT Vol | 0 | 82 | 7 | 0 |
| Lane Flow Rate | 9 | 98 | 47 | 21 |
| Geometry Grp | 1 | 1 | 1 | 1 |
| Degree of Util (X) | 0.012 | 0.093 | 0.055 | 0.024 |
| Departure Headway (Hd) | 4.793 | 3.414 | 4.177 | 4.157 |
| Convergence, Y/N | Yes | Yes | Yes | Yes |
| Cap | 745 | 1046 | 857 | 858 |
| Service Time | 2.835 | 1.445 | 2.202 | 2.197 |
| HCM Lane V/C Ratio | 0.012 | 0.094 | 0.055 | 0.024 |
| HCM Control Delay | 7.9 | 6.8 | 7.4 | 7.3 |
| HCM Lane LOS | A | A | A | A |
| HCM 95th-tile Q | 0 | 0.3 | 0.2 | 0.1 |

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 0.2 | | | | | |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 150 | 5 | 1 | 116 | 4 | 1 |
| Future Vol, veh/h | 150 | 5 | 1 | 116 | 4 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 2 | - | - | -3 | -5 | - |
| Peak Hour Factor | 75 | 75 | 75 | 75 | 75 | 75 |
| Heavy Vehicles, % | 6 | 0 | 0 | 9 | 0 | 0 |
| Mvmt Flow | 200 | 7 | 1 | 155 | 5 | 1 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 207 | 0 | 361 | 204 |
| Stage 1 | - | - | - | - | 204 | - |
| Stage 2 | - | - | - | - | 157 | - |
| Critical Hdwy | - | - | 4.9 | - | 8.1 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | 4.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 4.4 | - |
| Follow-up Hdwy | - | - | 3.5 | - | 3 | 3.4 |
| Pot Cap-1 Maneuver | - | - | 857 | - | 617 | 810 |
| Stage 1 | - | - | - | - | 1017 | - |
| Stage 2 | - | - | - | - | 1057 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 857 | - | 616 | 810 |
| Mov Cap-2 Maneuver | - | - | - | - | 616 | - |
| Stage 1 | - | - | - | - | 1017 | - |
| Stage 2 | - | - | - | - | 1056 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0.1 | 10.6 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 647 | - | - | 857 | - |
| HCM Lane V/C Ratio | 0.01 | - | - | 0.002 | - |
| HCM Control Delay (s) | 10.6 | - | - | 9.2 | 0 |
| HCM Lane LOS | B | - | - | A | A |
| HCM 95th %tile Q(veh) | 0 | - | - | 0 | - |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 94 | 107 | 10 | 186 | 65 | 30 | 14 | 418 | 296 | 17 | 257 | 36 |
| Future Volume (veh/h) | 94 | 107 | 10 | 186 | 65 | 30 | 14 | 418 | 296 | 17 | 257 | 36 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1684 | 1645 | 1645 | 1542 | 1619 | 1619 | 1581 | 1764 | 1790 | 1389 | 1324 | 1324 |
| Adj Flow Rate, veh/h | 103 | 118 | 0 | 204 | 71 | 0 | 15 | 459 | 0 | 19 | 282 | 0 |
| Peak Hour Factor | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Percent Heavy Veh, % | 0 | 3 | 3 | 8 | 2 | 2 | 21 | 7 | 5 | 6 | 11 | 11 |
| Cap, veh/h | 121 | 150 | | 230 | 276 | | 17 | 688 | | 20 | 500 | |
| Arrive On Green | 0.08 | 0.09 | 0.00 | 0.16 | 0.17 | 0.00 | 0.01 | 0.39 | 0.00 | 0.02 | 0.38 | 0.00 |
| Sat Flow, veh/h | 1604 | 1645 | 0 | 1469 | 1619 | 0 | 1506 | 1764 | 1517 | 1323 | 1324 | 0 |
| Grp Volume(v), veh/h | 103 | 118 | 0 | 204 | 71 | 0 | 15 | 459 | 0 | 19 | 282 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1604 | 1645 | 0 | 1469 | 1619 | 0 | 1506 | 1764 | 1517 | 1323 | 1324 | 0 |
| Q Serve(g_s), s | 5.1 | 5.6 | 0.0 | 10.9 | 3.0 | 0.0 | 0.8 | 17.1 | 0.0 | 1.1 | 13.5 | 0.0 |
| Cycle Q Clear(g_c), s | 5.1 | 5.6 | 0.0 | 10.9 | 3.0 | 0.0 | 0.8 | 17.1 | 0.0 | 1.1 | 13.5 | 0.0 |
| Prop In Lane | 1.00 | | 0.00 | 1.00 | | 0.00 | 1.00 | | 1.00 | 1.00 | | 0.00 |
| Lane Grp Cap(c), veh/h | 121 | 150 | | 230 | 276 | | 17 | 688 | | 20 | 500 | |
| V/C Ratio(X) | 0.85 | 0.79 | | 0.89 | 0.26 | | 0.87 | 0.67 | | 0.94 | 0.56 | |
| Avail Cap(c_a), veh/h | 361 | 340 | | 335 | 284 | | 253 | 1047 | | 227 | 753 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 36.5 | 35.5 | 0.0 | 33.0 | 28.8 | 0.0 | 39.4 | 20.1 | 0.0 | 39.3 | 19.7 | 0.0 |
| Incr Delay (d2), s/veh | 15.2 | 8.7 | 0.0 | 17.5 | 0.5 | 0.0 | 68.9 | 4.0 | 0.0 | 77.9 | 3.6 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.4 | 2.5 | 0.0 | 4.7 | 1.1 | 0.0 | 0.6 | 7.0 | 0.0 | 0.8 | 4.2 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 51.7 | 44.3 | 0.0 | 50.5 | 29.2 | 0.0 | 108.3 | 24.1 | 0.0 | 117.2 | 23.3 | 0.0 |
| LnGrp LOS | D | D | | D | C | | F | C | | F | C | |
| Approach Vol, veh/h | | 221 | A | | 275 | A | | 474 | A | | 301 | A |
| Approach Delay, s/veh | | 47.7 | | | 45.0 | | | 26.8 | | | 29.2 | |
| Approach LOS | | D | | | D | | | C | | | C | |

| Timer - Assigned Phs | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 7.5 | 38.7 | 19.3 | 14.3 | 8.5 | 37.7 | 13.0 | 20.6 |
| Change Period (Y+Rc), s | * 5.8 | 7.1 | 6.3 | 6.5 | 7.1 | 7.1 | 6.5 | 6.5 |
| Max Green Setting (Gmax), s | * 14 | 47.9 | 18.7 | 17.0 | 13.9 | 45.9 | 18.5 | 14.5 |
| Max Q Clear Time (g_c+I1), s | 3.1 | 19.1 | 12.9 | 7.6 | 2.8 | 15.5 | 7.1 | 5.0 |
| Green Ext Time (p_c), s | 0.0 | 12.5 | 0.3 | 0.2 | 0.0 | 7.5 | 0.2 | 0.1 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 34.9 |
| HCM 6th LOS | C |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 2 | | | | | |

| Movement | NBL | NBT | SBT | SBR | SEL | SER |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 23 | 272 | 166 | 0 | 47 | 16 |
| Future Vol, veh/h | 23 | 272 | 166 | 0 | 47 | 16 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | 7 | -6 | - | 0 | - |
| Peak Hour Factor | 93 | 93 | 93 | 93 | 93 | 93 |
| Heavy Vehicles, % | 9 | 6 | 13 | 0 | 6 | 13 |
| Mvmt Flow | 25 | 292 | 178 | 0 | 51 | 17 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 178 | 0 | - | 0 | 520 | 178 |
| Stage 1 | - | - | - | - | 178 | - |
| Stage 2 | - | - | - | - | 342 | - |
| Critical Hdwy | 4.9 | - | - | - | 8.1 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | 5.46 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 5.46 | - |
| Follow-up Hdwy | 3.5 | - | - | - | 3 | 3.4 |
| Pot Cap-1 Maneuver | 879 | - | - | 0 | 459 | 838 |
| Stage 1 | - | - | - | 0 | 986 | - |
| Stage 2 | - | - | - | 0 | 821 | - |
| Platoon blocked, % | | - | - | | | |
| Mov Cap-1 Maneuver | 879 | - | - | - | 443 | 838 |
| Mov Cap-2 Maneuver | - | - | - | - | 443 | - |
| Stage 1 | - | - | - | - | 952 | - |
| Stage 2 | - | - | - | - | 821 | - |

| Approach | NB | SB | SE |
|---|---|---|---|
| HCM Control Delay, s | 0.7 | 0 | 13.3 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBL | NBT | SELn1 | SBT |
|---|---|---|---|---|
| Capacity (veh/h) | 879 | - | 503 | - |
| HCM Lane V/C Ratio | 0.028 | - | 0.135 | - |
| HCM Control Delay (s) | 9.2 | 0 | 13.3 | - |
| HCM Lane LOS | A | A | B | - |
| HCM 95th %tile Q(veh) | 0.1 | - | 0.5 | - |

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 0.2 | | | | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 8 | 2 | 1 | 331 | 310 | 11 |
| Future Vol, veh/h | 8 | 2 | 1 | 331 | 310 | 11 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Free | Free | Free | Free |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | 0 | - | - | - | - | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 8 | - | - | -4 | -2 | - |
| Peak Hour Factor | 95 | 95 | 95 | 95 | 95 | 95 |
| Heavy Vehicles, % | 0 | 0 | 100 | 8 | 5 | 9 |
| Mvmt Flow | 8 | 2 | 1 | 348 | 326 | 12 |

| Major/Minor | Minor2 | | Major1 | | Major2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 682 | 332 | 338 | 0 | - | 0 |
| Stage 1 | 332 | - | - | - | - | - |
| Stage 2 | 350 | - | - | - | - | - |
| Critical Hdwy | 8 | 7 | 4.3 | - | - | - |
| Critical Hdwy Stg 1 | 7 | - | - | - | - | - |
| Critical Hdwy Stg 2 | 7 | - | - | - | - | - |
| Follow-up Hdwy | 3 | 3.1 | 3 | - | - | - |
| Pot Cap-1 Maneuver | 346 | 700 | 920 | - | - | - |
| Stage 1 | 720 | - | - | - | - | - |
| Stage 2 | 701 | - | - | - | - | - |
| Platoon blocked, % | | | | - | - | - |
| Mov Cap-1 Maneuver | 346 | 700 | 920 | - | - | - |
| Mov Cap-2 Maneuver | 346 | - | - | - | - | - |
| Stage 1 | 719 | - | - | - | - | - |
| Stage 2 | 701 | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 14.6 | 0 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | EBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 920 | - | 385 | - | - |
| HCM Lane V/C Ratio | 0.001 | - | 0.027 | - | - |
| HCM Control Delay (s) | 8.9 | 0 | 14.6 | - | - |
| HCM Lane LOS | A | A | B | - | - |
| HCM 95th %tile Q(veh) | 0 | - | 0.1 | - | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.8 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 1 | 366 | 1 | 89 | 353 | 8 | 1 | 2 | 58 | 2 | 1 | 1 |
| Future Vol, veh/h | 1 | 366 | 1 | 89 | 353 | 8 | 1 | 2 | 58 | 2 | 1 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | 120 | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | -5 | - | - | 3 | - | - | -7 | - | - | 7 | - |
| Peak Hour Factor | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 | 95 |
| Heavy Vehicles, % | 0 | 6 | 0 | 0 | 5 | 13 | 0 | 0 | 3 | 0 | 0 | 0 |
| Mvmt Flow | 1 | 385 | 1 | 94 | 372 | 8 | 1 | 2 | 61 | 2 | 1 | 1 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 380 | 0 | 0 | 386 | 0 | 0 | 954 | 956 | 386 | 983 | 952 | 377 |
| Stage 1 | - | - | - | - | - | - | 388 | 388 | - | 564 | 564 | - |
| Stage 2 | - | - | - | - | - | - | 566 | 568 | - | 419 | 388 | - |
| Critical Hdwy | 4.3 | - | - | 4.3 | - | - | 5.7 | 5.1 | 5.53 | 8.5 | 7.9 | 6.9 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 4.7 | 4.1 | - | 7.5 | 6.9 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 4.7 | 4.1 | - | 7.5 | 6.9 | - |
| Follow-up Hdwy | 3 | - | - | 3 | - | - | 3 | 4 | 3.1 | 3 | 4 | 3.1 |
| Pot Cap-1 Maneuver | 889 | - | - | 885 | - | - | 384 | 377 | 754 | 173 | 181 | 660 |
| Stage 1 | - | - | - | - | - | - | 846 | 712 | - | 464 | 411 | - |
| Stage 2 | - | - | - | - | - | - | 719 | 636 | - | 594 | 527 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 889 | - | - | 885 | - | - | 350 | 337 | 754 | 145 | 162 | 659 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 350 | 337 | - | 145 | 162 | - |
| Stage 1 | - | - | - | - | - | - | 845 | 711 | - | 464 | 367 | - |
| Stage 2 | - | - | - | - | - | - | 639 | 569 | - | 544 | 526 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0 | 1.9 | 10.6 | 24.8 |
| HCM LOS | | | B | C |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 712 | 889 | - | - | 885 | - | - | 186 |
| HCM Lane V/C Ratio | 0.09 | 0.001 | - | - | 0.106 | - | - | 0.023 |
| HCM Control Delay (s) | 10.6 | 9.1 | 0 | - | 9.5 | - | - | 24.8 |
| HCM Lane LOS | B | A | A | - | A | - | - | C |
| HCM 95th %tile Q(veh) | 0.3 | 0 | - | - | 0.4 | - | - | 0.1 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 117 | 255 | 2 | 1 | 258 | 112 | 5 | 4 | 4 | 170 | 6 | 143 |
| Future Volume (veh/h) | 117 | 255 | 2 | 1 | 258 | 112 | 5 | 4 | 4 | 170 | 6 | 143 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 0.97 | 0.99 | | 0.99 | 1.00 | | 0.99 | 0.99 | | 0.99 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1481 | 1557 | 1557 | 1582 | 1582 | 1582 | 1685 | 1685 | 1685 | 1685 | 1685 | 1685 |
| Adj Flow Rate, veh/h | 122 | 266 | 2 | 1 | 269 | 117 | 5 | 4 | 4 | 177 | 6 | 149 |
| Peak Hour Factor | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 | 0.96 |
| Percent Heavy Veh, % | 11 | 5 | 5 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cap, veh/h | 426 | 788 | 6 | 65 | 340 | 147 | 219 | 170 | 133 | 303 | 27 | 187 |
| Arrive On Green | 0.09 | 0.51 | 0.49 | 0.31 | 0.33 | 0.31 | 0.29 | 0.31 | 0.31 | 0.29 | 0.31 | 0.29 |
| Sat Flow, veh/h | 1410 | 1543 | 12 | 1 | 1041 | 451 | 418 | 548 | 429 | 657 | 86 | 605 |
| Grp Volume(v), veh/h | 122 | 0 | 268 | 387 | 0 | 0 | 13 | 0 | 0 | 332 | 0 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1410 | 0 | 1554 | 1493 | 0 | 0 | 1396 | 0 | 0 | 1349 | 0 | 0 |
| Q Serve(g_s), s | 2.9 | 0.0 | 5.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.6 | 0.0 | 0.0 |
| Cycle Q Clear(g_c), s | 2.9 | 0.0 | 5.7 | 13.4 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 12.8 | 0.0 | 0.0 |
| Prop In Lane | 1.00 | | 0.01 | 0.00 | | 0.30 | 0.38 | | 0.31 | 0.53 | | 0.45 |
| Lane Grp Cap(c), veh/h | 426 | 0 | 794 | 526 | 0 | 0 | 496 | 0 | 0 | 492 | 0 | 0 |
| V/C Ratio(X) | 0.29 | 0.00 | 0.34 | 0.74 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.67 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h | 571 | 0 | 1312 | 868 | 0 | 0 | 827 | 0 | 0 | 822 | 0 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh | 9.0 | 0.0 | 8.1 | 17.3 | 0.0 | 0.0 | 13.5 | 0.0 | 0.0 | 18.1 | 0.0 | 0.0 |
| Incr Delay (d2), s/veh | 0.4 | 0.0 | 0.2 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 0.8 | 0.0 | 1.6 | 4.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 9.4 | 0.0 | 8.3 | 19.3 | 0.0 | 0.0 | 13.5 | 0.0 | 0.0 | 19.7 | 0.0 | 0.0 |
| LnGrp LOS | A | A | A | B | A | A | B | A | A | B | A | A |
| Approach Vol, veh/h | | 390 | | | 387 | | | 13 | | | 332 | |
| Approach Delay, s/veh | | 8.6 | | | 19.3 | | | 13.5 | | | 19.7 | |
| Approach LOS | | A | | | B | | | B | | | B | |
| Timer - Assigned Phs | 1 | 2 | | 4 | | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 10.3 | 23.2 | | 22.2 | | 33.5 | | 22.2 | | | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | | 6.0 | | 6.0 | | 6.0 | | | | |
| Max Green Setting (Gmax), s | 10.0 | 30.0 | | 30.0 | | 46.0 | | 30.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 4.9 | 15.4 | | 2.3 | | 7.7 | | 14.8 | | | | |
| Green Ext Time (p_c), s | 0.1 | 1.4 | | 0.0 | | 1.0 | | 1.2 | | | | |
| Intersection Summary | | | | | | | | | | | | |
| HCM 6th Ctrl Delay | | | 15.6 | | | | | | | | | |
| HCM 6th LOS | | | B | | | | | | | | | |

| Intersection | |
|---|---|
| Int Delay, s/veh | 1.4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 13 | 218 | 10 | 11 | 257 | 6 | 15 | 1 | 2 | 8 | 2 | 12 |
| Future Vol, veh/h | 13 | 218 | 10 | 11 | 257 | 6 | 15 | 1 | 2 | 8 | 2 | 12 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 1 | - | - | -1 | - | - | 9 | - | - | -3 | - |
| Peak Hour Factor | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Heavy Vehicles, % | 0 | 6 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 13 | 0 | 8 |
| Mvmt Flow | 15 | 256 | 12 | 13 | 302 | 7 | 18 | 1 | 2 | 9 | 2 | 14 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 309 | 0 | 0 | 268 | 0 | 0 | 632 | 627 | 262 | 626 | 630 | 306 |
| Stage 1 | - | - | - | - | - | - | 292 | 292 | - | 332 | 332 | - |
| Stage 2 | - | - | - | - | - | - | 340 | 335 | - | 294 | 298 | - |
| Critical Hdwy | 4.9 | - | - | 4.9 | - | - | 8.1 | 8.3 | 6.4 | 8.1 | 5.9 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 7.9 | 7.3 | - | 5.63 | 4.9 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 7.9 | 7.3 | - | 5.63 | 4.9 | - |
| Follow-up Hdwy | 3.5 | - | - | 3.5 | - | - | 3 | 4 | 3.4 | 3 | 4 | 3.4 |
| Pot Cap-1 Maneuver | 782 | - | - | 811 | - | - | 372 | 294 | 750 | 377 | 446 | 708 |
| Stage 1 | - | - | - | - | - | - | 712 | 583 | - | 817 | 685 | - |
| Stage 2 | - | - | - | - | - | - | 653 | 546 | - | 854 | 705 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 782 | - | - | 811 | - | - | 352 | 282 | 750 | 363 | 427 | 708 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 352 | 282 | - | 363 | 427 | - |
| Stage 1 | - | - | - | - | - | - | 696 | 570 | - | 798 | 672 | - |
| Stage 2 | - | - | - | - | - | - | 626 | 536 | - | 830 | 689 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.5 | 0.4 | 15.3 | 12.5 |
| HCM LOS | | | C | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 369 | 782 | - | - | 811 | - | - | 504 |
| HCM Lane V/C Ratio | 0.057 | 0.02 | - | - | 0.016 | - | - | 0.051 |
| HCM Control Delay (s) | 15.3 | 9.7 | 0 | - | 9.5 | 0 | - | 12.5 |
| HCM Lane LOS | C | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.2 | 0.1 | - | - | 0 | - | - | 0.2 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 3.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 1 | 140 | 36 | 30 | 165 | 14 | 39 | 12 | 18 | 10 | 9 | 6 |
| Future Vol, veh/h | 1 | 140 | 36 | 30 | 165 | 14 | 39 | 12 | 18 | 10 | 9 | 6 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 6 | - | - | -2 | - | - | -3 | - | - | 12 | - |
| Peak Hour Factor | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 |
| Heavy Vehicles, % | 0 | 9 | 8 | 7 | 8 | 0 | 10 | 0 | 6 | 20 | 11 | 0 |
| Mvmt Flow | 1 | 169 | 43 | 36 | 199 | 17 | 47 | 14 | 22 | 12 | 11 | 7 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 216 | 0 | 0 | 212 | 0 | 0 | 482 | 481 | 191 | 491 | 494 | 208 |
| Stage 1 | - | - | - | - | - | - | 193 | 193 | - | 280 | 280 | - |
| Stage 2 | - | - | - | - | - | - | 289 | 288 | - | 211 | 214 | - |
| Critical Hdwy | 4.9 | - | - | 4.9 | - | - | 8.1 | 5.9 | 6.4 | 8.1 | 9.01 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 5.6 | 4.9 | - | 8.7 | 8.01 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 5.6 | 4.9 | - | 8.7 | 8.01 | - |
| Follow-up Hdwy | 3.5 | - | - | 3.5 | - | - | 3 | 4 | 3.4 | 3 | 4.099 | 3.4 |
| Pot Cap-1 Maneuver | 850 | - | - | 853 | - | - | 493 | 528 | 824 | 484 | 334 | 806 |
| Stage 1 | - | - | - | - | - | - | 962 | 769 | - | 684 | 550 | - |
| Stage 2 | - | - | - | - | - | - | 861 | 711 | - | 786 | 615 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 850 | - | - | 853 | - | - | 458 | 502 | 824 | 444 | 318 | 806 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 458 | 502 | - | 444 | 318 | - |
| Stage 1 | - | - | - | - | - | - | 961 | 768 | - | 683 | 524 | - |
| Stage 2 | - | - | - | - | - | - | 796 | 677 | - | 750 | 614 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.1 | 1.4 | 13.1 | 14 |
| HCM LOS | | | B | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 527 | 850 | - | - | 853 | - | - | 429 |
| HCM Lane V/C Ratio | 0.158 | 0.001 | - | - | 0.042 | - | - | 0.07 |
| HCM Control Delay (s) | 13.1 | 9.2 | 0 | - | 9.4 | 0 | - | 14 |
| HCM Lane LOS | B | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.6 | 0 | - | - | 0.1 | - | - | 0.2 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | ✣ | | | ✣ | | | ✣ | | | ✣ | |
| Traffic Vol, veh/h | 2 | 113 | 10 | 38 | 200 | 17 | 9 | 11 | 19 | 8 | 9 | 5 |
| Future Vol, veh/h | 2 | 113 | 10 | 38 | 200 | 17 | 9 | 11 | 19 | 8 | 9 | 5 |
| Conflicting Peds, #/hr | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 0 | - | - | 0 | - | - | 2 | - | - | -2 | - |
| Peak Hour Factor | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 | 91 |
| Heavy Vehicles, % | 50 | 7 | 0 | 11 | 7 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| Mvmt Flow | 2 | 124 | 11 | 42 | 220 | 19 | 10 | 12 | 21 | 9 | 10 | 5 |

| Major/Minor | Major1 | | | Major2 | | | Minor1 | | | Minor2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 239 | 0 | 0 | 136 | 0 | 0 | 456 | 458 | 131 | 464 | 454 | 230 |
| Stage 1 | - | - | - | - | - | - | 135 | 135 | - | 314 | 314 | - |
| Stage 2 | - | - | - | - | - | - | 321 | 323 | - | 150 | 140 | - |
| Critical Hdwy | 4.9 | - | - | 4.9 | - | - | 8.1 | 6.9 | 6.45 | 8.1 | 6.1 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | - | - | 6.5 | 5.9 | - | 5.7 | 5.1 | - |
| Critical Hdwy Stg 2 | - | - | - | - | - | - | 6.5 | 5.9 | - | 5.7 | 5.1 | - |
| Follow-up Hdwy | 3.5 | - | - | 3.5 | - | - | 3 | 4 | 3.4 | 3 | 4 | 3.4 |
| Pot Cap-1 Maneuver | 833 | - | - | 913 | - | - | 517 | 477 | 890 | 509 | 531 | 783 |
| Stage 1 | - | - | - | - | - | - | 994 | 777 | - | 830 | 683 | - |
| Stage 2 | - | - | - | - | - | - | 766 | 631 | - | 1007 | 797 | - |
| Platoon blocked, % | | - | - | | - | - | | | | | | |
| Mov Cap-1 Maneuver | 833 | - | - | 912 | - | - | 484 | 450 | 889 | 466 | 501 | 783 |
| Mov Cap-2 Maneuver | - | - | - | - | - | - | 484 | 450 | - | 466 | 501 | - |
| Stage 1 | - | - | - | - | - | - | 990 | 774 | - | 828 | 647 | - |
| Stage 2 | - | - | - | - | - | - | 709 | 598 | - | 965 | 794 | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 0.1 | 1.4 | 11.4 | 12.1 |
| HCM LOS | | | B | B |

| Minor Lane/Major Mvmt | NBLn1 | EBL | EBT | EBR | WBL | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 605 | 833 | - | - | 912 | - | - | 530 |
| HCM Lane V/C Ratio | 0.071 | 0.003 | - | - | 0.046 | - | - | 0.046 |
| HCM Control Delay (s) | 11.4 | 9.3 | 0 | - | 9.1 | 0 | - | 12.1 |
| HCM Lane LOS | B | A | A | - | A | A | - | B |
| HCM 95th %tile Q(veh) | 0.2 | 0 | - | - | 0.1 | - | - | 0.1 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 3 | 1 | 2 | 106 | 2 | 35 | 1 | 122 | 36 | 19 | 177 | 5 |
| Future Vol, veh/h | 3 | 1 | 2 | 106 | 2 | 35 | 1 | 122 | 36 | 19 | 177 | 5 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | 2 | - | - | -1 | - | - | 1 | - | - | -1 | - |
| Peak Hour Factor | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 |
| Heavy Vehicles, % | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 12 | 0 | 5 | 8 | 0 |
| Mvmt Flow | 4 | 1 | 2 | 128 | 2 | 42 | 1 | 147 | 43 | 23 | 213 | 6 |

| Major/Minor | Minor2 | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 455 | 454 | 216 | 435 | 436 | 169 | 219 | 0 | 0 | 190 | 0 | 0 |
| Stage 1 | 262 | 262 | - | 171 | 171 | - | - | - | - | - | - | - |
| Stage 2 | 193 | 192 | - | 264 | 265 | - | - | - | - | - | - | - |
| Critical Hdwy | 7.5 | 6.9 | 6.4 | 6.93 | 6.3 | 6.13 | 4.3 | - | - | 4.3 | - | - |
| Critical Hdwy Stg 1 | 6.5 | 5.9 | - | 5.93 | 5.3 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 6.5 | 5.9 | - | 5.93 | 5.3 | - | - | - | - | - | - | - |
| Follow-up Hdwy | 3 | 4 | 3.1 | 3 | 4 | 3.1 | 3 | - | - | 3 | - | - |
| Pot Cap-1 Maneuver | 559 | 480 | 867 | 619 | 529 | 936 | 1011 | - | - | 1034 | - | - |
| Stage 1 | 832 | 675 | - | 971 | 768 | - | - | - | - | - | - | - |
| Stage 2 | 917 | 730 | - | 865 | 703 | - | - | - | - | - | - | - |
| Platoon blocked, % | | | | | | | | - | - | | - | - |
| Mov Cap-1 Maneuver | 522 | 468 | 867 | 604 | 515 | 936 | 1011 | - | - | 1034 | - | - |
| Mov Cap-2 Maneuver | 522 | 468 | - | 604 | 515 | - | - | - | - | - | - | - |
| Stage 1 | 831 | 658 | - | 970 | 767 | - | - | - | - | - | - | - |
| Stage 2 | 872 | 729 | - | 839 | 685 | - | - | - | - | - | - | - |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| HCM Control Delay, s | 11.2 | 12.4 | 0.1 | 0.8 |
| HCM LOS | B | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | NBR | EBLn1 | WBLn1 | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|
| Capacity (veh/h) | 1011 | - | - | 589 | 660 | 1034 | - | - |
| HCM Lane V/C Ratio | 0.001 | - | - | 0.012 | 0.261 | 0.022 | - | - |
| HCM Control Delay (s) | 8.6 | 0 | - | 11.2 | 12.4 | 8.6 | 0 | - |
| HCM Lane LOS | A | A | - | B | B | A | A | - |
| HCM 95th %tile Q(veh) | 0 | - | - | 0 | 1 | 0.1 | - | - |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 67 | 147 | 28 | 30 | 137 | 270 | 24 | 122 | 16 | 234 | 148 | 64 |
| Future Volume (veh/h) | 67 | 147 | 28 | 30 | 137 | 270 | 24 | 122 | 16 | 234 | 148 | 64 |
| Initial Q (Qb), veh | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1764 | 1764 | 1764 | 2167 | 2167 | 2167 | 1665 | 1637 | 1637 | 1758 | 1674 | 1730 |
| Adj Flow Rate, veh/h | 73 | 160 | 0 | 33 | 149 | 0 | 26 | 133 | 0 | 254 | 161 | 0 |
| Peak Hour Factor | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Percent Heavy Veh, % | 1 | 1 | 1 | 1 | 1 | 1 | 8 | 10 | 10 | 3 | 9 | 5 |
| Cap, veh/h | 184 | 269 | | 140 | 411 | | 487 | 380 | | 645 | 601 | |
| Arrive On Green | 0.20 | 0.22 | 0.00 | 0.20 | 0.22 | 0.00 | 0.05 | 0.23 | 0.00 | 0.18 | 0.36 | 0.00 |
| Sat Flow, veh/h | 381 | 1224 | 0 | 228 | 1870 | 0 | 1586 | 1637 | 0 | 1674 | 1674 | 1466 |
| Grp Volume(v), veh/h | 233 | 0 | 0 | 182 | 0 | 0 | 26 | 133 | 0 | 254 | 161 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1605 | 0 | 0 | 2098 | 0 | 0 | 1586 | 1637 | 0 | 1674 | 1674 | 1466 |
| Q Serve(g_s), s | 2.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 3.2 | 0.0 | 4.6 | 3.2 | 0.0 |
| Cycle Q Clear(g_c), s | 6.2 | 0.0 | 0.0 | 3.4 | 0.0 | 0.0 | 0.6 | 3.2 | 0.0 | 4.6 | 3.2 | 0.0 |
| Prop In Lane | 0.31 | | 0.00 | 0.18 | | 0.00 | 1.00 | | 0.00 | 1.00 | | 1.00 |
| Lane Grp Cap(c), veh/h | 419 | 0 | | 507 | 0 | | 487 | 380 | | 645 | 601 | |
| V/C Ratio(X) | 0.56 | 0.00 | | 0.36 | 0.00 | | 0.05 | 0.35 | | 0.39 | 0.27 | |
| Avail Cap(c_a), veh/h | 1112 | 0 | | 1408 | 0 | | 1108 | 1210 | | 1088 | 1237 | |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.00 | 0.00 | 1.00 | 1.00 | 0.00 |
| Uniform Delay (d), s/veh | 16.9 | 0.0 | 0.0 | 15.8 | 0.0 | 0.0 | 12.3 | 15.2 | 0.0 | 8.7 | 10.8 | 0.0 |
| Incr Delay (d2), s/veh | 1.6 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.1 | 0.8 | 0.0 | 0.6 | 0.3 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 2.2 | 0.0 | 0.0 | 1.6 | 0.0 | 0.0 | 0.2 | 1.0 | 0.0 | 1.3 | 1.0 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 18.5 | 0.0 | 0.0 | 16.4 | 0.0 | 0.0 | 12.4 | 16.0 | 0.0 | 9.3 | 11.1 | 0.0 |
| LnGrp LOS | B | A | | B | A | | B | B | | A | B | |
| Approach Vol, veh/h | | 233 | A | | 182 | A | | 159 | A | | 415 | A |
| Approach Delay, s/veh | | 18.5 | | | 16.4 | | | 15.4 | | | 10.0 | |
| Approach LOS | | B | | | B | | | B | | | A | |
| Timer - Assigned Phs | 1 | 2 | | 4 | 5 | 6 | | 8 | | | | |
| Phs Duration (G+Y+Rc), s | 14.5 | 17.0 | | 15.9 | 8.4 | 23.0 | | 15.9 | | | | |
| Change Period (Y+Rc), s | 7.0 | 7.0 | | 6.5 | 7.0 | 7.0 | | 6.5 | | | | |
| Max Green Setting (Gmax), s | 20.0 | 34.0 | | 31.0 | 20.0 | 34.0 | | 31.0 | | | | |
| Max Q Clear Time (g_c+I1), s | 6.6 | 5.2 | | 8.2 | 2.6 | 5.2 | | 5.4 | | | | |
| Green Ext Time (p_c), s | 1.1 | 0.6 | | 1.2 | 0.0 | 0.8 | | 0.9 | | | | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 6th Ctrl Delay | | | 14.1 |
| HCM 6th LOS | | | B |

Notes

Unsignalized Delay for [NBR, EBR, WBR, SBR] is excluded from calculations of the approach delay and intersection delay.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 85 | 1 | 128 | 0 | 0 | 0 | 0 | 319 | 161 | 126 | 316 | 0 |
| Future Volume (veh/h) | 85 | 1 | 128 | 0 | 0 | 0 | 0 | 319 | 161 | 126 | 316 | 0 |
| Initial Q (Qb), veh | 0 | 0 | 0 | | | | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | 1.00 | | 1.00 | | | | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | No | | | | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | 1878 | 1949 | 1878 | | | | 0 | 1694 | 1694 | 1300 | 1812 | 0 |
| Adj Flow Rate, veh/h | 96 | 1 | 144 | | | | 0 | 358 | 181 | 142 | 355 | 0 |
| Peak Hour Factor | 0.89 | 0.89 | 0.89 | | | | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| Percent Heavy Veh, % | 5 | 0 | 5 | | | | 0 | 4 | 4 | 43 | 7 | 0 |
| Cap, veh/h | 239 | 2 | 207 | | | | 0 | 1201 | 597 | 497 | 2514 | 0 |
| Arrive On Green | 0.12 | 0.13 | 0.13 | | | | 0.00 | 0.58 | 0.56 | 0.03 | 0.24 | 0.00 |
| Sat Flow, veh/h | 1838 | 19 | 1591 | | | | 0 | 2166 | 1035 | 1238 | 3534 | 0 |
| Grp Volume(v), veh/h | 97 | 0 | 144 | | | | 0 | 275 | 264 | 142 | 355 | 0 |
| Grp Sat Flow(s),veh/h/ln | 1857 | 0 | 1591 | | | | 0 | 1609 | 1507 | 1238 | 1722 | 0 |
| Q Serve(g_s), s | 3.4 | 0.0 | 6.1 | | | | 0.0 | 6.1 | 6.4 | 2.8 | 5.7 | 0.0 |
| Cycle Q Clear(g_c), s | 3.4 | 0.0 | 6.1 | | | | 0.0 | 6.1 | 6.4 | 2.8 | 5.7 | 0.0 |
| Prop In Lane | 0.99 | | 1.00 | | | | 0.00 | | 0.69 | 1.00 | | 0.00 |
| Lane Grp Cap(c), veh/h | 241 | 0 | 207 | | | | 0 | 928 | 870 | 497 | 2514 | 0 |
| V/C Ratio(X) | 0.40 | 0.00 | 0.70 | | | | 0.00 | 0.30 | 0.30 | 0.29 | 0.14 | 0.00 |
| Avail Cap(c_a), veh/h | 271 | 0 | 232 | | | | 0 | 928 | 870 | 643 | 2514 | 0 |
| HCM Platoon Ratio | 1.00 | 1.00 | 1.00 | | | | 1.00 | 1.00 | 1.00 | 0.33 | 0.33 | 1.00 |
| Upstream Filter(I) | 1.00 | 0.00 | 1.00 | | | | 0.00 | 1.00 | 1.00 | 0.96 | 0.96 | 0.00 |
| Uniform Delay (d), s/veh | 28.4 | 0.0 | 29.1 | | | | 0.0 | 7.6 | 7.8 | 4.8 | 9.3 | 0.0 |
| Incr Delay (d2), s/veh | 1.1 | 0.0 | 7.7 | | | | 0.0 | 0.8 | 0.9 | 0.3 | 0.1 | 0.0 |
| Initial Q Delay(d3),s/veh | 0.0 | 0.0 | 0.0 | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | 1.4 | 0.0 | 2.5 | | | | 0.0 | 1.9 | 1.9 | 0.5 | 1.5 | 0.0 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | 29.5 | 0.0 | 36.8 | | | | 0.0 | 8.4 | 8.7 | 5.1 | 9.4 | 0.0 |
| LnGrp LOS | C | A | D | | | | A | A | A | A | A | A |
| Approach Vol, veh/h | | 241 | | | | | | 539 | | | 497 | |
| Approach Delay, s/veh | | 33.9 | | | | | | 8.5 | | | 8.2 | |
| Approach LOS | | C | | | | | | A | | | A | |

| Timer - Assigned Phs | 1 | 2 | 4 | 6 |
|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 10.7 | 45.4 | 13.9 | 56.1 |
| Change Period (Y+Rc), s | 6.0 | 6.0 | * 5.8 | 6.0 |
| Max Green Setting (Gmax), s | 13.0 | 30.0 | * 9.2 | 49.0 |
| Max Q Clear Time (g_c+I1), s | 4.8 | 8.4 | 8.1 | 7.7 |
| Green Ext Time (p_c), s | 0.3 | 8.9 | 0.1 | 7.8 |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 13.2 |
| HCM 6th LOS | B |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 0 | 0 | 0 | 125 | 1 | 150 | 95 | 298 | 0 | 0 | 321 | 80 |
| Future Volume (veh/h) | 0 | 0 | 0 | 125 | 1 | 150 | 95 | 298 | 0 | 0 | 321 | 80 |
| Initial Q (Qb), veh | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ped-Bike Adj(A_pbT) | | | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | | 1.00 |
| Parking Bus, Adj | | | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Work Zone On Approach | | | | | No | | | No | | | No | |
| Adj Sat Flow, veh/h/ln | | | | 1441 | 602 | 1441 | 1652 | 1427 | 0 | 0 | 1613 | 1613 |
| Adj Flow Rate, veh/h | | | | 137 | 1 | 165 | 104 | 327 | 0 | 0 | 353 | 88 |
| Peak Hour Factor | | | | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 | 0.91 |
| Percent Heavy Veh, % | | | | 41 | 100 | 41 | 7 | 23 | 0 | 0 | 21 | 21 |
| Cap, veh/h | | | | 115 | 1 | 246 | 578 | 1782 | 0 | 0 | 1242 | 306 |
| Arrive On Green | | | | 0.19 | 0.20 | 0.20 | 0.15 | 1.00 | 0.00 | 0.00 | 0.51 | 0.50 |
| Sat Flow, veh/h | | | | 569 | 4 | 1221 | 1573 | 2782 | 0 | 0 | 2518 | 600 |
| Grp Volume(v), veh/h | | | | 138 | 0 | 165 | 104 | 327 | 0 | 0 | 220 | 221 |
| Grp Sat Flow(s),veh/h/ln | | | | 573 | 0 | 1221 | 1573 | 1356 | 0 | 0 | 1533 | 1504 |
| Q Serve(g_s), s | | | | 14.1 | 0.0 | 8.7 | 1.9 | 0.0 | 0.0 | 0.0 | 5.8 | 6.0 |
| Cycle Q Clear(g_c), s | | | | 14.1 | 0.0 | 8.7 | 1.9 | 0.0 | 0.0 | 0.0 | 5.8 | 6.0 |
| Prop In Lane | | | | 0.99 | | 1.00 | 1.00 | | 0.00 | 0.00 | | 0.40 |
| Lane Grp Cap(c), veh/h | | | | 115 | 0 | 246 | 578 | 1782 | 0 | 0 | 781 | 766 |
| V/C Ratio(X) | | | | 1.20 | 0.00 | 0.67 | 0.18 | 0.18 | 0.00 | 0.00 | 0.28 | 0.29 |
| Avail Cap(c_a), veh/h | | | | 115 | 0 | 246 | 683 | 1782 | 0 | 0 | 781 | 766 |
| HCM Platoon Ratio | | | | 1.00 | 1.00 | 1.00 | 2.00 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I) | | | | 1.00 | 0.00 | 1.00 | 0.95 | 0.95 | 0.00 | 0.00 | 1.00 | 1.00 |
| Uniform Delay (d), s/veh | | | | 28.4 | 0.0 | 25.8 | 5.6 | 0.0 | 0.0 | 0.0 | 9.8 | 10.0 |
| Incr Delay (d2), s/veh | | | | 145.6 | 0.0 | 6.9 | 0.1 | 0.2 | 0.0 | 0.0 | 0.9 | 0.9 |
| Initial Q Delay(d3),s/veh | | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| %ile BackOfQ(50%),veh/ln | | | | 6.4 | 0.0 | 2.7 | 0.5 | 0.1 | 0.0 | 0.0 | 1.8 | 1.9 |
| Unsig. Movement Delay, s/veh | | | | | | | | | | | | |
| LnGrp Delay(d),s/veh | | | | 174.0 | 0.0 | 32.7 | 5.7 | 0.2 | 0.0 | 0.0 | 10.7 | 10.9 |
| LnGrp LOS | | | | F | A | C | A | A | A | A | B | B |
| Approach Vol, veh/h | | | | | 303 | | | 431 | | | 441 | |
| Approach Delay, s/veh | | | | | 97.1 | | | 1.5 | | | 10.8 | |
| Approach LOS | | | | | F | | | A | | | B | |

| Timer - Assigned Phs | 1 | 2 | | 4 | | 6 | | |
|---|---|---|---|---|---|---|---|---|
| Phs Duration (G+Y+Rc), s | 10.3 | 40.7 | | 19.0 | | 51.0 | | |
| Change Period (Y+Rc), s | 6.0 | 6.0 | | * 5.9 | | 6.0 | | |
| Max Green Setting (Gmax), s | 9.0 | 30.0 | | * 13 | | 45.0 | | |
| Max Q Clear Time (g_c+I1), s | 3.9 | 8.0 | | 16.1 | | 2.0 | | |
| Green Ext Time (p_c), s | 0.1 | 7.3 | | 0.0 | | 7.3 | | |

| Intersection Summary | |
|---|---|
| HCM 6th Ctrl Delay | 29.7 |
| HCM 6th LOS | C |

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

| Intersection | | | | | | |
|---|---|---|---|---|---|---|
| Int Delay, s/veh | 0.2 | | | | | |

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 13 | 493 | 385 | 9 | 4 | 1 |
| Future Vol, veh/h | 13 | 493 | 385 | 9 | 4 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | - | 0 | 0 | - | 0 | - |
| Grade, % | - | -9 | 9 | - | -10 | - |
| Peak Hour Factor | 77 | 77 | 77 | 77 | 77 | 77 |
| Heavy Vehicles, % | 0 | 2 | 2 | 0 | 25 | 0 |
| Mvmt Flow | 17 | 640 | 500 | 12 | 5 | 1 |

| Major/Minor | Major1 | | Major2 | | Minor2 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 512 | 0 | - | 0 | 1180 | 506 |
| Stage 1 | - | - | - | - | 506 | - |
| Stage 2 | - | - | - | - | 674 | - |
| Critical Hdwy | 4.3 | - | - | - | 4.65 | 5.2 |
| Critical Hdwy Stg 1 | - | - | - | - | 3.65 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 3.65 | - |
| Follow-up Hdwy | 3 | - | - | - | 3 | 3.1 |
| Pot Cap-1 Maneuver | 800 | - | - | - | 411 | 690 |
| Stage 1 | - | - | - | - | 880 | - |
| Stage 2 | - | - | - | - | 792 | - |
| Platoon blocked, % | | - | - | - | | |
| Mov Cap-1 Maneuver | 800 | - | - | - | 397 | 690 |
| Mov Cap-2 Maneuver | - | - | - | - | 397 | - |
| Stage 1 | - | - | - | - | 851 | - |
| Stage 2 | - | - | - | - | 792 | - |

| Approach | EB | WB | SB |
|---|---|---|---|
| HCM Control Delay, s | 0.2 | 0 | 13.4 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|---|---|---|---|---|---|
| Capacity (veh/h) | 800 | - | - | - | 434 |
| HCM Lane V/C Ratio | 0.021 | - | - | - | 0.015 |
| HCM Control Delay (s) | 9.6 | 0 | - | - | 13.4 |
| HCM Lane LOS | A | A | - | - | B |
| HCM 95th %tile Q(veh) | 0.1 | - | - | - | 0 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 2.4 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 79 | 1 | 44 | 0 | 0 | 0 | 0 | 204 | 72 | 9 | 145 | 0 |
| Future Vol, veh/h | 79 | 1 | 44 | 0 | 0 | 0 | 0 | 204 | 72 | 9 | 145 | 0 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | Yield | - | - | None |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 0 | - | - | 16979 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | -3 | - | - | -2 | - | - | 1 | - | - | -1 | - |
| Peak Hour Factor | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Heavy Vehicles, % | 8 | 0 | 11 | 0 | 0 | 0 | 0 | 6 | 7 | 22 | 7 | 0 |
| Mvmt Flow | 93 | 1 | 52 | 0 | 0 | 0 | 0 | 240 | 85 | 11 | 171 | 0 |

| Major/Minor | Minor2 | | | | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | 313 | 433 | 86 | | | | - | 0 | 0 | 240 | 0 | 0 |
| Stage 1 | 193 | 193 | - | | | | - | - | - | - | - | - |
| Stage 2 | 120 | 240 | - | | | | - | - | - | - | - | - |
| Critical Hdwy | 6.36 | 5.9 | 6.82 | | | | - | - | - | 4.3 | - | - |
| Critical Hdwy Stg 1 | 5.36 | 4.9 | - | | | | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | 5.36 | 4.9 | - | | | | - | - | - | - | - | - |
| Follow-up Hdwy | 3 | 4 | 3.1 | | | | - | - | - | 3 | - | - |
| Pot Cap-1 Maneuver | 784 | 558 | 1024 | | | | 0 | - | - | 994 | - | 0 |
| Stage 1 | 975 | 769 | - | | | | 0 | - | - | - | - | 0 |
| Stage 2 | 1055 | 740 | - | | | | 0 | - | - | - | - | 0 |
| Platoon blocked, % | | | | | | | | - | - | | - | |
| Mov Cap-1 Maneuver | 775 | 0 | 1024 | | | | - | - | - | 994 | - | - |
| Mov Cap-2 Maneuver | 775 | 0 | - | | | | - | - | - | - | - | - |
| Stage 1 | 975 | 0 | - | | | | - | - | - | - | - | - |
| Stage 2 | 1042 | 0 | - | | | | - | - | - | - | - | - |

| Approach | EB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 10.1 | 0 | 0.5 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBT | NBR | EBLn1 | SBL | SBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | - | - | 849 | 994 | - |
| HCM Lane V/C Ratio | - | - | 0.172 | 0.011 | - |
| HCM Control Delay (s) | - | - | 10.1 | 8.7 | 0 |
| HCM Lane LOS | - | - | B | A | A |
| HCM 95th %tile Q(veh) | - | - | 0.6 | 0 | - |

| Intersection | |
|---|---|
| Int Delay, s/veh | 3.3 |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 0 | 0 | 59 | 1 | 9 | 96 | 185 | 0 | 0 | 92 | 88 |
| Future Vol, veh/h | 0 | 0 | 0 | 59 | 1 | 9 | 96 | 185 | 0 | 0 | 92 | 88 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Stop | Stop | Stop | Stop | Stop | Stop | Free | Free | Free | Free | Free | Free |
| RT Channelized | - | - | None | - | - | None | - | - | None | - | - | Yield |
| Storage Length | - | - | - | - | - | - | - | - | - | - | - | - |
| Veh in Median Storage, # | - | 2 | - | - | 0 | - | - | 0 | - | - | 0 | - |
| Grade, % | - | -3 | - | - | -1 | - | - | 7 | - | - | 0 | - |
| Peak Hour Factor | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 |
| Heavy Vehicles, % | 0 | 0 | 0 | 8 | 0 | 11 | 7 | 8 | 0 | 0 | 5 | 15 |
| Mvmt Flow | 0 | 0 | 0 | 68 | 1 | 10 | 110 | 213 | 0 | 0 | 106 | 101 |

| Major/Minor | | | | Minor1 | | | Major1 | | | Major2 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Conflicting Flow All | | | | 486 | 539 | 107 | 106 | 0 | - | - | - | 0 |
| Stage 1 | | | | 433 | 433 | - | - | - | - | - | - | - |
| Stage 2 | | | | 53 | 106 | - | - | - | - | - | - | - |
| Critical Hdwy | | | | 6.76 | 6.3 | 7.02 | 4.3 | - | - | - | - | - |
| Critical Hdwy Stg 1 | | | | 5.76 | 5.3 | - | - | - | - | - | - | - |
| Critical Hdwy Stg 2 | | | | 5.76 | 5.3 | - | - | - | - | - | - | - |
| Follow-up Hdwy | | | | 3 | 4 | 3.1 | 3 | - | - | - | - | - |
| Pot Cap-1 Maneuver | | | | 586 | 466 | 987 | 1105 | - | 0 | 0 | - | - |
| Stage 1 | | | | 715 | 599 | - | - | - | 0 | 0 | - | - |
| Stage 2 | | | | 1127 | 816 | - | - | - | 0 | 0 | - | - |
| Platoon blocked, % | | | | | | | | - | | | - | - |
| Mov Cap-1 Maneuver | | | | 520 | 0 | 987 | 1105 | - | - | - | - | - |
| Mov Cap-2 Maneuver | | | | 520 | 0 | - | - | - | - | - | - | - |
| Stage 1 | | | | 634 | 0 | - | - | - | - | - | - | - |
| Stage 2 | | | | 1127 | 0 | - | - | - | - | - | - | - |

| Approach | WB | NB | SB |
|---|---|---|---|
| HCM Control Delay, s | 12.6 | 3.1 | 0 |
| HCM LOS | B | | |

| Minor Lane/Major Mvmt | NBL | NBT | WBLn1 | SBT | SBR |
|---|---|---|---|---|---|
| Capacity (veh/h) | 1105 | - | 555 | - | - |
| HCM Lane V/C Ratio | 0.1 | - | 0.143 | - | - |
| HCM Control Delay (s) | 8.6 | 0.2 | 12.6 | - | - |
| HCM Lane LOS | A | A | B | - | - |
| HCM 95th %tile Q(veh) | 0.3 | - | 0.5 | - | - |

| Intersection | |
|---|---|
| Intersection Delay, s/veh | 7.5 |
| Intersection LOS | A |

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Vol, veh/h | 0 | 49 | 17 | 0 | 90 | 15 | 17 | 6 | 0 | 0 | 14 | 3 |
| Future Vol, veh/h | 0 | 49 | 17 | 0 | 90 | 15 | 17 | 6 | 0 | 0 | 14 | 3 |
| Peak Hour Factor | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |
| Heavy Vehicles, % | 0 | 0 | 10 | 0 | 4 | 0 | 12 | 0 | 0 | 0 | 0 | 0 |
| Mvmt Flow | 0 | 53 | 18 | 0 | 97 | 16 | 18 | 6 | 0 | 0 | 15 | 3 |
| Number of Lanes | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |

| Approach | EB | WB | NB | SB |
|---|---|---|---|---|
| Opposing Approach | WB | EB | SB | NB |
| Opposing Lanes | 1 | 1 | 1 | 1 |
| Conflicting Approach Left | SB | NB | EB | WB |
| Conflicting Lanes Left | 1 | 1 | 1 | 1 |
| Conflicting Approach Right | NB | SB | WB | EB |
| Conflicting Lanes Right | 1 | 1 | 1 | 1 |
| HCM Control Delay | 7.3 | 7.6 | 7.8 | 7.3 |
| HCM LOS | A | A | A | A |

| Lane | NBLn1 | EBLn1 | WBLn1 | SBLn1 |
|---|---|---|---|---|
| Vol Left, % | 74% | 0% | 0% | 0% |
| Vol Thru, % | 26% | 74% | 86% | 82% |
| Vol Right, % | 0% | 26% | 14% | 18% |
| Sign Control | Stop | Stop | Stop | Stop |
| Traffic Vol by Lane | 23 | 66 | 105 | 17 |
| LT Vol | 17 | 0 | 0 | 0 |
| Through Vol | 6 | 49 | 90 | 14 |
| RT Vol | 0 | 17 | 15 | 3 |
| Lane Flow Rate | 25 | 71 | 113 | 18 |
| Geometry Grp | 1 | 1 | 1 | 1 |
| Degree of Util (X) | 0.031 | 0.077 | 0.126 | 0.021 |
| Departure Headway (Hd) | 4.583 | 3.904 | 4.01 | 4.129 |
| Convergence, Y/N | Yes | Yes | Yes | Yes |
| Cap | 772 | 911 | 891 | 855 |
| Service Time | 2.664 | 1.954 | 2.05 | 2.214 |
| HCM Lane V/C Ratio | 0.032 | 0.078 | 0.127 | 0.021 |
| HCM Control Delay | 7.8 | 7.3 | 7.6 | 7.3 |
| HCM Lane LOS | A | A | A | A |
| HCM 95th-tile Q | 0.1 | 0.2 | 0.4 | 0.1 |

| Intersection | |
|---|---|
| Int Delay, s/veh | 0.1 |

| Movement | EBT | EBR | WBL | WBT | NBL | NBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Vol, veh/h | 162 | 6 | 1 | 207 | 2 | 1 |
| Future Vol, veh/h | 162 | 6 | 1 | 207 | 2 | 1 |
| Conflicting Peds, #/hr | 0 | 0 | 0 | 0 | 0 | 0 |
| Sign Control | Free | Free | Free | Free | Stop | Stop |
| RT Channelized | - | None | - | None | - | None |
| Storage Length | - | - | - | - | 0 | - |
| Veh in Median Storage, # | 0 | - | - | 0 | 0 | - |
| Grade, % | 2 | - | - | -3 | -5 | - |
| Peak Hour Factor | 83 | 83 | 83 | 83 | 83 | 83 |
| Heavy Vehicles, % | 9 | 0 | 0 | 8 | 0 | 0 |
| Mvmt Flow | 195 | 7 | 1 | 249 | 2 | 1 |

| Major/Minor | Major1 | | Major2 | | Minor1 | |
|---|---|---|---|---|---|---|
| Conflicting Flow All | 0 | 0 | 202 | 0 | 450 | 199 |
| Stage 1 | - | - | - | - | 199 | - |
| Stage 2 | - | - | - | - | 251 | - |
| Critical Hdwy | - | - | 4.9 | - | 8.1 | 6.4 |
| Critical Hdwy Stg 1 | - | - | - | - | 4.4 | - |
| Critical Hdwy Stg 2 | - | - | - | - | 4.4 | - |
| Follow-up Hdwy | - | - | 3.5 | - | 3 | 3.4 |
| Pot Cap-1 Maneuver | - | - | 861 | - | 523 | 815 |
| Stage 1 | - | - | - | - | 1021 | - |
| Stage 2 | - | - | - | - | 979 | - |
| Platoon blocked, % | - | - | | - | | |
| Mov Cap-1 Maneuver | - | - | 861 | - | 522 | 815 |
| Mov Cap-2 Maneuver | - | - | - | - | 522 | - |
| Stage 1 | - | - | - | - | 1021 | - |
| Stage 2 | - | - | - | - | 978 | - |

| Approach | EB | WB | NB |
|---|---|---|---|
| HCM Control Delay, s | 0 | 0 | 11.1 |
| HCM LOS | | | B |

| Minor Lane/Major Mvmt | NBLn1 | EBT | EBR | WBL | WBT |
|---|---|---|---|---|---|
| Capacity (veh/h) | 593 | - | - | 861 | - |
| HCM Lane V/C Ratio | 0.006 | - | - | 0.001 | - |
| HCM Control Delay (s) | 11.1 | - | - | 9.2 | 0 |
| HCM Lane LOS | B | - | - | A | A |
| HCM 95th %tile Q(veh) | 0 | - | - | 0 | - |

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 NB |
| From/To | Oscar Road to Baum Pump Sta |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.82 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.0 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 13 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 220 | veh/h |
| Opposing direction volume, Vo | 403 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.2 | | 1.8 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.865 | | 0.906 | |
| Grade adj. factor,(note-1) fg | 0.80 | | 0.95 | |
| Directional flow rate,(note-2) vi | 388 | pc/h | 571 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 3.3 | mi/h |
| Free-flow speed, FFSd | 56.3 | mi/h |
| Adjustment for no-passing zones, fnp | 2.1 | mi/h |
| Average travel speed, ATSd | 46.8 | mi/h |
| Percent Free Flow Speed, PFFS | 83.1 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                     Analysis(d)         Opposing (o)
PCE for trucks, ET                                1.7                 1.4
PCE for RVs, ER                                   1.0                 1.0
Heavy-vehicle adjustment factor, fHV              0.917               0.951
Grade adjustment factor,(note-1) fg               0.83                0.95
Directional flow rate,(note-2) vi                 353    pc/h         544     pc/h
Base percent time-spent-following,(note-4) BPTSFd  41.7   %
Adjustment for no-passing zones, fnp                       36.4
Percent time-spent-following, PTSFd                        56.0   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                      C
Volume to capacity ratio, v/c                              0.16
Peak 15-min vehicle-miles of travel, VMT15                 67      veh-mi
Peak-hour vehicle-miles of travel, VMT60                   220     veh-mi
Peak 15-min total travel time, TT15                        1.4     veh-h
Capacity from ATS, CdATS                                   1635    veh/h
Capacity from PTSF, CdPTSF                                 1700    veh/h
Directional Capacity                                       1635    veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                                 1.0     mi
Length of two-lane highway upstream of the passing lane, Lu          -       mi
Length of passing lane including tapers, Lpl                         -       mi
Average travel speed, ATSd (from above)                              46.8    mi/h
Percent time-spent-following, PTSFd (from above)                     56.0
Level of service, LOSd (from above)                                  C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde             -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld          -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                            -
Average travel speed including passing lane, ATSpl                   -
Percent free flow speed including passing lane, PFFSpl               0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde            -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld            -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                             -
Percent time-spent-following
    including passing lane, PTSFpl                                   -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl             E
Peak 15-min total travel time, TT15                        -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 268.3 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 7.02 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 NB |
| From/To | Oscar Road to Baum Pump Sta |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.94 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.0 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 13 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 542 | veh/h |
| Opposing direction volume, Vo | 310 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 2.1 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.960 | | 0.938 | |
| Grade adj. factor,(note-1) fg | 0.97 | | 0.85 | |
| Directional flow rate,(note-2) vi | 619 | pc/h | 414 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 3.3 | mi/h |
| Free-flow speed, FFSd | 56.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.0 | mi/h |
| Average travel speed, ATSd | 45.3 | mi/h |
| Percent Free Flow Speed, PFFS | 80.4 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                     Analysis(d)        Opposing (o)
PCE for trucks, ET                                1.2                1.6
PCE for RVs, ER                                   1.0                1.0
Heavy-vehicle adjustment factor, fHV              0.988              0.965
Grade adjustment factor,(note-1) fg               0.97               0.87
Directional flow rate,(note-2) vi                 602    pc/h        393     pc/h
Base percent time-spent-following,(note-4) BPTSFd  55.9   %
Adjustment for no-passing zones, fnp                        34.7
Percent time-spent-following, PTSFd                         76.9   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                       D
Volume to capacity ratio, v/c                               0.35
Peak 15-min vehicle-miles of travel, VMT15                  144     veh-mi
Peak-hour vehicle-miles of travel, VMT60                    542     veh-mi
Peak 15-min total travel time, TT15                         3.2     veh-h
Capacity from ATS, CdATS                                    1669    veh/h
Capacity from PTSF, CdPTSF                                  1700    veh/h
Directional Capacity                                        1669    veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                                  1.0     mi
Length of two-lane highway upstream of the passing lane, Lu           -       mi
Length of passing lane including tapers, Lpl                          -       mi
Average travel speed, ATSd (from above)                               45.3    mi/h
Percent time-spent-following, PTSFd (from above)                      76.9
Level of service, LOSd (from above)                                   D

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde              -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld           -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                             -
Average travel speed including passing lane, ATSpl                    -
Percent free flow speed including passing lane, PFFSpl                0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde             -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld             -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                              -
Percent time-spent-following
    including passing lane, PTSFpl                                    -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl              E
Peak 15-min total travel time, TT15                         -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 576.6 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.65 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7


Phone:                                  Fax:
E-Mail:


```
_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                  French
Agency/Co.               French Engineering
Date Performed           1/30/2020
Analysis Time Period     AM Peak
Highway                  SR 28 SB
From/To                  Oscar Road to Baum Pump Sta
Jurisdiction             Boggs Township, Armstrong Co
Analysis Year            2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1            Peak hour factor, PHF    0.92
Shoulder width       6.0    ft    % Trucks and buses       12      %
Lane width           11.0   ft    % Trucks crawling        0.0     %
Segment length       1.0    mi    Truck crawl speed        0.0     mi/hr
Terrain type         Rolling      % Recreational vehicles  0       %
Grade:  Length       -      mi    % No-passing zones       100     %
        Up/down      -      %     Access point density     13      /mi

Analysis direction volume, Vd  403     veh/h
Opposing direction volume, Vo  220     veh/h

____________________________Average Travel Speed______________________________

Direction                                Analysis(d)         Opposing (o)
PCE for trucks, ET                           1.9                 2.2
PCE for RVs, ER                              1.1                 1.1
Heavy-vehicle adj. factor,(note-5) fHV       0.903               0.874
Grade adj. factor,(note-1) fg                0.92                0.78
Directional flow rate,(note-2) vi            527     pc/h        351     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM                 -      mi/h
Observed total demand,(note-3) V                   -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS               60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS  0.4     mi/h
Adj. for access point density,(note-3) fA      3.3     mi/h

Free-flow speed, FFSd                            56.3    mi/h

Adjustment for no-passing zones, fnp             3.3     mi/h
Average travel speed, ATSd                       46.2    mi/h
Percent Free Flow Speed, PFFS                    82.0    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.4 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.954 | | 0.923 | |
| Grade adjustment factor,(note-1) fg | 0.92 | | 0.82 | |
| Directional flow rate,(note-2) vi | 499 | pc/h | 316 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 48.8 | % |
| Adjustment for no-passing zones, fnp | 38.2 | |
| Percent time-spent-following, PTSFd | 72.2 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.27 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 110 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 403 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.4 | veh-h |
| Capacity from ATS, CdATS | 1641 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1641 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.0 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 46.2 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 72.2 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

```
Posted speed limit, Sp                                        55
Percent of segment with occupied on-highway parking           0
Pavement rating, P                                            3
Flow rate in outside lane, vOL                                438.0
Effective width of outside lane, We                           23.00
Effective speed factor, St                                    4.79
Bicycle LOS Score, BLOS                                       6.81
Bicycle LOS                                                   F
```

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 SB |
| From/To | Oscar Road to Baum Pump Sta |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.82 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 9 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.0 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 13 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 310 | veh/h |
| Opposing direction volume, Vo | 542 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.0 | | 1.6 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.917 | | 0.949 | |
| Grade adj. factor,(note-1) fg | 0.88 | | 0.98 | |
| Directional flow rate,(note-2) vi | 468 | pc/h | 711 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 3.3 | mi/h |
| Free-flow speed, FFSd | 56.3 | mi/h |
| Adjustment for no-passing zones, fnp | 1.6 | mi/h |
| Average travel speed, ATSd | 45.6 | mi/h |
| Percent Free Flow Speed, PFFS | 80.9 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                Analysis(d)         Opposing (o)
PCE for trucks, ET                           1.6                 1.0
PCE for RVs, ER                              1.0                 1.0
Heavy-vehicle adjustment factor, fHV         0.949               1.000
Grade adjustment factor,(note-1) fg          0.89                0.98
Directional flow rate,(note-2) vi            448    pc/h         674     pc/h
Base percent time-spent-following,(note-4) BPTSFd  49.8   %
Adjustment for no-passing zones, fnp               31.8
Percent time-spent-following, PTSFd                62.5   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                              C
Volume to capacity ratio, v/c                      0.23
Peak 15-min vehicle-miles of travel, VMT15         95      veh-mi
Peak-hour vehicle-miles of travel, VMT60           310     veh-mi
Peak 15-min total travel time, TT15                2.1     veh-h
Capacity from ATS, CdATS                           1656    veh/h
Capacity from PTSF, CdPTSF                         1700    veh/h
Directional Capacity                               1656    veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                         1.0     mi
Length of two-lane highway upstream of the passing lane, Lu  -       mi
Length of passing lane including tapers, Lpl                 -       mi
Average travel speed, ATSd (from above)                      45.6    mi/h
Percent time-spent-following, PTSFd (from above)             62.5
Level of service, LOSd (from above)                          C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde     -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld  -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                    -
Average travel speed including passing lane, ATSpl           -
Percent free flow speed including passing lane, PFFSpl       0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde    -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld    -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                     -
Percent time-spent-following
    including passing lane, PTSFpl                           -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     E
Peak 15-min total travel time, TT15                -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 378.0 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.49 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

```
_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                  French
Agency/Co.               French Engineering
Date Performed           1/30/2020
Analysis Time Period     AM Peak
Highway                  SR 28 NB
From/To                  Between Distant and South Beth
Jurisdiction             Mahoning Twnshp, Armstrong Co
Analysis Year            2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1             Peak hour factor, PHF    0.85
Shoulder width       6.0    ft     % Trucks and buses       9       %
Lane width           11.0   ft     % Trucks crawling        0.0     %
Segment length       0.5    mi     Truck crawl speed        0.0     mi/hr
Terrain type         Rolling       % Recreational vehicles  0       %
Grade:  Length       -      mi     % No-passing zones       100     %
        Up/down      -      %      Access point density     10      /mi

Analysis direction volume, Vd  285     veh/h
Opposing direction volume, Vo  232     veh/h

____________________________Average Travel Speed______________________________

Direction                                 Analysis(d)        Opposing (o)
PCE for trucks, ET                            2.1                2.2
PCE for RVs, ER                               1.1                1.1
Heavy-vehicle adj. factor,(note-5) fHV        0.910              0.903
Grade adj. factor,(note-1) fg                 0.85               0.81
Directional flow rate,(note-2) vi             433     pc/h       373     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM                 -      mi/h
Observed total demand,(note-3) V                   -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS               60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS    0.4     mi/h
Adj. for access point density,(note-3) fA        2.5     mi/h

Free-flow speed, FFSd                            57.1    mi/h

Adjustment for no-passing zones, fnp             3.4     mi/h
Average travel speed, ATSd                       47.5    mi/h
Percent Free Flow Speed, PFFS                    83.1    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | Opposing (o) |
|---|---|---|
| PCE for trucks, ET | 1.6 | 1.7 |
| PCE for RVs, ER | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, fHV | 0.949 | 0.941 |
| Grade adjustment factor,(note-1) fg | 0.87 | 0.84 |
| Directional flow rate,(note-2) vi | 406 pc/h | 345 pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 42.7 % | |
| Adjustment for no-passing zones, fnp | 46.8 | |
| Percent time-spent-following, PTSFd | 68.0 % | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.20 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 42 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 143 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 1656 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1656 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.5 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 47.5 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 68.0 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 335.3 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.43 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 NB |
| From/To | Between Distant and South Beth |
| Jurisdiction | Mahoning Twnshp, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.88 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 8 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.5 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 10 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 332 | veh/h |
| Opposing direction volume, Vo | 312 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.0 | | 2.0 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.926 | | 0.926 | |
| Grade adj. factor,(note-1) fg | 0.88 | | 0.87 | |
| Directional flow rate,(note-2) vi | 463 | pc/h | 440 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 2.5 | mi/h |
| Free-flow speed, FFSd | 57.1 | mi/h |
| Adjustment for no-passing zones, fnp | 3.0 | mi/h |
| Average travel speed, ATSd | 47.1 | mi/h |
| Percent Free Flow Speed, PFFS | 82.5 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                 Analysis(d)         Opposing (o)
PCE for trucks, ET                            1.6                 1.6
PCE for RVs, ER                               1.0                 1.0
Heavy-vehicle adjustment factor, fHV          0.954               0.954
Grade adjustment factor,(note-1) fg           0.89                0.88
Directional flow rate,(note-2) vi             444    pc/h         422     pc/h
Base percent time-spent-following,(note-4) BPTSFd  46.0   %
Adjustment for no-passing zones, fnp               43.9
Percent time-spent-following, PTSFd                68.5   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                              D
Volume to capacity ratio, v/c                      0.23
Peak 15-min vehicle-miles of travel, VMT15         47      veh-mi
Peak-hour vehicle-miles of travel, VMT60           166     veh-mi
Peak 15-min total travel time, TT15                1.0     veh-h
Capacity from ATS, CdATS                           1661    veh/h
Capacity from PTSF, CdPTSF                         1700    veh/h
Directional Capacity                               1661    veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                         0.5     mi
Length of two-lane highway upstream of the passing lane, Lu  -       mi
Length of passing lane including tapers, Lpl                 -       mi
Average travel speed, ATSd (from above)                      47.1    mi/h
Percent time-spent-following, PTSFd (from above)             68.5
Level of service, LOSd (from above)                          D

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde     -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld  -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                    -
Average travel speed including passing lane, ATSpl           -
Percent free flow speed including passing lane, PFFSpl       0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde    -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld    -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                     -
Percent time-spent-following
    including passing lane, PTSFpl                           -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     E
Peak 15-min total travel time, TT15                -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 377.3 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.12 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 SB |
| From/To | Between Distant and South Beth |
| Jurisdiction | Mahoning Twnshp, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.95 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.5 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 10 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 232 | veh/h |
| Opposing direction volume, Vo | 285 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.2 | | 2.1 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.865 | | 0.875 | |
| Grade adj. factor,(note-1) fg | 0.79 | | 0.83 | |
| Directional flow rate,(note-2) vi | 357 | pc/h | 413 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 2.5 | mi/h |
| Free-flow speed, FFSd | 57.1 | mi/h |
| Adjustment for no-passing zones, fnp | 3.2 | mi/h |
| Average travel speed, ATSd | 47.9 | mi/h |
| Percent Free Flow Speed, PFFS | 84.0 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.917 | | 0.917 | |
| Grade adjustment factor,(note-1) fg | 0.82 | | 0.85 | |
| Directional flow rate,(note-2) vi | 325 | pc/h | 385 | pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 36.1 | % | | |
| Adjustment for no-passing zones, fnp | 49.2 | | | |
| Percent time-spent-following, PTSFd | 58.6 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.15 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 31 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 116 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.6 | veh-h |
| Capacity from ATS, CdATS | 1635 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1635 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.5 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 47.9 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 58.6 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 244.2 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.97 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 SB |
| From/To | Between Distant and South Beth |
| Jurisdiction | Mahoning Twnshp, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.89 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 4 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.5 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 10 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 312 | veh/h |
| Opposing direction volume, Vo | 332 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.0 | | 2.0 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.962 | | 0.962 | |
| Grade adj. factor,(note-1) fg | 0.87 | | 0.88 | |
| Directional flow rate,(note-2) vi | 419 | pc/h | 441 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 2.5 | mi/h |
| Free-flow speed, FFSd | 57.1 | mi/h |
| Adjustment for no-passing zones, fnp | 3.0 | mi/h |
| Average travel speed, ATSd | 47.4 | mi/h |
| Percent Free Flow Speed, PFFS | 83.1 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.6 | | 1.6 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.977 | | 0.977 | |
| Grade adjustment factor,(note-1) fg | 0.88 | | 0.89 | |
| Directional flow rate,(note-2) vi | 408 | pc/h | 429 | pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 44.4 | % | | |
| Adjustment for no-passing zones, fnp | 44.7 | | | |
| Percent time-spent-following, PTSFd | 66.2 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.21 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 44 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 156 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 1680 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1680 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.5 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 47.4 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 66.2 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 350.6 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.79 |
| Bicycle LOS | D |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 NB |
| From/To | Longview / Yearney |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.79 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 11 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.6 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 4 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 258 | veh/h |
| Opposing direction volume, Vo | 236 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.1 | | 2.1 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.892 | | 0.892 | |
| Grade adj. factor,(note-1) fg | 0.85 | | 0.83 | |
| Directional flow rate,(note-2) vi | 431 | pc/h | 403 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.0 | mi/h |
| Free-flow speed, FFSd | 57.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.3 | mi/h |
| Average travel speed, ATSd | 47.5 | mi/h |
| Percent Free Flow Speed, PFFS | 83.0 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.6 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.938 | | 0.929 | |
| Grade adjustment factor,(note-1) fg | 0.86 | | 0.85 | |
| Directional flow rate,(note-2) vi | 405 | pc/h | 379 | pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 42.4 | % | | |
| Adjustment for no-passing zones, fnp | 46.3 | | | |
| Percent time-spent-following, PTSFd | 66.3 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.20 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 49 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 155 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |
| Capacity from ATS, CdATS | 1646 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1646 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.6 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 47.5 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 66.3 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 326.6 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 7.75 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 NB |
| From/To | Longview / Yearney |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.83 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.6 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 4 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 228 | veh/h |
| Opposing direction volume, Vo | 274 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.1 | | 2.1 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.938 | | 0.938 | |
| Grade adj. factor,(note-1) fg | 0.81 | | 0.85 | |
| Directional flow rate,(note-2) vi | 362 | pc/h | 414 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.0 | mi/h |
| Free-flow speed, FFSd | 57.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.2 | mi/h |
| Average travel speed, ATSd | 48.1 | mi/h |
| Percent Free Flow Speed, PFFS | 83.9 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 1.6 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.960 | | 0.965 | |
| Grade adjustment factor,(note-1) fg | 0.84 | | 0.87 | |
| Directional flow rate,(note-2) vi | 341 | pc/h | 393 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 38.4 | % |
| Adjustment for no-passing zones, fnp | 48.0 | |
| Percent time-spent-following, PTSFd | 60.7 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.16 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 41 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 137 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 1669 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1669 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.6 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 48.1 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 60.7 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 274.7 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.79 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 SB |
| From/To | Longview / Yearney |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.86 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.6 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 4 | /mi |

Analysis direction volume, Vd 236 veh/h
Opposing direction volume, Vo 258 veh/h

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.2 | | 2.1 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.865 | | 0.875 | |
| Grade adj. factor,(note-1) fg | 0.81 | | 0.83 | |
| Directional flow rate,(note-2) vi | 392 | pc/h | 413 | pc/h |

Free-Flow Speed from Field Measurement:

| | | |
|---|---|---|
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |

Estimated Free-Flow Speed:

| | | |
|---|---|---|
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.0 | mi/h |
| Free-flow speed, FFSd | 57.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.2 | mi/h |
| Average travel speed, ATSd | 47.8 | mi/h |
| Percent Free Flow Speed, PFFS | 83.5 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.917 | | 0.917 | |
| Grade adjustment factor,(note-1) fg | 0.84 | | 0.85 | |
| Directional flow rate,(note-2) vi | 356 | pc/h | 385 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 38.5 | % |
| Adjustment for no-passing zones, fnp | 48.6 | |
| Percent time-spent-following, PTSFd | 61.8 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.17 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 41 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 142 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 1635 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1635 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.6 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 47.8 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 61.8 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 274.4 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 8.55 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 SB |
| From/To | Longview / Yearney |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.88 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 4 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.6 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 4 | /mi |

Analysis direction volume, Vd 274 veh/h
Opposing direction volume, Vo 228 veh/h

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.1 | | 2.2 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.958 | | 0.954 | |
| Grade adj. factor,(note-1) fg | 0.84 | | 0.80 | |
| Directional flow rate,(note-2) vi | 387 | pc/h | 339 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.0 | mi/h |
| Free-flow speed, FFSd | 57.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.6 | mi/h |
| Average travel speed, ATSd | 48.1 | mi/h |
| Percent Free Flow Speed, PFFS | 84.0 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | Opposing (o) |
|---|---|---|
| PCE for trucks, ET | 1.6 | 1.7 |
| PCE for RVs, ER | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, fHV | 0.977 | 0.973 |
| Grade adjustment factor,(note-1) fg | 0.86 | 0.83 |
| Directional flow rate,(note-2) vi | 371 pc/h | 321 pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 39.5 % | |
| Adjustment for no-passing zones, fnp | 50.4 | |
| Percent time-spent-following, PTSFd | 66.5 % | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.19 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 47 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 164 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |
| Capacity from ATS, CdATS | 1680 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1680 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.6 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 48.1 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 66.5 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 311.4 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.25 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 NB |
| From/To | Dewey Rd / SR 2001 |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.78 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 7 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 87 | % |
| Up/down | - | % | Access point density | 20 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 150 | veh/h |
| Opposing direction volume, Vo | 116 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.3 | | 2.5 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.917 | | 0.905 | |
| Grade adj. factor,(note-1) fg | 0.74 | | 0.71 | |
| Directional flow rate,(note-2) vi | 283 | pc/h | 231 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 5.0 | mi/h |
| Free-flow speed, FFSd | 53.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.8 | mi/h |
| Average travel speed, ATSd | 45.5 | mi/h |
| Percent Free Flow Speed, PFFS | 85.5 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.8 | | 1.8 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.947 | | 0.947 | |
| Grade adjustment factor,(note-1) fg | 0.79 | | 0.76 | |
| Directional flow rate,(note-2) vi | 257 | pc/h | 207 | pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 26.4 | % | | |
| Adjustment for no-passing zones, fnp | 57.3 | | | |
| Percent time-spent-following, PTSFd | 58.1 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.12 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 43 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 135 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 1664 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1664 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 45.5 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 58.1 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 192.3 |
| Effective width of outside lane, We | 25.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.94 |
| Bicycle LOS | D |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 NB |
| From/To | Dewey Rd / SR 2001 |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.89 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 9 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 87 | % |
| Up/down | - | % | Access point density | 20 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 161 | veh/h |
| Opposing direction volume, Vo | 208 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.4 | | 2.2 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.888 | | 0.903 | |
| Grade adj. factor,(note-1) fg | 0.73 | | 0.78 | |
| Directional flow rate,(note-2) vi | 279 | pc/h | 332 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 5.0 | mi/h |
| Free-flow speed, FFSd | 53.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.1 | mi/h |
| Average travel speed, ATSd | 45.4 | mi/h |
| Percent Free Flow Speed, PFFS | 85.2 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.8 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.933 | | 0.941 | |
| Grade adjustment factor,(note-1) fg | 0.79 | | 0.82 | |
| Directional flow rate,(note-2) vi | 245 | pc/h | 303 | pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 28.1 | % | | |
| Adjustment for no-passing zones, fnp | 55.4 | | | |
| Percent time-spent-following, PTSFd | 52.9 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.11 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 41 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 145 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 1656 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1656 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 45.4 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 52.9 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 180.9 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.56 |
| Bicycle LOS | F |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

```
_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                  French
Agency/Co.               French Engineering
Date Performed           1/30/2020
Analysis Time Period     AM Peak
Highway                  SR 28 SB
From/To                  Dewey Rd / SR 2001
Jurisdiction             Redbank Township, Clarion Co
Analysis Year            2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1             Peak hour factor, PHF    0.69
Shoulder width       5.0     ft    % Trucks and buses       10      %
Lane width           11.0    ft    % Trucks crawling        0.0     %
Segment length       0.9     mi    Truck crawl speed        0.0     mi/hr
Terrain type         Rolling       % Recreational vehicles  0       %
Grade:  Length       -       mi    % No-passing zones       72      %
        Up/down      -       %     Access point density     20      /mi

Analysis direction volume, Vd  116     veh/h
Opposing direction volume, Vo  150     veh/h

____________________________Average Travel Speed______________________________

Direction                                 Analysis(d)        Opposing (o)
PCE for trucks, ET                            2.4                2.3
PCE for RVs, ER                               1.1                1.1
Heavy-vehicle adj. factor,(note-5) fHV        0.877              0.885
Grade adj. factor,(note-1) fg                 0.72               0.76
Directional flow rate,(note-2) vi             266     pc/h       323     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM                 -      mi/h
Observed total demand,(note-3) V                   -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS                60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS     1.7     mi/h
Adj. for access point density,(note-3) fA         5.0     mi/h

Free-flow speed, FFSd                             53.3    mi/h

Adjustment for no-passing zones, fnp              3.0     mi/h
Average travel speed, ATSd                        45.7    mi/h
Percent Free Flow Speed, PFFS                     85.8    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.8 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.926 | | 0.935 | |
| Grade adjustment factor,(note-1) fg | 0.78 | | 0.81 | |
| Directional flow rate,(note-2) vi | 233 | pc/h | 287 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 26.2 | % |
| Adjustment for no-passing zones, fnp | 54.7 | |
| Percent time-spent-following, PTSFd | 50.7 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.10 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 38 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 104 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.8 | veh-h |
| Capacity from ATS, CdATS | 1651 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1651 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 45.7 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 50.7 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 168.1 |
| Effective width of outside lane, We | 27.72 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.28 |
| Bicycle LOS | D |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 SB |
| From/To | Dewey Rd / SR 2001 |
| Jurisdiction | Redbank Township, Clarion Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.74 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 7 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 72 | % |
| Up/down | - | % | Access point density | 20 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 208 | veh/h |
| Opposing direction volume, Vo | 161 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.1 | | 2.3 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.929 | | 0.917 | |
| Grade adj. factor,(note-1) fg | 0.81 | | 0.76 | |
| Directional flow rate,(note-2) vi | 374 | pc/h | 312 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 5.0 | mi/h |
| Free-flow speed, FFSd | 53.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.1 | mi/h |
| Average travel speed, ATSd | 44.9 | mi/h |
| Percent Free Flow Speed, PFFS | 84.3 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.953 | | 0.953 | |
| Grade adjustment factor,(note-1) fg | 0.84 | | 0.81 | |
| Directional flow rate,(note-2) vi | 351 | pc/h | 282 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 36.3 | % |
| Adjustment for no-passing zones, fnp | 51.0 | |
| Percent time-spent-following, PTSFd | 64.6 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.17 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 63 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 187 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.4 | veh-h |
| Capacity from ATS, CdATS | 1664 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1664 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 44.9 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 64.6 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 281.1 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.05 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 NB |
| From/To | Moore Rd / Mendenhall Rd |
| Jurisdiction | Clover Township, Jefferson Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.78 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 8 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 14 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 185 | veh/h |
| Opposing direction volume, Vo | 106 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.2 | | 2.6 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.912 | | 0.887 | |
| Grade adj. factor,(note-1) fg | 0.78 | | 0.70 | |
| Directional flow rate,(note-2) vi | 333 | pc/h | 219 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 3.5 | mi/h |
| Free-flow speed, FFSd | 54.8 | mi/h |
| Adjustment for no-passing zones, fnp | 4.0 | mi/h |
| Average travel speed, ATSd | 46.5 | mi/h |
| Percent Free Flow Speed, PFFS | 84.9 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 1.8 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.947 | | 0.940 | |
| Grade adjustment factor,(note-1) fg | 0.82 | | 0.76 | |
| Directional flow rate,(note-2) vi | 305 | pc/h | 190 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 30.6 | % |
| Adjustment for no-passing zones, fnp | 52.8 | |
| Percent time-spent-following, PTSFd | 63.1 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.14 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 53 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 166 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.1 | veh-h |
| Capacity from ATS, CdATS | 1661 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1661 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 46.5 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 63.1 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 237.2 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.40 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 NB |
| From/To | Moore Rd / Mendenhall Rd |
| Jurisdiction | Clover Township, Jefferson Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.76 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 9 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 14 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 158 | veh/h |
| Opposing direction volume, Vo | 285 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.3 | | 2.0 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.895 | | 0.917 | |
| Grade adj. factor,(note-1) fg | 0.76 | | 0.88 | |
| Directional flow rate,(note-2) vi | 306 | pc/h | 465 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 3.5 | mi/h |
| Free-flow speed, FFSd | 54.8 | mi/h |
| Adjustment for no-passing zones, fnp | 2.5 | mi/h |
| Average travel speed, ATSd | 46.3 | mi/h |
| Percent Free Flow Speed, PFFS | 84.5 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.7 | | 1.6 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.941 | | 0.949 | |
| Grade adjustment factor,(note-1) fg | 0.80 | | 0.89 | |
| Directional flow rate,(note-2) vi | 276 | pc/h | 444 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 33.1 | % |
| Adjustment for no-passing zones, fnp | 43.8 | |
| Percent time-spent-following, PTSFd | 49.9 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.13 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 47 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 142 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |
| Capacity from ATS, CdATS | 1656 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1656 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 46.3 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 49.9 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 207.9 |
| Effective width of outside lane, We | 18.15 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.19 |
| Bicycle LOS | F |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 SB |
| From/To | Moore Rd / Mendenhall Rd |
| Jurisdiction | Clover Township, Jefferson Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.80 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 12 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Rolling | | % Recreational vehicles | 0 | % |
| Grade: Length | - | mi | % No-passing zones | 100 | % |
| Up/down | - | % | Access point density | 14 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 106 | veh/h |
| Opposing direction volume, Vo | 185 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 2.6 | | 2.2 | |
| PCE for RVs, ER | 1.1 | | 1.1 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.839 | | 0.874 | |
| Grade adj. factor,(note-1) fg | 0.70 | | 0.77 | |
| Directional flow rate,(note-2) vi | 226 | pc/h | 344 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 3.5 | mi/h |
| Free-flow speed, FFSd | 54.8 | mi/h |
| Adjustment for no-passing zones, fnp | 3.2 | mi/h |
| Average travel speed, ATSd | 47.2 | mi/h |
| Percent Free Flow Speed, PFFS | 86.2 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                    Analysis(d)         Opposing (o)
PCE for trucks, ET                               1.8                 1.7
PCE for RVs, ER                                  1.0                 1.0
Heavy-vehicle adjustment factor, fHV             0.912               0.923
Grade adjustment factor,(note-1) fg              0.75                0.82
Directional flow rate,(note-2) vi                194    pc/h         306     pc/h
Base percent time-spent-following,(note-4) BPTSFd  23.2   %
Adjustment for no-passing zones, fnp                  52.8
Percent time-spent-following, PTSFd                   43.7   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                 C
Volume to capacity ratio, v/c                         0.08
Peak 15-min vehicle-miles of travel, VMT15            30      veh-mi
Peak-hour vehicle-miles of travel, VMT60              95      veh-mi
Peak 15-min total travel time, TT15                   0.6     veh-h
Capacity from ATS, CdATS                              1641    veh/h
Capacity from PTSF, CdPTSF                            1700    veh/h
Directional Capacity                                  1641    veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                            0.9     mi
Length of two-lane highway upstream of the passing lane, Lu     -       mi
Length of passing lane including tapers, Lpl                    -       mi
Average travel speed, ATSd (from above)                         47.2    mi/h
Percent time-spent-following, PTSFd (from above)                43.7
Level of service, LOSd (from above)                             C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde        -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld     -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                       -
Average travel speed including passing lane, ATSpl              -
Percent free flow speed including passing lane, PFFSpl          0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde       -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld       -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                        -
Percent time-spent-following
    including passing lane, PTSFpl                              -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl        E
Peak 15-min total travel time, TT15                   -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 132.5 |
| Effective width of outside lane, We | 22.05 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.42 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

```
Analyst                    French
Agency/Co.                 French Engineering
Date Performed             1/30/2020
Analysis Time Period       PM Peak
Highway                    SR 28 SB
From/To                    Moore Rd / Mendenhall Rd
Jurisdiction               Clover Township, Jefferson Co
Analysis Year              2019
Description  SR 28 Corridor Study
```

## Input Data

```
Highway class  Class 1               Peak hour factor, PHF    0.69
Shoulder width       4.0     ft      % Trucks and buses       6       %
Lane width           11.0    ft      % Trucks crawling        0.0     %
Segment length       0.9     mi      Truck crawl speed        0.0     mi/hr
Terrain type         Rolling         % Recreational vehicles  0       %
Grade:  Length       -       mi      % No-passing zones       100     %
        Up/down      -       %       Access point density     14      /mi

Analysis direction volume, Vd  285     veh/h
Opposing direction volume, Vo  158     veh/h
```

## Average Travel Speed

```
Direction                                Analysis(d)        Opposing (o)
PCE for trucks, ET                           2.0                2.2
PCE for RVs, ER                              1.1                1.1
Heavy-vehicle adj. factor,(note-5) fHV       0.943              0.933
Grade adj. factor,(note-1) fg                0.91               0.77
Directional flow rate,(note-2) vi            481     pc/h       319     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM                  -      mi/h
Observed total demand,(note-3) V                    -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS                 60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS      1.7     mi/h
Adj. for access point density,(note-3) fA          3.5     mi/h

Free-flow speed, FFSd                              54.8    mi/h

Adjustment for no-passing zones, fnp               3.3     mi/h
Average travel speed, ATSd                         45.3    mi/h
Percent Free Flow Speed, PFFS                      82.6    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.4 | | 1.7 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.977 | | 0.960 | |
| Grade adjustment factor,(note-1) fg | 0.91 | | 0.81 | |
| Directional flow rate,(note-2) vi | 465 | pc/h | 295 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 45.8 | % |
| Adjustment for no-passing zones, fnp | 41.3 | |
| Percent time-spent-following, PTSFd | 71.1 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.25 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 93 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 256 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.1 | veh-h |
| Capacity from ATS, CdATS | 1669 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1669 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 45.3 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 71.1 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 413.0 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.00 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL NB1 |
| From/To | 0.5 miles north of SR 85 |
| Jurisdiction | Rayburn Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.94 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.73 | mi | % No-passing zones | 0 | % |
| Up/down | 5.5 | % | Access point density | 1 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 542 | veh/h |
| Opposing direction volume, Vo | 310 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 8.9 | | 1.4 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.677 | | 0.977 | |
| Grade adj. factor,(note-1) fg | 0.87 | | 1.00 | |
| Directional flow rate,(note-2) vi | 979 | pc/h | 338 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 0.3 | mi/h |
| Free-flow speed, FFSd | 59.3 | mi/h |
| Adjustment for no-passing zones, fnp | 1.5 | mi/h |
| Average travel speed, ATSd | 47.6 | mi/h |
| Percent Free Flow Speed, PFFS | 80.2 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | Opposing (o) |
|---|---|---|
| PCE for trucks, ET | 1.0 | 1.1 |
| PCE for RVs, ER | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, fHV | 1.000 | 0.994 |
| Grade adjustment factor,(note-1) fg | 1.00 | 1.00 |
| Directional flow rate,(note-2) vi | 577 pc/h | 332 pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 52.7 % | |
| Adjustment for no-passing zones, fnp | 12.0 | |
| Percent time-spent-following, PTSFd | 60.3 % | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.50 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 130 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 488 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.7 | veh-h |
| Capacity from ATS, CdATS | 1151 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1151 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.9 | mi |
| Average travel speed, ATSd (from above) | 47.6 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 60.3 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 54.3 | |
| Percent free flow speed including passing lane, PFFSpl | 91.4 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.21 | |
| Percent time-spent-following including passing lane, PTSFpl | 12.7 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 2.4 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 576.6 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.65 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Existing CL NB2 |
| From/To | btw SR 1027 and SR 1016 |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.76 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.7 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.53 | mi | % No-passing zones | 0 | % |
| Up/down | 5.6 | % | Access point density | 1 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 151 | veh/h |
| Opposing direction volume, Vo | 217 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 7.4 | | 1.4 | |
| PCE for RVs, ER | 1.4 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.545 | | 0.951 | |
| Grade adj. factor,(note-1) fg | 0.61 | | 1.00 | |
| Directional flow rate,(note-2) vi | 598 | pc/h | 300 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 0.3 | mi/h |
| Free-flow speed, FFSd | 58.0 | mi/h |
| Adjustment for no-passing zones, fnp | 1.6 | mi/h |
| Average travel speed, ATSd | 49.5 | mi/h |
| Percent Free Flow Speed, PFFS | 85.3 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.987 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 199 | pc/h | 289 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 24.1 | % |
| Adjustment for no-passing zones, fnp | 14.8 | |
| Percent time-spent-following, PTSFd | 30.1 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.21 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 35 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 106 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.7 | veh-h |
| Capacity from ATS, CdATS | 927 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 927 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.7 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.7 | mi |
| Average travel speed, ATSd (from above) | 49.5 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 30.1 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.07 | |
| Average travel speed including passing lane, ATSpl | 53.0 | |
| Percent free flow speed including passing lane, PFFSpl | 91.3 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 6.0 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 0.7 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 198.7 |
| Effective width of outside lane, We | 24.92 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.41 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL NB2 |
| From/To | btw SR 1027 and SR 1016 |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.90 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.7 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.53 | mi | % No-passing zones | 0 | % |
| Up/down | 5.6 | % | Access point density | 1 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 295 | veh/h |
| Opposing direction volume, Vo | 182 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 7.4 | | 1.5 | |
| PCE for RVs, ER | 1.1 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.722 | | 0.971 | |
| Grade adj. factor,(note-1) fg | 0.67 | | 1.00 | |
| Directional flow rate,(note-2) vi | 678 | pc/h | 208 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 0.3 | mi/h |
| Free-flow speed, FFSd | 58.0 | mi/h |
| Adjustment for no-passing zones, fnp | 1.7 | mi/h |
| Average travel speed, ATSd | 49.4 | mi/h |
| Percent Free Flow Speed, PFFS | 85.2 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.994 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 328 | pc/h | 203 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 32.3 | % |
| Adjustment for no-passing zones, fnp | 14.0 | |
| Percent time-spent-following, PTSFd | 40.9 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.27 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 57 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 206 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.2 | veh-h |
| Capacity from ATS, CdATS | 1227 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1227 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.7 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.7 | mi |
| Average travel speed, ATSd (from above) | 49.4 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 40.9 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 56.4 | |
| Percent free flow speed including passing lane, PFFSpl | 97.1 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.21 | |
| Percent time-spent-following including passing lane, PTSFpl | 8.6 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | A | |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 327.8 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.80 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Existing CL NB3 |
| From/To | 0.4 mi south of Distant |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.76 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.5 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.35 | mi | % No-passing zones | 0 | % |
| Up/down | 8.5 | % | Access point density | 0 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 151 | veh/h |
| Opposing direction volume, Vo | 217 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 6.2 | | 1.4 | |
| PCE for RVs, ER | 1.5 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.598 | | 0.951 | |
| Grade adj. factor,(note-1) fg | 0.59 | | 1.00 | |
| Directional flow rate,(note-2) vi | 563 | pc/h | 300 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 0.0 | mi/h |
| Free-flow speed, FFSd | 58.3 | mi/h |
| Adjustment for no-passing zones, fnp | 1.6 | mi/h |
| Average travel speed, ATSd | 50.0 | mi/h |
| Percent Free Flow Speed, PFFS | 85.8 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.987 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 199 | pc/h | 289 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 24.1 | % |
| Adjustment for no-passing zones, fnp | 14.8 | |
| Percent time-spent-following, PTSFd | 30.1 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | B | |
| Volume to capacity ratio, v/c | 0.19 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 25 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 76 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.5 | veh-h |
| Capacity from ATS, CdATS | 1051 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1051 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.5 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.5 | mi |
| Average travel speed, ATSd (from above) | 50.0 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 30.1 | |
| Level of service, LOSd (from above) | B | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.07 | |
| Average travel speed including passing lane, ATSpl | 53.5 | |
| Percent free flow speed including passing lane, PFFSpl | 91.8 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 6.0 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 0.5 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 198.7 |
| Effective width of outside lane, We | 24.92 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.41 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL NB3 |
| From/To | 0.4 mi south of Distant |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.90 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.5 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.35 | mi | % No-passing zones | 0 | % |
| Up/down | 8.5 | % | Access point density | 0 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 295 | veh/h |
| Opposing direction volume, Vo | 182 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 6.1 | | 1.5 | |
| PCE for RVs, ER | 1.2 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.765 | | 0.971 | |
| Grade adj. factor,(note-1) fg | 0.65 | | 1.00 | |
| Directional flow rate,(note-2) vi | 659 | pc/h | 208 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 0.0 | mi/h |
| Free-flow speed, FFSd | 58.3 | mi/h |
| Adjustment for no-passing zones, fnp | 1.7 | mi/h |
| Average travel speed, ATSd | 49.8 | mi/h |
| Percent Free Flow Speed, PFFS | 85.5 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.994 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 328 | pc/h | 203 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 32.3 | % |
| Adjustment for no-passing zones, fnp | 14.0 | |
| Percent time-spent-following, PTSFd | 40.9 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.25 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 41 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 148 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.8 | veh-h |
| Capacity from ATS, CdATS | 1323 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1323 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.5 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.5 | mi |
| Average travel speed, ATSd (from above) | 49.8 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 40.9 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 56.8 | |
| Percent free flow speed including passing lane, PFFSpl | 97.4 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.21 | |
| Percent time-spent-following including passing lane, PTSFpl | 8.6 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | A | |
| Peak 15-min total travel time, TT15 | 0.7 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 327.8 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.80 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

```
Analyst                  French
Agency/Co.               French Engineering
Date Performed           1/30/2020
Analysis Time Period     AM Peak
Highway                  SR 28 - Existing CL NB4
From/To                  2.25 mi south of South Main St
Jurisdiction             Clover Township, Jefferson Co
Analysis Year            2019
Description  SR 28 Corridor Study
```

## Input Data

```
Highway class  Class 1              Peak hour factor, PHF    0.78
Shoulder width       5.0     ft     % Trucks and buses       8       %
Lane width           11.0    ft     % Trucks crawling        0.0     %
Segment length       1.0     mi     Truck crawl speed        0.0     mi/hr
Terrain type         Specific Grade % Recreational vehicles  0       %
Grade:  Length       0.81    mi     % No-passing zones       0       %
        Up/down      5.1     %      Access point density     12      /mi

Analysis direction volume, Vd  185     veh/h
Opposing direction volume, Vo  106     veh/h
```

## Average Travel Speed

```
Direction                                Analysis(d)        Opposing (o)
PCE for trucks, ET                           7.9                 1.8
PCE for RVs, ER                              1.3                 1.0
Heavy-vehicle adj. factor,(note-5) fHV       0.644               0.940
Grade adj. factor,(note-1) fg                0.67                1.00
Directional flow rate,(note-2) vi            550     pc/h        145     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM                -      mi/h
Observed total demand,(note-3) V                  -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS               60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS    1.7     mi/h
Adj. for access point density,(note-3) fA        3.0     mi/h

Free-flow speed, FFSd                            55.3    mi/h

Adjustment for no-passing zones, fnp             1.0     mi/h
Average travel speed, ATSd                       48.9    mi/h
Percent Free Flow Speed, PFFS                    88.5    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.992 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 237 | pc/h | 137 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 24.9 | % |
| Adjustment for no-passing zones, fnp | 12.8 | |
| Percent time-spent-following, PTSFd | 33.0 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.22 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 59 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 185 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.2 | veh-h |
| Capacity from ATS, CdATS | 1098 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1098 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.0 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.0 | mi |
| Average travel speed, ATSd (from above) | 48.9 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 33.0 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.07 | |
| Average travel speed including passing lane, ATSpl | 52.4 | |
| Percent free flow speed including passing lane, PFFSpl | 94.7 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 6.6 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 1.1 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 237.2 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.32 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL NB4 |
| From/To | 2.25 mi south of South Main St |
| Jurisdiction | Clover Township, Jefferson Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.76 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 9 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.0 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.81 | mi | % No-passing zones | 0 | % |
| Up/down | 5.1 | % | Access point density | 12 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 158 | veh/h |
| Opposing direction volume, Vo | 285 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 7.9 | | 1.3 | |
| PCE for RVs, ER | 1.3 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.617 | | 0.974 | |
| Grade adj. factor,(note-1) fg | 0.65 | | 1.00 | |
| Directional flow rate,(note-2) vi | 518 | pc/h | 385 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 3.0 | mi/h |
| Free-flow speed, FFSd | 55.3 | mi/h |
| Adjustment for no-passing zones, fnp | 1.3 | mi/h |
| Average travel speed, ATSd | 47.0 | mi/h |
| Percent Free Flow Speed, PFFS | 84.9 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.991 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 208 | pc/h | 378 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 25.7 | % |
| Adjustment for no-passing zones, fnp | 13.1 | |
| Percent time-spent-following, PTSFd | 30.3 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.20 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 52 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 158 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.1 | veh-h |
| Capacity from ATS, CdATS | 1052 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1052 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.0 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.0 | mi |
| Average travel speed, ATSd (from above) | 47.0 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 30.3 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.07 | |
| Average travel speed including passing lane, ATSpl | 50.3 | |
| Percent free flow speed including passing lane, PFFSpl | 90.9 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 6.1 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 207.9 |
| Effective width of outside lane, We | 24.36 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.87 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Existing CL SB1 |
| From/To | near SR 1027 |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.88 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 15 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.2 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.99 | mi | % No-passing zones | 0 | % |
| Up/down | 6.4 | % | Access point density | 5 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 217 | veh/h |
| Opposing direction volume, Vo | 151 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 10.3 | | 1.6 | |
| PCE for RVs, ER | 1.4 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.419 | | 0.917 | |
| Grade adj. factor,(note-1) fg | 0.58 | | 1.00 | |
| Directional flow rate,(note-2) vi | 1015 | pc/h | 187 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.3 | mi/h |
| Free-flow speed, FFSd | 57.0 | mi/h |
| Adjustment for no-passing zones, fnp | 1.5 | mi/h |
| Average travel speed, ATSd | 46.2 | mi/h |
| Percent Free Flow Speed, PFFS | 81.0 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.993 | | 0.985 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 248 | pc/h | 174 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 25.9 | % |
| Adjustment for no-passing zones, fnp | 14.8 | |
| Percent time-spent-following, PTSFd | 34.6 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.34 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 74 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 260 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.6 | veh-h |
| Capacity from ATS, CdATS | 721 | veh/h |
| Capacity from PTSF, CdPTSF | 1652 | veh/h |
| Directional Capacity | 721 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.2 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.2 | mi |
| Average travel speed, ATSd (from above) | 46.2 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 34.6 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 52.7 | |
| Percent free flow speed including passing lane, PFFSpl | 92.3 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 6.9 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 1.4 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 246.6 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 8.40 |
| Bicycle LOS | F |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL SB1 |
| From/To | near SR 1027 |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.95 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.2 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.99 | mi | % No-passing zones | 0 | % |
| Up/down | 6.4 | % | Access point density | 5 | /mi |

Analysis direction volume, Vd 182 veh/h
Opposing direction volume, Vo 295 veh/h

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 10.3 | | 1.4 | |
| PCE for RVs, ER | 1.5 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.454 | | 0.951 | |
| Grade adj. factor,(note-1) fg | 0.55 | | 1.00 | |
| Directional flow rate,(note-2) vi | 767 | pc/h | 327 | pc/h |

Free-Flow Speed from Field Measurement:

| | | |
|---|---|---|
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |

Estimated Free-Flow Speed:

| | | |
|---|---|---|
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.3 | mi/h |
| | | |
| Free-flow speed, FFSd | 57.0 | mi/h |
| | | |
| Adjustment for no-passing zones, fnp | 1.5 | mi/h |
| Average travel speed, ATSd | 47.1 | mi/h |
| Percent Free Flow Speed, PFFS | 82.6 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.987 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 192 | pc/h | 315 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 23.8 | % |
| Adjustment for no-passing zones, fnp | 14.0 | |
| Percent time-spent-following, PTSFd | 29.1 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.25 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 57 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 218 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.2 | veh-h |
| Capacity from ATS, CdATS | 780 | veh/h |
| Capacity from PTSF, CdPTSF | 1659 | veh/h |
| Directional Capacity | 780 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.2 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.2 | mi |
| Average travel speed, ATSd (from above) | 47.1 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 29.1 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 53.7 | |
| Percent free flow speed including passing lane, PFFSpl | 94.1 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 5.8 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 1.1 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 191.6 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 7.29 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

```
Phone:                                  Fax:
E-Mail:

_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                 French
Agency/Co.              French Engineering
Date Performed          1/30/2020
Analysis Time Period    AM Peak
Highway                 SR 28 - Existing CL SB2
From/To                 north of Calhoun Rd
Jurisdiction            Mahoning Twnshp, Armstrong Co
Analysis Year           2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1             Peak hour factor, PHF    0.88
Shoulder width       8.0     ft    % Trucks and buses       15      %
Lane width           11.0    ft    % Trucks crawling        0.0     %
Segment length       1.7     mi    Truck crawl speed        0.0     mi/hr
Terrain type         Specific Grade % Recreational vehicles  0       %
Grade:  Length       1.39    mi    % No-passing zones       0       %
        Up/down      5.9     %     Access point density     4       /mi

Analysis direction volume, Vd  217     veh/h
Opposing direction volume, Vo  151     veh/h

____________________________Average Travel Speed______________________________

Direction                             Analysis(d)         Opposing (o)
PCE for trucks, ET                        11.5                1.6
PCE for RVs, ER                           1.4                 1.0
Heavy-vehicle adj. factor,(note-5) fHV    0.387               0.917
Grade adj. factor,(note-1) fg             0.57                1.00
Directional flow rate,(note-2) vi         1118    pc/h        187     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM              -       mi/h
Observed total demand,(note-3) V                -       veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS             60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS  0.4     mi/h
Adj. for access point density,(note-3) fA      1.0     mi/h

Free-flow speed, FFSd                          58.6    mi/h

Adjustment for no-passing zones, fnp           1.6     mi/h
Average travel speed, ATSd                     46.8    mi/h
Percent Free Flow Speed, PFFS                  79.9    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.4 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.943 | | 0.985 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 261 | pc/h | 174 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 27.0 | % |
| Adjustment for no-passing zones, fnp | 14.8 | |
| Percent time-spent-following, PTSFd | 35.9 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.37 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 105 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 369 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.2 | veh-h |
| Capacity from ATS, CdATS | 670 | veh/h |
| Capacity from PTSF, CdPTSF | 1579 | veh/h |
| Directional Capacity | 670 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.7 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.7 | mi |
| Average travel speed, ATSd (from above) | 46.8 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 35.9 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 53.4 | |
| Percent free flow speed including passing lane, PFFSpl | 91.1 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 7.2 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 2.0 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 246.6 |
| Effective width of outside lane, We | 27.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.96 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL SB2 |
| From/To | north of Calhoun Rd |
| Jurisdiction | Mahoning Twnshp, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.95 | |
| Shoulder width | 8.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.7 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 1.39 | mi | % No-passing zones | 0 | % |
| Up/down | 5.9 | % | Access point density | 4 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 182 | veh/h |
| Opposing direction volume, Vo | 295 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 11.5 | | 1.4 | |
| PCE for RVs, ER | 1.5 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.422 | | 0.951 | |
| Grade adj. factor,(note-1) fg | 0.54 | | 1.00 | |
| Directional flow rate,(note-2) vi | 841 | pc/h | 327 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 1.0 | mi/h |
| Free-flow speed, FFSd | 58.6 | mi/h |
| Adjustment for no-passing zones, fnp | 1.5 | mi/h |
| Average travel speed, ATSd | 48.0 | mi/h |
| Percent Free Flow Speed, PFFS | 81.9 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                     Analysis(d)        Opposing (o)
PCE for trucks, ET                                1.4                 1.1
PCE for RVs, ER                                   1.0                 1.0
Heavy-vehicle adjustment factor, fHV              0.952               0.987
Grade adjustment factor,(note-1) fg               1.00                1.00
Directional flow rate,(note-2) vi                 201    pc/h         315     pc/h
Base percent time-spent-following,(note-4) BPTSFd  24.7   %
Adjustment for no-passing zones, fnp                     14.0
Percent time-spent-following, PTSFd                      30.2   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                    C
Volume to capacity ratio, v/c                            0.26
Peak 15-min vehicle-miles of travel, VMT15               81      veh-mi
Peak-hour vehicle-miles of travel, VMT60                 309     veh-mi
Peak 15-min total travel time, TT15                      1.7     veh-h
Capacity from ATS, CdATS                                 728     veh/h
Capacity from PTSF, CdPTSF                               1594    veh/h
Directional Capacity                                     728     veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                               1.7     mi
Length of two-lane highway upstream of the passing lane, Lu        0.0     mi
Length of passing lane including tapers, Lpl                       1.7     mi
Average travel speed, ATSd (from above)                            48.0    mi/h
Percent time-spent-following, PTSFd (from above)                   30.2
Level of service, LOSd (from above)                                C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde           0.00    mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld        0.00    mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                          1.14
Average travel speed including passing lane, ATSpl                 54.7
Percent free flow speed including passing lane, PFFSpl             93.4    %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde          0.00    mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld          0.00    mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                           0.20
Percent time-spent-following
    including passing lane, PTSFpl                                 6.0     %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     B
Peak 15-min total travel time, TT15                      1.5     veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 191.6 |
| Effective width of outside lane, We | 27.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.85 |
| Bicycle LOS | F |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

```
_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                  French
Agency/Co.               French Engineering
Date Performed           1/30/2020
Analysis Time Period     AM Peak
Highway                  SR 28 - Existing CL SB3
From/To                  btw Distant and S Bethlehem
Jurisdiction             Mahoning Twnshp, Armstrong Co
Analysis Year            2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1             Peak hour factor, PHF    0.95
Shoulder width       10.0    ft    % Trucks and buses       13      %
Lane width           11.0    ft    % Trucks crawling        0.0     %
Segment length       0.9     mi    Truck crawl speed        0.0     mi/hr
Terrain type         Specific Grade % Recreational vehicles  0       %
Grade:  Length       0.69    mi    % No-passing zones       0       %
        Up/down      4.8     %     Access point density     2       /mi

Analysis direction volume, Vd  232     veh/h
Opposing direction volume, Vo  285     veh/h

____________________________Average Travel Speed______________________________

Direction                              Analysis(d)         Opposing (o)
PCE for trucks, ET                         7.1                 1.4
PCE for RVs, ER                            1.3                 1.0
Heavy-vehicle adj. factor,(note-5) fHV     0.556               0.951
Grade adj. factor,(note-1) fg              0.68                1.00
Directional flow rate,(note-2) vi          646     pc/h        316     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM               -      mi/h
Observed total demand,(note-3) V                 -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS              60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS   0.4     mi/h
Adj. for access point density,(note-3) fA       0.5     mi/h

Free-flow speed, FFSd                           59.1    mi/h

Adjustment for no-passing zones, fnp            1.6     mi/h
Average travel speed, ATSd                      50.1    mi/h
Percent Free Flow Speed, PFFS                   84.7    %
```

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.987 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 244 | pc/h | 304 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 28.0 | % |
| Adjustment for no-passing zones, fnp | 15.3 | |
| Percent time-spent-following, PTSFd | 34.8 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | B | |
| Volume to capacity ratio, v/c | 0.25 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 55 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 209 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.1 | veh-h |
| Capacity from ATS, CdATS | 976 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 976 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.9 | mi |
| Average travel speed, ATSd (from above) | 50.1 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 34.8 | |
| Level of service, LOSd (from above) | B | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 57.1 | |
| Percent free flow speed including passing lane, PFFSpl | 96.6 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 7.0 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | A | |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 244.2 |
| Effective width of outside lane, We | 31.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.81 |
| Bicycle LOS | E |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL SB3 |
| From/To | Btw Distant and S Bethlehem |
| Jurisdiction | Mahoning Twnshp, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.89 | |
| Shoulder width | 10.0 | ft | % Trucks and buses | 4 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.69 | mi | % No-passing zones | 0 | % |
| Up/down | 4.8 | % | Access point density | 2 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 312 | veh/h |
| Opposing direction volume, Vo | 332 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 7.1 | | 1.3 | |
| PCE for RVs, ER | 1.2 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.803 | | 0.988 | |
| Grade adj. factor,(note-1) fg | 0.74 | | 1.00 | |
| Directional flow rate,(note-2) vi | 590 | pc/h | 378 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 0.5 | mi/h |
| Free-flow speed, FFSd | 59.1 | mi/h |
| Adjustment for no-passing zones, fnp | 1.4 | mi/h |
| Average travel speed, ATSd | 50.2 | mi/h |
| Percent Free Flow Speed, PFFS | 84.9 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | Opposing (o) |
|---|---|---|
| PCE for trucks, ET | 1.0 | 1.1 |
| PCE for RVs, ER | 1.0 | 1.0 |
| Heavy-vehicle adjustment factor, fHV | 1.000 | 0.996 |
| Grade adjustment factor,(note-1) fg | 1.00 | 1.00 |
| Directional flow rate,(note-2) vi | 351 pc/h | 375 pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 38.5 % | |
| Adjustment for no-passing zones, fnp | 15.5 | |
| Percent time-spent-following, PTSFd | 46.0 % | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | B | |
| Volume to capacity ratio, v/c | 0.25 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 79 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 281 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.6 | veh-h |
| Capacity from ATS, CdATS | 1384 | veh/h |
| Capacity from PTSF, CdPTSF | 1700 | veh/h |
| Directional Capacity | 1384 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 0.9 | mi |
| Average travel speed, ATSd (from above) | 50.2 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 46.0 | |
| Level of service, LOSd (from above) | B | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.07 | |
| Average travel speed including passing lane, ATSpl | 53.7 | |
| Percent free flow speed including passing lane, PFFSpl | 90.8 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.21 | |
| Percent time-spent-following including passing lane, PTSFpl | 9.7 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 1.5 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 350.6 |
| Effective width of outside lane, We | 31.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 1.63 |
| Bicycle LOS | B |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Existing CL SB4 |
| From/To | Just west of Summerville |
| Jurisdiction | Clover Township, Jefferson Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.83 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 12 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.1 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.88 | mi | % No-passing zones | 0 | % |
| Up/down | 6.0 | % | Access point density | 5 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 73 | veh/h |
| Opposing direction volume, Vo | 154 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 9.7 | | 1.6 | |
| PCE for RVs, ER | 1.6 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.489 | | 0.933 | |
| Grade adj. factor,(note-1) fg | 0.47 | | 1.00 | |
| Directional flow rate,(note-2) vi | 383 | pc/h | 199 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.3 | mi/h |
| Free-flow speed, FFSd | 57.0 | mi/h |
| Adjustment for no-passing zones, fnp | 1.7 | mi/h |
| Average travel speed, ATSd | 50.9 | mi/h |
| Percent Free Flow Speed, PFFS | 89.2 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.988 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 88 | pc/h | 188 | pc/h |
| Base percent time-spent-following,(note-4) BPTSFd | 10.3 | % | | |
| Adjustment for no-passing zones, fnp | 10.6 | | | |
| Percent time-spent-following, PTSFd | 13.7 | % | | |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | B | |
| Volume to capacity ratio, v/c | 0.11 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 24 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 80 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.5 | veh-h |
| Capacity from ATS, CdATS | 836 | veh/h |
| Capacity from PTSF, CdPTSF | 1679 | veh/h |
| Directional Capacity | 836 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.1 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.1 | mi |
| Average travel speed, ATSd (from above) | 50.9 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 13.7 | |
| Level of service, LOSd (from above) | B | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.07 | |
| Average travel speed including passing lane, ATSpl | 54.4 | |
| Percent free flow speed including passing lane, PFFSpl | 95.4 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 2.7 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | B | |
| Peak 15-min total travel time, TT15 | 0.4 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 88.0 |
| Effective width of outside lane, We | 31.16 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 3.79 |
| Bicycle LOS | D |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Existing CL SB4 |
| From/To | Just west of Summerville |
| Jurisdiction | Clover Township, Jefferson Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.85 | |
| Shoulder width | 5.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.1 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.88 | mi | % No-passing zones | 0 | % |
| Up/down | 6.0 | % | Access point density | 5 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 214 | veh/h |
| Opposing direction volume, Vo | 125 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 9.7 | | 1.7 | |
| PCE for RVs, ER | 1.4 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.656 | | 0.960 | |
| Grade adj. factor,(note-1) fg | 0.59 | | 1.00 | |
| Directional flow rate,(note-2) vi | 650 | pc/h | 153 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 1.3 | mi/h |
| Free-flow speed, FFSd | 57.0 | mi/h |
| Adjustment for no-passing zones, fnp | 1.2 | mi/h |
| Average travel speed, ATSd | 49.7 | mi/h |
| Percent Free Flow Speed, PFFS | 87.1 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.998 | | 0.994 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 252 | pc/h | 148 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 26.2 | % |
| Adjustment for no-passing zones, fnp | 13.3 | |
| Percent time-spent-following, PTSFd | 34.6 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | C | |
| Volume to capacity ratio, v/c | 0.22 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 69 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 235 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.4 | veh-h |
| Capacity from ATS, CdATS | 1120 | veh/h |
| Capacity from PTSF, CdPTSF | 1689 | veh/h |
| Directional Capacity | 1120 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.1 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | 0.0 | mi |
| Length of passing lane including tapers, Lpl | 1.1 | mi |
| Average travel speed, ATSd (from above) | 49.7 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 34.6 | |
| Level of service, LOSd (from above) | C | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | 1.14 | |
| Average travel speed including passing lane, ATSpl | 56.6 | |
| Percent free flow speed including passing lane, PFFSpl | 99.2 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | 0.00 | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | 0.00 | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | 0.20 | |
| Percent time-spent-following including passing lane, PTSFpl | 6.9 | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | A | |
| Peak 15-min total travel time, TT15 | 1.2 | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 251.8 |
| Effective width of outside lane, We | 21.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.67 |
| Bicycle LOS | E |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Existing CL SB5 |
| From/To | 1.1 miles S of S Main St |
| Jurisdiction | Rose Township, Jefferson Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.80 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 12 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.4 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 1.21 | mi | % No-passing zones | 0 | % |
| Up/down | 4.4 | % | Access point density | 15 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 106 | veh/h |
| Opposing direction volume, Vo | 185 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 8.5 | | 1.5 | |
| PCE for RVs, ER | 1.3 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.526 | | 0.943 | |
| Grade adj. factor,(note-1) fg | 0.67 | | 1.00 | |
| Directional flow rate,(note-2) vi | 376 | pc/h | 245 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 3.8 | mi/h |
| Free-flow speed, FFSd | 55.8 | mi/h |
| Adjustment for no-passing zones, fnp | 1.5 | mi/h |
| Average travel speed, ATSd | 49.5 | mi/h |
| Percent Free Flow Speed, PFFS | 88.7 | % |

```
__________________________Percent Time-Spent-Following__________________________

Direction                                Analysis(d)        Opposing (o)
PCE for trucks, ET                           1.0                1.1
PCE for RVs, ER                              1.0                1.0
Heavy-vehicle adjustment factor, fHV         0.995              0.988
Grade adjustment factor,(note-1) fg          1.00               1.00
Directional flow rate,(note-2) vi            133    pc/h        234     pc/h
Base percent time-spent-following,(note-4) BPTSFd  15.5   %
Adjustment for no-passing zones, fnp               12.7
Percent time-spent-following, PTSFd                20.1   %

________________Level of Service and Other Performance Measures________________

Level of service, LOS                              C
Volume to capacity ratio, v/c                      0.12
Peak 15-min vehicle-miles of travel, VMT15         46      veh-mi
Peak-hour vehicle-miles of travel, VMT60           148     veh-mi
Peak 15-min total travel time, TT15                0.9     veh-h
Capacity from ATS, CdATS                           1131    veh/h
Capacity from PTSF, CdPTSF                         1649    veh/h
Directional Capacity                               1131    veh/h

_____________________________Passing Lane Analysis_____________________________

Total length of analysis segment, Lt                         1.4     mi
Length of two-lane highway upstream of the passing lane, Lu  0.0     mi
Length of passing lane including tapers, Lpl                 1.4     mi
Average travel speed, ATSd (from above)                      49.5    mi/h
Percent time-spent-following, PTSFd (from above)             20.1
Level of service, LOSd (from above)                          C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde     0.00    mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld  0.00    mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                    1.07
Average travel speed including passing lane, ATSpl           53.0
Percent free flow speed including passing lane, PFFSpl       94.9    %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde    0.00    mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld    0.00    mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                     0.20
Percent time-spent-following
    including passing lane, PTSFpl                           4.0     %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     B
Peak 15-min total travel time, TT15                0.9     veh-h

__________________________ Bicycle Level of Service ___________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 132.5 |
| Effective width of outside lane, We | 30.99 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.05 |
| Bicycle LOS | D |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

```
Phone:                                  Fax:
E-Mail:

_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                  French
Agency/Co.               French Engineering
Date Performed           1/30/2020
Analysis Time Period     PM Peak
Highway                  SR 28 - Existing CL SB5
From/To                  1.1 miles S of S Main St
Jurisdiction             Rose Township, Jefferson Co
Analysis Year            2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1              Peak hour factor, PHF    0.69
Shoulder width       6.0     ft     % Trucks and buses       6       %
Lane width           11.0    ft     % Trucks crawling        0.0     %
Segment length       1.4     mi     Truck crawl speed        0.0     mi/hr
Terrain type         Specific Grade % Recreational vehicles  0       %
Grade:  Length       1.21    mi     % No-passing zones       0       %
        Up/down      4.4     %      Access point density     15      /mi

Analysis direction volume, Vd  285     veh/h
Opposing direction volume, Vo  158     veh/h

____________________________Average Travel Speed______________________________

Direction                                Analysis(d)        Opposing (o)
PCE for trucks, ET                           7.9                1.5
PCE for RVs, ER                              1.0                1.0
Heavy-vehicle adj. factor,(note-5) fHV       0.708              0.971
Grade adj. factor,(note-1) fg                0.82               1.00
Directional flow rate,(note-2) vi            711     pc/h       236     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM                 -      mi/h
Observed total demand,(note-3) V                   -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS               60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS    0.4     mi/h
Adj. for access point density,(note-3) fA        3.8     mi/h

Free-flow speed, FFSd                            55.8    mi/h

Adjustment for no-passing zones, fnp             1.5     mi/h
Average travel speed, ATSd                       47.0    mi/h
Percent Free Flow Speed, PFFS                    84.1    %
```

```
_________________________Percent Time-Spent-Following_________________________

Direction                                     Analysis(d)         Opposing (o)
PCE for trucks, ET                                1.0                 1.1
PCE for RVs, ER                                   1.0                 1.0
Heavy-vehicle adjustment factor, fHV              1.000               0.994
Grade adjustment factor,(note-1) fg               0.99                1.00
Directional flow rate,(note-2) vi                 418    pc/h         230     pc/h
Base percent time-spent-following,(note-4) BPTSFd  39.8   %
Adjustment for no-passing zones, fnp                      12.9
Percent time-spent-following, PTSFd                       48.1   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                     C
Volume to capacity ratio, v/c                             0.30
Peak 15-min vehicle-miles of travel, VMT15                145     veh-mi
Peak-hour vehicle-miles of travel, VMT60                  399     veh-mi
Peak 15-min total travel time, TT15                       3.1     veh-h
Capacity from ATS, CdATS                                  1358    veh/h
Capacity from PTSF, CdPTSF                                1649    veh/h
Directional Capacity                                      1358    veh/h

_____________________________Passing Lane Analysis_____________________________

Total length of analysis segment, Lt                                1.4     mi
Length of two-lane highway upstream of the passing lane, Lu         0.0     mi
Length of passing lane including tapers, Lpl                        1.4     mi
Average travel speed, ATSd (from above)                             47.0    mi/h
Percent time-spent-following, PTSFd (from above)                    48.1
Level of service, LOSd (from above)                                 C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde            0.00    mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld         0.00    mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                           1.14
Average travel speed including passing lane, ATSpl                  53.6
Percent free flow speed including passing lane, PFFSpl              95.9    %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde           0.00    mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld           0.00    mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                            0.21
Percent time-spent-following
    including passing lane, PTSFpl                                  10.1    %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl            B
Peak 15-min total travel time, TT15                       2.7     veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 413.0 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 4.48 |
| Bicycle LOS | D |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Proposed CL NBX1 |
| From/To | Pine Furnace to SR 1029 |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.82 | |
| Shoulder width | 3.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 1.4 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 1.38 | mi | % No-passing zones | 100 | % |
| Up/down | 4.0 | % | Access point density | 13 | /mi |

Analysis direction volume, Vd 220 veh/h
Opposing direction volume, Vo 403 veh/h

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 8.7 | | 1.2 | |
| PCE for RVs, ER | 1.2 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.500 | | 0.975 | |
| Grade adj. factor,(note-1) fg | 0.75 | | 1.00 | |
| Directional flow rate,(note-2) vi | 715 | pc/h | 504 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 3.0 | mi/h |
| Adj. for access point density,(note-3) fA | 3.3 | mi/h |
| Free-flow speed, FFSd | 53.8 | mi/h |
| Adjustment for no-passing zones, fnp | 2.3 | mi/h |
| Average travel speed, ATSd | 42.0 | mi/h |
| Percent Free Flow Speed, PFFS | 78.1 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.0 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.997 | | 1.000 | |
| Grade adjustment factor,(note-1) fg | 0.99 | | 1.00 | |
| Directional flow rate,(note-2) vi | 271 | pc/h | 491 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 34.0 | % |
| Adjustment for no-passing zones, fnp | 40.9 | |
| Percent time-spent-following, PTSFd | 48.5 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.25 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 94 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 308 | veh-mi |
| Peak 15-min total travel time, TT15 | 2.2 | veh-h |
| Capacity from ATS, CdATS | 1063 | veh/h |
| Capacity from PTSF, CdPTSF | 1649 | veh/h |
| Directional Capacity | 1063 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 1.4 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 42.0 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 48.5 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 268.3 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 8.69 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

```
                        HCS7: Two-Lane Highways Release 7.7




Phone:                                  Fax:
E-Mail:

_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                 French
Agency/Co.              French Engineering
Date Performed          1/30/2020
Analysis Time Period    PM Peak
Highway                 SR 28 - Proposed CL NBX1
From/To                 Pine Furnace to SR 1029
Jurisdiction            Boggs Township, Armstrong Co
Analysis Year           2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1            Peak hour factor, PHF    0.94
Shoulder width       3.0     ft     % Trucks and buses       6       %
Lane width           11.0    ft     % Trucks crawling        0.0     %
Segment length       1.4     mi     Truck crawl speed        0.0     mi/hr
Terrain type         Specific Grade % Recreational vehicles  0       %
Grade:  Length       1.38    mi     % No-passing zones       100     %
        Up/down      4.0     %      Access point density     13      /mi

Analysis direction volume, Vd  542     veh/h
Opposing direction volume, Vo  310     veh/h

____________________________Average Travel Speed______________________________

Direction                              Analysis(d)        Opposing (o)
PCE for trucks, ET                         7.6                1.4
PCE for RVs, ER                            1.0                1.0
Heavy-vehicle adj. factor,(note-5) fHV     0.715              0.977
Grade adj. factor,(note-1) fg              0.95               1.00
Directional flow rate,(note-2) vi          849     pc/h       338     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM              -      mi/h
Observed total demand,(note-3) V                -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS             60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS  3.0     mi/h
Adj. for access point density,(note-3) fA      3.3     mi/h

Free-flow speed, FFSd                          53.8    mi/h

Adjustment for no-passing zones, fnp           3.2     mi/h
Average travel speed, ATSd                     41.4    mi/h
Percent Free Flow Speed, PFFS                  77.0    %
```

```
_________________________Percent Time-Spent-Following_________________________

Direction                                  Analysis(d)         Opposing (o)
PCE for trucks, ET                             1.0                 1.1
PCE for RVs, ER                                1.0                 1.0
Heavy-vehicle adjustment factor, fHV           1.000               0.994
Grade adjustment factor,(note-1) fg            0.97                1.00
Directional flow rate,(note-2) vi              594    pc/h         332     pc/h
Base percent time-spent-following,(note-4) BPTSFd  53.7   %
Adjustment for no-passing zones, fnp               36.3
Percent time-spent-following, PTSFd                77.0   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                              D
Volume to capacity ratio, v/c                      0.43
Peak 15-min vehicle-miles of travel, VMT15         202     veh-mi
Peak-hour vehicle-miles of travel, VMT60           759     veh-mi
Peak 15-min total travel time, TT15                4.9     veh-h
Capacity from ATS, CdATS                           1331    veh/h
Capacity from PTSF, CdPTSF                         1649    veh/h
Directional Capacity                               1331    veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                         1.4     mi
Length of two-lane highway upstream of the passing lane, Lu  -       mi
Length of passing lane including tapers, Lpl                 -       mi
Average travel speed, ATSd (from above)                      41.4    mi/h
Percent time-spent-following, PTSFd (from above)             77.0
Level of service, LOSd (from above)                          D

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde     -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld  -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                    -
Average travel speed including passing lane, ATSpl           -
Percent free flow speed including passing lane, PFFSpl       0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde    -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld    -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                     -
Percent time-spent-following
    including passing lane, PTSFpl                           -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     E
Peak 15-min total travel time, TT15                -       veh-h

__________________________ Bicycle Level of Service ___________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 576.6 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 6.31 |
| Bicycle LOS | F |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

```
Phone:                                  Fax:
E-Mail:

_________________Directional Two-Lane Highway Segment Analysis________________

Analyst                   French
Agency/Co.                French Engineering
Date Performed            1/30/2020
Analysis Time Period      AM Peak
Highway                   SR 28 - Proposed CL NBX2
From/To                   North of SR 1018
Jurisdiction              Boggs Township, Armstrong Co
Analysis Year             2019
Description  SR 28 Corridor Study

__________________________________Input Data__________________________________

Highway class  Class 1              Peak hour factor, PHF    0.76
Shoulder width       4.0     ft     % Trucks and buses       13      %
Lane width           11.0    ft     % Trucks crawling        0.0     %
Segment length       0.9     mi     Truck crawl speed        0.0     mi/hr
Terrain type         Specific Grade % Recreational vehicles  0       %
Grade:  Length       0.90    mi     % No-passing zones       100     %
        Up/down      6.4     %      Access point density     10      /mi

Analysis direction volume, Vd  151     veh/h
Opposing direction volume, Vo  217     veh/h

____________________________Average Travel Speed______________________________

Direction                               Analysis(d)         Opposing (o)
PCE for trucks, ET                          9.8                 1.4
PCE for RVs, ER                             1.5                 1.0
Heavy-vehicle adj. factor,(note-5) fHV      0.466               0.951
Grade adj. factor,(note-1) fg               0.56                1.00
Directional flow rate,(note-2) vi           761     pc/h        300     pc/h

Free-Flow Speed from Field Measurement:
Field measured speed,(note-3) S FM               -      mi/h
Observed total demand,(note-3) V                 -      veh/h
Estimated Free-Flow Speed:
Base free-flow speed,(note-3) BFFS              60.0    mi/h
Adj. for lane and shoulder width,(note-3) fLS  1.7     mi/h
Adj. for access point density,(note-3) fA      2.5     mi/h

Free-flow speed, FFSd                           55.8    mi/h

Adjustment for no-passing zones, fnp            3.5     mi/h
Average travel speed, ATSd                      44.0    mi/h
Percent Free Flow Speed, PFFS                   78.9    %
```

```
_________________________Percent Time-Spent-Following_________________________

Direction                                     Analysis(d)         Opposing (o)
PCE for trucks, ET                                1.0                 1.1
PCE for RVs, ER                                   1.0                 1.0
Heavy-vehicle adjustment factor, fHV              1.000               0.987
Grade adjustment factor,(note-1) fg               1.00                1.00
Directional flow rate,(note-2) vi                 199    pc/h         289     pc/h
Base percent time-spent-following,(note-4) BPTSFd  24.1   %
Adjustment for no-passing zones, fnp                      56.2
Percent time-spent-following, PTSFd                       47.0   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                     D
Volume to capacity ratio, v/c                             0.25
Peak 15-min vehicle-miles of travel, VMT15                45      veh-mi
Peak-hour vehicle-miles of travel, VMT60                  136     veh-mi
Peak 15-min total travel time, TT15                       1.0     veh-h
Capacity from ATS, CdATS                                  797     veh/h
Capacity from PTSF, CdPTSF                                1674    veh/h
Directional Capacity                                      797     veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                                0.9     mi
Length of two-lane highway upstream of the passing lane, Lu         -       mi
Length of passing lane including tapers, Lpl                        -       mi
Average travel speed, ATSd (from above)                             44.0    mi/h
Percent time-spent-following, PTSFd (from above)                    47.0
Level of service, LOSd (from above)                                 D

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde            -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld         -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                           -
Average travel speed including passing lane, ATSpl                  -
Percent free flow speed including passing lane, PFFSpl              0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde           -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld           -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                            -
Percent time-spent-following
    including passing lane, PTSFpl                                  -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl            E
Peak 15-min total travel time, TT15                       -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 198.7 |
| Effective width of outside lane, We | 18.68 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 7.77 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Proposed CL NBX2 |
| From/To | North of SR 1018 |
| Jurisdiction | Boggs Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.90 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 6 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.90 | mi | % No-passing zones | 100 | % |
| Up/down | 6.4 | % | Access point density | 10 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 295 | veh/h |
| Opposing direction volume, Vo | 182 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 9.8 | | 1.5 | |
| PCE for RVs, ER | 1.2 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.654 | | 0.971 | |
| Grade adj. factor,(note-1) fg | 0.62 | | 1.00 | |
| Directional flow rate,(note-2) vi | 808 | pc/h | 208 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 2.5 | mi/h |
| Free-flow speed, FFSd | 55.8 | mi/h |
| Adjustment for no-passing zones, fnp | 4.1 | mi/h |
| Average travel speed, ATSd | 43.8 | mi/h |
| Percent Free Flow Speed, PFFS | 78.6 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.1 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 0.996 | | 0.994 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 329 | pc/h | 203 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 32.4 | % |
| Adjustment for no-passing zones, fnp | 53.8 | |
| Percent time-spent-following, PTSFd | 65.7 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.29 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 74 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 265 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.7 | veh-h |
| Capacity from ATS, CdATS | 1117 | veh/h |
| Capacity from PTSF, CdPTSF | 1688 | veh/h |
| Directional Capacity | 1117 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 43.8 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 65.7 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 327.8 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 5.88 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Proposed CL SBX1 |
| From/To | North of SR 1028 |
| Jurisdiction | Rayburn Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.88 | |
| Shoulder width | 3.0 | ft | % Trucks and buses | 15 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.6 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.62 | mi | % No-passing zones | 100 | % |
| Up/down | 7.4 | % | Access point density | 19 | /mi |

Analysis direction volume, Vd 217 veh/h
Opposing direction volume, Vo 151 veh/h

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 8.8 | | 1.6 | |
| PCE for RVs, ER | 1.4 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.462 | | 0.917 | |
| Grade adj. factor,(note-1) fg | 0.53 | | 1.00 | |
| Directional flow rate,(note-2) vi | 1007 | pc/h | 187 | pc/h |

Free-Flow Speed from Field Measurement:

| | | |
|---|---|---|
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |

Estimated Free-Flow Speed:

| | | |
|---|---|---|
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 3.0 | mi/h |
| Adj. for access point density,(note-3) fA | 4.8 | mi/h |
| Free-flow speed, FFSd | 52.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.9 | mi/h |
| Average travel speed, ATSd | 39.1 | mi/h |
| Percent Free Flow Speed, PFFS | 74.9 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.985 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 247 | pc/h | 174 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 25.8 | % |
| Adjustment for no-passing zones, fnp | 57.0 | |
| Percent time-spent-following, PTSFd | 59.2 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | E | |
| Volume to capacity ratio, v/c | 0.31 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 37 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 130 | veh-mi |
| Peak 15-min total travel time, TT15 | 0.9 | veh-h |
| Capacity from ATS, CdATS | 785 | veh/h |
| Capacity from PTSF, CdPTSF | 1630 | veh/h |
| Directional Capacity | 785 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.6 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 39.1 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 59.2 | |
| Level of service, LOSd (from above) | E | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 246.6 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 9.62 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Proposed CL SBX1 |
| From/To | North of SR 1028 |
| Jurisdiction | Rayburn Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.95 | |
| Shoulder width | 3.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.6 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.62 | mi | % No-passing zones | 100 | % |
| Up/down | 7.4 | % | Access point density | 19 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 182 | veh/h |
| Opposing direction volume, Vo | 295 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 8.8 | | 1.4 | |
| PCE for RVs, ER | 1.5 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.498 | | 0.951 | |
| Grade adj. factor,(note-1) fg | 0.50 | | 1.00 | |
| Directional flow rate,(note-2) vi | 769 | pc/h | 327 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 3.0 | mi/h |
| Adj. for access point density,(note-3) fA | 4.8 | mi/h |
| Free-flow speed, FFSd | 52.3 | mi/h |
| Adjustment for no-passing zones, fnp | 3.2 | mi/h |
| Average travel speed, ATSd | 40.5 | mi/h |
| Percent Free Flow Speed, PFFS | 77.6 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                Analysis(d)        Opposing (o)
PCE for trucks, ET                           1.0                1.1
PCE for RVs, ER                              1.0                1.0
Heavy-vehicle adjustment factor, fHV         1.000              0.987
Grade adjustment factor,(note-1) fg          1.00               1.00
Directional flow rate,(note-2) vi            192    pc/h        315     pc/h
Base percent time-spent-following,(note-4) BPTSFd  23.8   %
Adjustment for no-passing zones, fnp               54.0
Percent time-spent-following, PTSFd                44.2   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                              D
Volume to capacity ratio, v/c                      0.23
Peak 15-min vehicle-miles of travel, VMT15         29       veh-mi
Peak-hour vehicle-miles of travel, VMT60           109      veh-mi
Peak 15-min total travel time, TT15                0.7      veh-h
Capacity from ATS, CdATS                           847      veh/h
Capacity from PTSF, CdPTSF                         1639     veh/h
Directional Capacity                               847      veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                         0.6       mi
Length of two-lane highway upstream of the passing lane, Lu  -         mi
Length of passing lane including tapers, Lpl                 -         mi
Average travel speed, ATSd (from above)                      40.5      mi/h
Percent time-spent-following, PTSFd (from above)             44.2
Level of service, LOSd (from above)                          D

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde     -         mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld  -         mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                    -
Average travel speed including passing lane, ATSpl           -
Percent free flow speed including passing lane, PFFSpl       0.0       %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde    -         mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld    -         mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                     -
Percent time-spent-following
    including passing lane, PTSFpl                           -         %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     E
Peak 15-min total travel time, TT15                -        veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 191.6 |
| Effective width of outside lane, We | 14.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 8.52 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Proposed CL SBX2 |
| From/To | Pine Furnace to Mechling Rd |
| Jurisdiction | Rayburn Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.88 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 15 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.88 | mi | % No-passing zones | 100 | % |
| Up/down | 5.5 | % | Access point density | 9 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 217 | veh/h |
| Opposing direction volume, Vo | 151 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 9.7 | | 1.6 | |
| PCE for RVs, ER | 1.4 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.433 | | 0.917 | |
| Grade adj. factor,(note-1) fg | 0.59 | | 1.00 | |
| Directional flow rate,(note-2) vi | 965 | pc/h | 187 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 2.3 | mi/h |
| Free-flow speed, FFSd | 56.0 | mi/h |
| Adjustment for no-passing zones, fnp | 3.9 | mi/h |
| Average travel speed, ATSd | 43.2 | mi/h |
| Percent Free Flow Speed, PFFS | 77.0 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                     Analysis(d)        Opposing (o)
PCE for trucks, ET                                1.0                1.1
PCE for RVs, ER                                   1.0                1.0
Heavy-vehicle adjustment factor, fHV              0.996              0.985
Grade adjustment factor,(note-1) fg               1.00               1.00
Directional flow rate,(note-2) vi                 247    pc/h        174     pc/h
Base percent time-spent-following,(note-4) BPTSFd  25.8   %
Adjustment for no-passing zones, fnp                       57.0
Percent time-spent-following, PTSFd                        59.2   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                                      D
Volume to capacity ratio, v/c                              0.33
Peak 15-min vehicle-miles of travel, VMT15                 55      veh-mi
Peak-hour vehicle-miles of travel, VMT60                   195     veh-mi
Peak 15-min total travel time, TT15                        1.3     veh-h
Capacity from ATS, CdATS                                   741     veh/h
Capacity from PTSF, CdPTSF                                 1674    veh/h
Directional Capacity                                       741     veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                                 0.9     mi
Length of two-lane highway upstream of the passing lane, Lu          -       mi
Length of passing lane including tapers, Lpl                         -       mi
Average travel speed, ATSd (from above)                              43.2    mi/h
Percent time-spent-following, PTSFd (from above)                     59.2
Level of service, LOSd (from above)                                  D

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde             -       mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld          -       mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                            -
Average travel speed including passing lane, ATSpl                   -
Percent free flow speed including passing lane, PFFSpl               0.0     %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde            -       mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld            -       mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                             -
Percent time-spent-following
    including passing lane, PTSFpl                                   -       %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl             E
Peak 15-min total travel time, TT15                        -       veh-h

__________________________ Bicycle Level of Service __________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 246.6 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 9.48 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | PM Peak |
| Highway | SR 28 - Proposed CL SBX2 |
| From/To | Pine Furnace to Mechling Rd |
| Jurisdiction | Rayburn Township, Armstrong Co |
| Analysis Year | 2019 |
| Description | SR 28 Corridor Study |

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.95 | |
| Shoulder width | 4.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.88 | mi | % No-passing zones | 100 | % |
| Up/down | 5.5 | % | Access point density | 9 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 182 | veh/h |
| Opposing direction volume, Vo | 295 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 9.7 | | 1.4 | |
| PCE for RVs, ER | 1.5 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.469 | | 0.951 | |
| Grade adj. factor,(note-1) fg | 0.56 | | 1.00 | |
| Directional flow rate,(note-2) vi | 729 | pc/h | 327 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 1.7 | mi/h |
| Adj. for access point density,(note-3) fA | 2.3 | mi/h |
| Free-flow speed, FFSd | 56.0 | mi/h |
| Adjustment for no-passing zones, fnp | 3.4 | mi/h |
| Average travel speed, ATSd | 44.4 | mi/h |
| Percent Free Flow Speed, PFFS | 79.3 | % |

## Percent Time-Spent-Following

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 1.0 | | 1.1 | |
| PCE for RVs, ER | 1.0 | | 1.0 | |
| Heavy-vehicle adjustment factor, fHV | 1.000 | | 0.987 | |
| Grade adjustment factor,(note-1) fg | 1.00 | | 1.00 | |
| Directional flow rate,(note-2) vi | 192 | pc/h | 315 | pc/h |

| | | |
|---|---|---|
| Base percent time-spent-following,(note-4) BPTSFd | 23.8 | % |
| Adjustment for no-passing zones, fnp | 54.0 | |
| Percent time-spent-following, PTSFd | 44.2 | % |

## Level of Service and Other Performance Measures

| | | |
|---|---|---|
| Level of service, LOS | D | |
| Volume to capacity ratio, v/c | 0.24 | |
| Peak 15-min vehicle-miles of travel, VMT15 | 43 | veh-mi |
| Peak-hour vehicle-miles of travel, VMT60 | 164 | veh-mi |
| Peak 15-min total travel time, TT15 | 1.0 | veh-h |
| Capacity from ATS, CdATS | 802 | veh/h |
| Capacity from PTSF, CdPTSF | 1677 | veh/h |
| Directional Capacity | 802 | veh/h |

## Passing Lane Analysis

| | | |
|---|---|---|
| Total length of analysis segment, Lt | 0.9 | mi |
| Length of two-lane highway upstream of the passing lane, Lu | - | mi |
| Length of passing lane including tapers, Lpl | - | mi |
| Average travel speed, ATSd (from above) | 44.4 | mi/h |
| Percent time-spent-following, PTSFd (from above) | 44.2 | |
| Level of service, LOSd (from above) | D | |

## Average Travel Speed with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld | - | mi |
| Adj. factor for the effect of passing lane on average speed, fpl | - | |
| Average travel speed including passing lane, ATSpl | - | |
| Percent free flow speed including passing lane, PFFSpl | 0.0 | % |

## Percent Time-Spent-Following with Passing Lane

| | | |
|---|---|---|
| Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde | - | mi |
| Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld | - | mi |
| Adj. factor for the effect of passing lane on percent time-spent-following, fpl | - | |
| Percent time-spent-following including passing lane, PTSFpl | - | % |

## Level of Service and Other Performance Measures with Passing Lane

| | | |
|---|---|---|
| Level of service including passing lane, LOSpl | E | |
| Peak 15-min total travel time, TT15 | - | veh-h |

## Bicycle Level of Service

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 191.6 |
| Effective width of outside lane, We | 15.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 8.37 |
| Bicycle LOS | F |

Notes:

1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

HCS7: Two-Lane Highways Release 7.7

Phone: Fax:
E-Mail:

## Directional Two-Lane Highway Segment Analysis

| | |
|---|---|
| Analyst | French |
| Agency/Co. | French Engineering |
| Date Performed | 1/30/2020 |
| Analysis Time Period | AM Peak |
| Highway | SR 28 - Existing CL NB1 |
| From/To | 0.5 miles north of SR 85 |
| Jurisdiction | Rayburn Township, Armstrong Co |
| Analysis Year | 2019 |

Description SR 28 Corridor Study

## Input Data

| | | | | | |
|---|---|---|---|---|---|
| Highway class | Class 1 | | Peak hour factor, PHF | 0.82 | |
| Shoulder width | 6.0 | ft | % Trucks and buses | 13 | % |
| Lane width | 11.0 | ft | % Trucks crawling | 0.0 | % |
| Segment length | 0.9 | mi | Truck crawl speed | 0.0 | mi/hr |
| Terrain type | Specific Grade | | % Recreational vehicles | 0 | % |
| Grade: Length | 0.73 | mi | % No-passing zones | 0 | % |
| Up/down | 5.5 | % | Access point density | 1 | /mi |

| | | |
|---|---|---|
| Analysis direction volume, Vd | 220 | veh/h |
| Opposing direction volume, Vo | 403 | veh/h |

## Average Travel Speed

| Direction | Analysis(d) | | Opposing (o) | |
|---|---|---|---|---|
| PCE for trucks, ET | 8.9 | | 1.2 | |
| PCE for RVs, ER | 1.3 | | 1.0 | |
| Heavy-vehicle adj. factor,(note-5) fHV | 0.492 | | 0.975 | |
| Grade adj. factor,(note-1) fg | 0.61 | | 1.00 | |
| Directional flow rate,(note-2) vi | 894 | pc/h | 504 | pc/h |

| | | |
|---|---|---|
| Free-Flow Speed from Field Measurement: | | |
| Field measured speed,(note-3) S FM | - | mi/h |
| Observed total demand,(note-3) V | - | veh/h |
| Estimated Free-Flow Speed: | | |
| Base free-flow speed,(note-3) BFFS | 60.0 | mi/h |
| Adj. for lane and shoulder width,(note-3) fLS | 0.4 | mi/h |
| Adj. for access point density,(note-3) fA | 0.3 | mi/h |
| Free-flow speed, FFSd | 59.3 | mi/h |
| Adjustment for no-passing zones, fnp | 1.2 | mi/h |
| Average travel speed, ATSd | 47.3 | mi/h |
| Percent Free Flow Speed, PFFS | 79.7 | % |

```
_________________________Percent Time-Spent-Following_________________________

Direction                                  Analysis(d)        Opposing (o)
PCE for trucks, ET                             1.0                1.0
PCE for RVs, ER                                1.0                1.0
Heavy-vehicle adjustment factor, fHV           1.000              1.000
Grade adjustment factor,(note-1) fg            1.00               1.00
Directional flow rate,(note-2) vi              268    pc/h        491     pc/h
Base percent time-spent-following,(note-4) BPTSFd  33.7   %
Adjustment for no-passing zones, fnp               12.2
Percent time-spent-following, PTSFd                38.0   %

________________Level of Service and Other Performance Measures_______________

Level of service, LOS                              C
Volume to capacity ratio, v/c                      0.32
Peak 15-min vehicle-miles of travel, VMT15         60      veh-mi
Peak-hour vehicle-miles of travel, VMT60           198     veh-mi
Peak 15-min total travel time, TT15                1.3     veh-h
Capacity from ATS, CdATS                           836     veh/h
Capacity from PTSF, CdPTSF                         1700    veh/h
Directional Capacity                               836     veh/h

_____________________________Passing Lane Analysis____________________________

Total length of analysis segment, Lt                         0.9     mi
Length of two-lane highway upstream of the passing lane, Lu  0.0     mi
Length of passing lane including tapers, Lpl                 0.9     mi
Average travel speed, ATSd (from above)                      47.3    mi/h
Percent time-spent-following, PTSFd (from above)             38.0
Level of service, LOSd (from above)                          C

___________________Average Travel Speed  with Passing Lane____________________

Downstream length of two-lane highway within effective
    length of passing lane for average travel speed, Lde     0.00    mi
Length of two-lane highway downstream of effective
    length of the passing lane for average travel speed, Ld  0.00    mi
Adj. factor for the effect of passing lane
    on average speed, fpl                                    1.14
Average travel speed including passing lane, ATSpl           53.9
Percent free flow speed including passing lane, PFFSpl       90.8    %

________________Percent Time-Spent-Following with Passing Lane________________

Downstream length of two-lane highway within effective length
    of passing lane for percent time-spent-following, Lde    0.00    mi
Length of two-lane highway downstream of effective length of
    the passing lane for percent time-spent-following, Ld    0.00    mi
Adj. factor for the effect of passing lane
    on percent time-spent-following, fpl                     0.20
Percent time-spent-following
    including passing lane, PTSFpl                           7.6     %

______Level of Service and Other Performance Measures with Passing Lane ______

Level of service including passing lane, LOSpl     B
Peak 15-min total travel time, TT15                1.1     veh-h

__________________________ Bicycle Level of Service ___________________________
```

| | |
|---|---|
| Posted speed limit, Sp | 55 |
| Percent of segment with occupied on-highway parking | 0 |
| Pavement rating, P | 3 |
| Flow rate in outside lane, vOL | 268.3 |
| Effective width of outside lane, We | 23.00 |
| Effective speed factor, St | 4.79 |
| Bicycle LOS Score, BLOS | 7.02 |
| Bicycle LOS | F |

Notes:
1. Note that the adjustment factor for level terrain is 1.00, as level terrain is one of the base conditions. For the purpose of grade adjustment, specific dewngrade segments are treated as level terrain.
2. If vi (vd or vo ) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only and for v>200 veh/h.
4. For the analysis direction only.
5. Use alternative Exhibit 15-14 if some trucks operate at crawl speeds on a specific downgrade.

# APPENDIX C
## Design Criteria

# 25 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

1 **DESIGN CRITERIA MATRIX**
MPMS NO. N/A
SR 28 SEC N/A , Clarion COUNTY

2 **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

3 **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Suburban Center
TOPOGRAPHY Rolling
REMARKS New Bethlehem

4 **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 8896 (2017)
DESIGN YEAR ADT (Average Daily Traffic) 10229
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 818
D (Directional Distribution) 55
T (Truck Percentage) 5

| 5 Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 25 MPH | 30-35 MPH | 25 MPH | No | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 10' to 12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 8' | 4'-6' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | 44' | 28'-36' | 44' | Yes | DM-2, Sec. 1.2C | |
| Minimum Horizontal Radius | | | 600' | 231' to 340' | 600' | No | AASHTO, Table 3-9 | * 25 mph, minimum radius is 144' |
| Maximum Superelevation Rate | | | Varies | 6.0% | 6.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.10% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 103 |
| | Maximum | | 2.90% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 90 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 200'-250' | 200' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 335' to 390' | 280' | No | AASHTO, Table 9-6 | * 25 mph, minimum ISD is 280' |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2. Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | N/A | N/A | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

6

Any pedestrian and bicycle concerns/needs? Explain. Sidewalks, multimodal
Any ADA compliance issues? Explain. ADA ramps on corners through town
Any transit issues? Explain.
Any additional design issues? Explain.

# TABLE 1.2
# ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

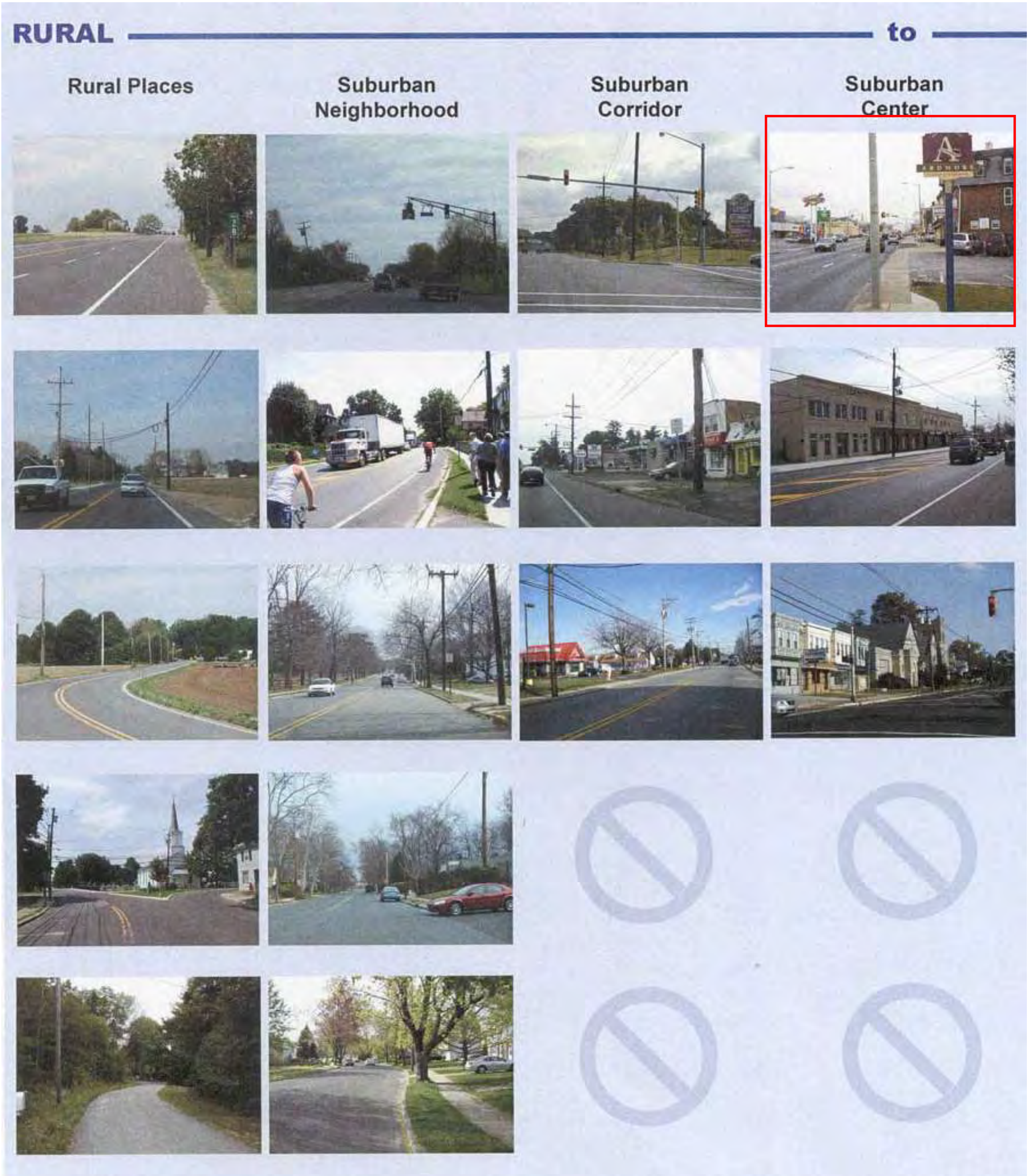
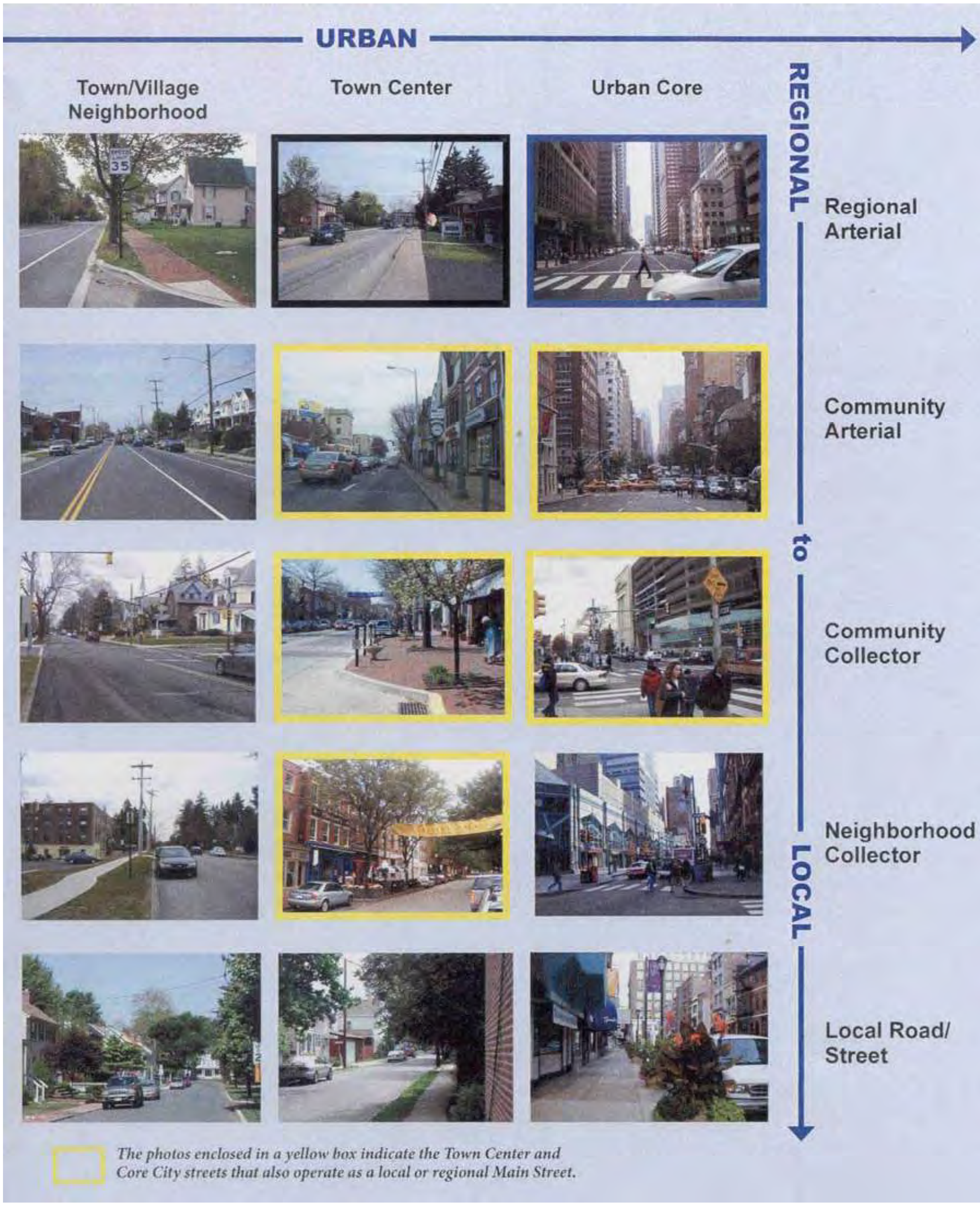


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-9. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 6%**

| Metric | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 20 km/h | $V_d$ = 30 km/h | $V_d$ = 40 km/h | $V_d$ = 50 km/h | $V_d$ = 60 km/h | $V_d$ = 70 km/h | $V_d$ = 80 km/h | $V_d$ = 90 km/h | $V_d$ = 100 km/h | $V_d$ = 110 km/h | $V_d$ = 120 km/h | $V_d$ = 130 km/h |
| *e* (%) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) |
| NC | 194 | 421 | 738 | 1050 | 1440 | 1910 | 2360 | 2880 | 3510 | 4060 | 4770 | 5240 |
| RC | 138 | 299 | 525 | 750 | 1030 | 1380 | 1710 | 2090 | 2560 | 2970 | 3510 | 3880 |
| 2.2 | 122 | 265 | 465 | 668 | 919 | 1230 | 1530 | 1880 | 2300 | 2670 | 3160 | 3500 |
| 2.4 | 109 | 236 | 415 | 599 | 825 | 1110 | 1380 | 1700 | 2080 | 2420 | 2870 | 3190 |
| 2.6 | 97 | 212 | 372 | 540 | 746 | 1000 | 1260 | 1540 | 1890 | 2210 | 2630 | 2930 |
| 2.8 | 87 | 190 | 334 | 488 | 676 | 910 | 1150 | 1410 | 1730 | 2020 | 2420 | 2700 |
| 3.0 | 78 | 170 | 300 | 443 | 615 | 831 | 1050 | 1290 | 1590 | 1870 | 2240 | 2510 |
| 3.2 | 70 | 152 | 269 | 402 | 561 | 761 | 959 | 1190 | 1470 | 1730 | 2080 | 2330 |
| 3.4 | 61 | 133 | 239 | 364 | 511 | 697 | 882 | 1100 | 1360 | 1600 | 1940 | 2180 |
| 3.6 | 51 | 113 | 206 | 329 | 465 | 640 | 813 | 1020 | 1260 | 1490 | 1810 | 2050 |
| 3.8 | 42 | 96 | 177 | 294 | 422 | 586 | 749 | 939 | 1170 | 1390 | 1700 | 1930 |
| 4.0 | 36 | 82 | 155 | 261 | 380 | 535 | 690 | 870 | 1090 | 1300 | 1590 | 1820 |
| 4.2 | 31 | 72 | 136 | 234 | 343 | 488 | 635 | 806 | 1010 | 1220 | 1500 | 1720 |
| 4.4 | 27 | 63 | 121 | 210 | 311 | 446 | 584 | 746 | 938 | 1140 | 1410 | 1630 |
| 4.6 | 24 | 56 | 108 | 190 | 283 | 408 | 538 | 692 | 873 | 1070 | 1330 | 1540 |
| 4.8 | 21 | 50 | 97 | 172 | 258 | 374 | 496 | 641 | 812 | 997 | 1260 | 1470 |
| 5.0 | 19 | 45 | 88 | 156 | 235 | 343 | 457 | 594 | 755 | 933 | 1190 | 1400 |
| 5.2 | 17 | 40 | 79 | 142 | 214 | 315 | 421 | 549 | 701 | 871 | 1120 | 1330 |
| 5.4 | 15 | 36 | 71 | 128 | 195 | 287 | 386 | 506 | 648 | 810 | 1060 | 1260 |
| 5.6 | 13 | 32 | 63 | 115 | 176 | 260 | 351 | 463 | 594 | 747 | 980 | 1190 |
| 5.8 | 11 | 28 | 56 | 102 | 156 | 232 | 315 | 416 | 537 | 679 | 900 | 1110 |
| 6.0 | 8 | 21 | 43 | 79 | 123 | 184 | 252 | 336 | 437 | 560 | 756 | 951 |

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| *e* (%) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) |
| NC | 868 | 1580 | 2290 | 3130 | 4100 | 5230 | 6480 | 7870 | 9410 | 11100 | 12600 | 14100 | 15700 | 17400 |
| RC | 614 | 1120 | 1630 | 2240 | 2950 | 3770 | 4680 | 5700 | 6820 | 8060 | 9130 | 10300 | 11500 | 12900 |
| 2.2 | 543 | 991 | 1450 | 2000 | 2630 | 3370 | 4190 | 5100 | 6110 | 7230 | 8200 | 9240 | 10400 | 11600 |
| 2.4 | 482 | 884 | 1300 | 1790 | 2360 | 3030 | 3770 | 4600 | 5520 | 6540 | 7430 | 8380 | 9420 | 10600 |
| 2.6 | 430 | 791 | 1170 | 1610 | 2130 | 2740 | 3420 | 4170 | 5020 | 5950 | 6770 | 7660 | 8620 | 9670 |
| 2.8 | 384 | 709 | 1050 | 1460 | 1930 | 2490 | 3110 | 3800 | 4580 | 5440 | 6200 | 7030 | 7930 | 8910 |
| 3.0 | 341 | 635 | 944 | 1320 | 1760 | 2270 | 2840 | 3480 | 4200 | 4990 | 5710 | 6490 | 7330 | 8260 |
| 3.2 | 300 | 566 | 850 | 1200 | 1600 | 2080 | 2600 | 3200 | 3860 | 4600 | 5280 | 6010 | 6810 | 7680 |
| 3.4 | 256 | 498 | 761 | 1080 | 1460 | 1900 | 2390 | 2940 | 3560 | 4250 | 4890 | 5580 | 6340 | 7180 |
| 3.6 | 209 | 422 | 673 | 972 | 1320 | 1740 | 2190 | 2710 | 3290 | 3940 | 4540 | 5210 | 5930 | 6720 |
| 3.8 | 176 | 358 | 583 | 864 | 1190 | 1590 | 2010 | 2490 | 3040 | 3650 | 4230 | 4860 | 5560 | 6320 |
| 4.0 | 151 | 309 | 511 | 766 | 1070 | 1440 | 1840 | 2300 | 2810 | 3390 | 3950 | 4550 | 5220 | 5950 |
| 4.2 | 131 | 270 | 452 | 684 | 960 | 1310 | 1680 | 2110 | 2590 | 3140 | 3680 | 4270 | 4910 | 5620 |
| 4.4 | 116 | 238 | 402 | 615 | 868 | 1190 | 1540 | 1940 | 2400 | 2920 | 3440 | 4010 | 4630 | 5320 |
| 4.6 | 102 | 212 | 360 | 555 | 788 | 1090 | 1410 | 1780 | 2210 | 2710 | 3220 | 3770 | 4380 | 5040 |
| 4.8 | 91 | 189 | 324 | 502 | 718 | 995 | 1300 | 1640 | 2050 | 2510 | 3000 | 3550 | 4140 | 4790 |
| 5.0 | 82 | 169 | 292 | 456 | 654 | 911 | 1190 | 1510 | 1890 | 2330 | 2800 | 3330 | 3910 | 4550 |
| 5.2 | 73 | 152 | 264 | 413 | 595 | 833 | 1090 | 1390 | 1750 | 2160 | 2610 | 3120 | 3690 | 4320 |
| 5.4 | 65 | 136 | 237 | 373 | 540 | 759 | 995 | 1280 | 1610 | 1990 | 2420 | 2910 | 3460 | 4090 |
| 5.6 | 58 | 121 | 212 | 335 | 487 | 687 | 903 | 1160 | 1470 | 1830 | 2230 | 2700 | 3230 | 3840 |
| 5.8 | 51 | 106 | 186 | 296 | 431 | 611 | 806 | 1040 | 1320 | 1650 | 2020 | 2460 | 2970 | 3560 |
| 6.0 | 39 | 81 | 144 | 231 | 340 | 485 | 643 | 833 | 1060 | 1330 | 1660 | 2040 | 2500 | 3050 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars: Calculated (m) | Intersection Sight Distance for Passenger Cars: Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars: Calculated (ft) | Intersection Sight Distance for Passenger Cars: Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 35 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

(1) **DESIGN CRITERIA MATRIX**
MPMS NO. N/A Armstrong COUNTY
SR 28 SEC N/A , Clarion COUNTY
Jefferson COUNTY

(2) **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

(3) **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Suburban Center
TOPOGRAPHY Rolling
REMARKS South Bethlehem, Hawthorn, Summerville

(4) **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 8996 (2017)
DESIGN YEAR ADT (Average Daily Traffic) 10344
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 828
D (Directional Distribution) 55
T (Truck Percentage) 5

| (5) Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 35 MPH | 30-35 MPH | 35 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 10'-12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 2'-8' | 4'-6' | 6' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | 44' | 28'-36' | 44' | Yes | DM-2, Table 1.2G | |
| Minimum Horizontal Radius | | | 75' | 231' to 340' | 340' | Yes | AASHTO, Table 3-9 | |
| Maximum Superelevation Rate | | | Varies | 6.0% | 6.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.40% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 110 |
| | Maximum | | 1.90% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 117 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 200' to 250' | 250' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 335' to 390' | 390' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | N/A | Yes | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

(6)
Any pedestrian and bicycle concerns/needs? Explain. Sidewalks, multimodal
Any ADA compliance issues? Explain. ADA ramps on corners through town
Any transit issues? Explain.
Any additional design issues? Explain. 15 mph curve entering New Bethleham

## TABLE 1.2
## ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

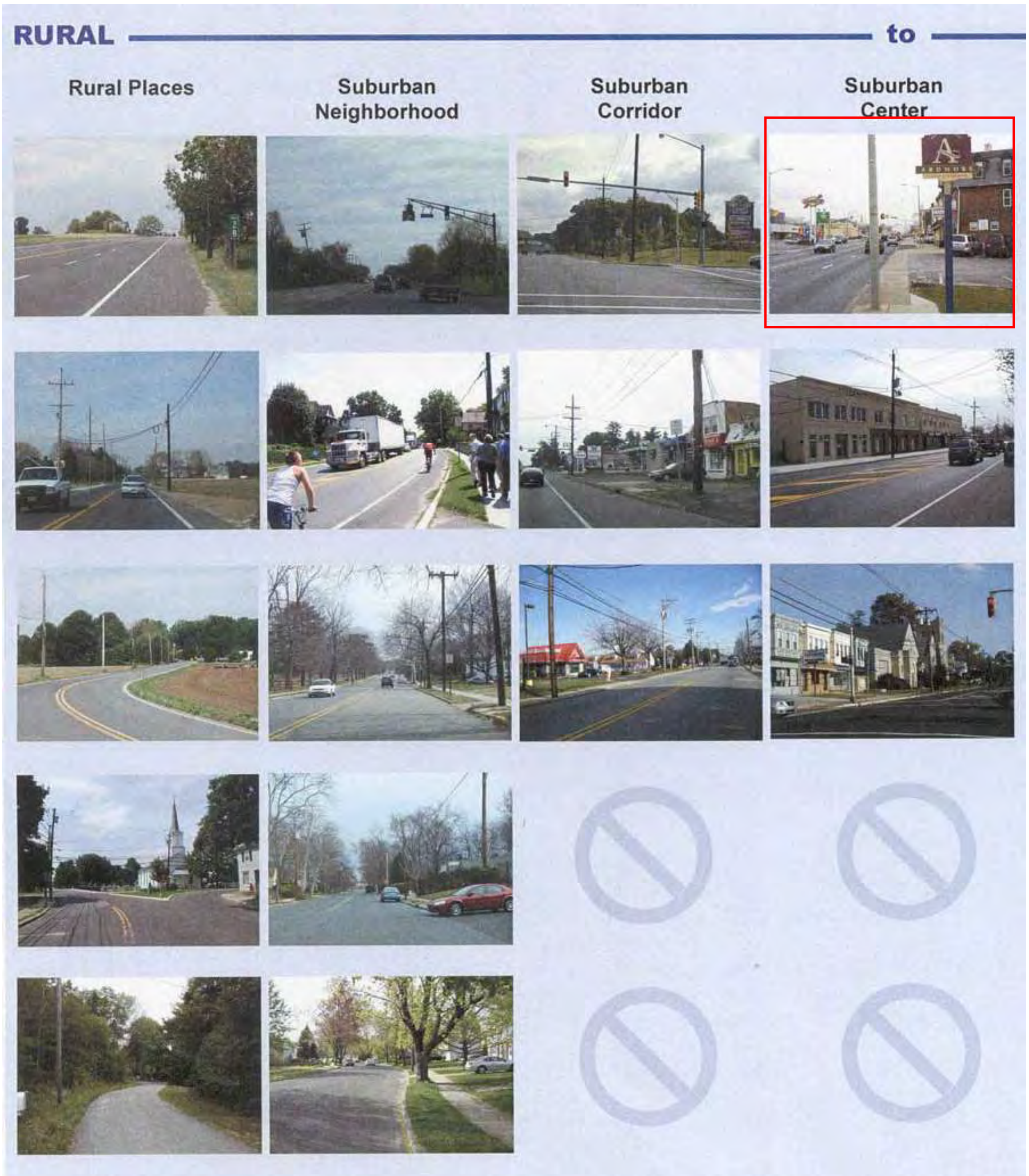
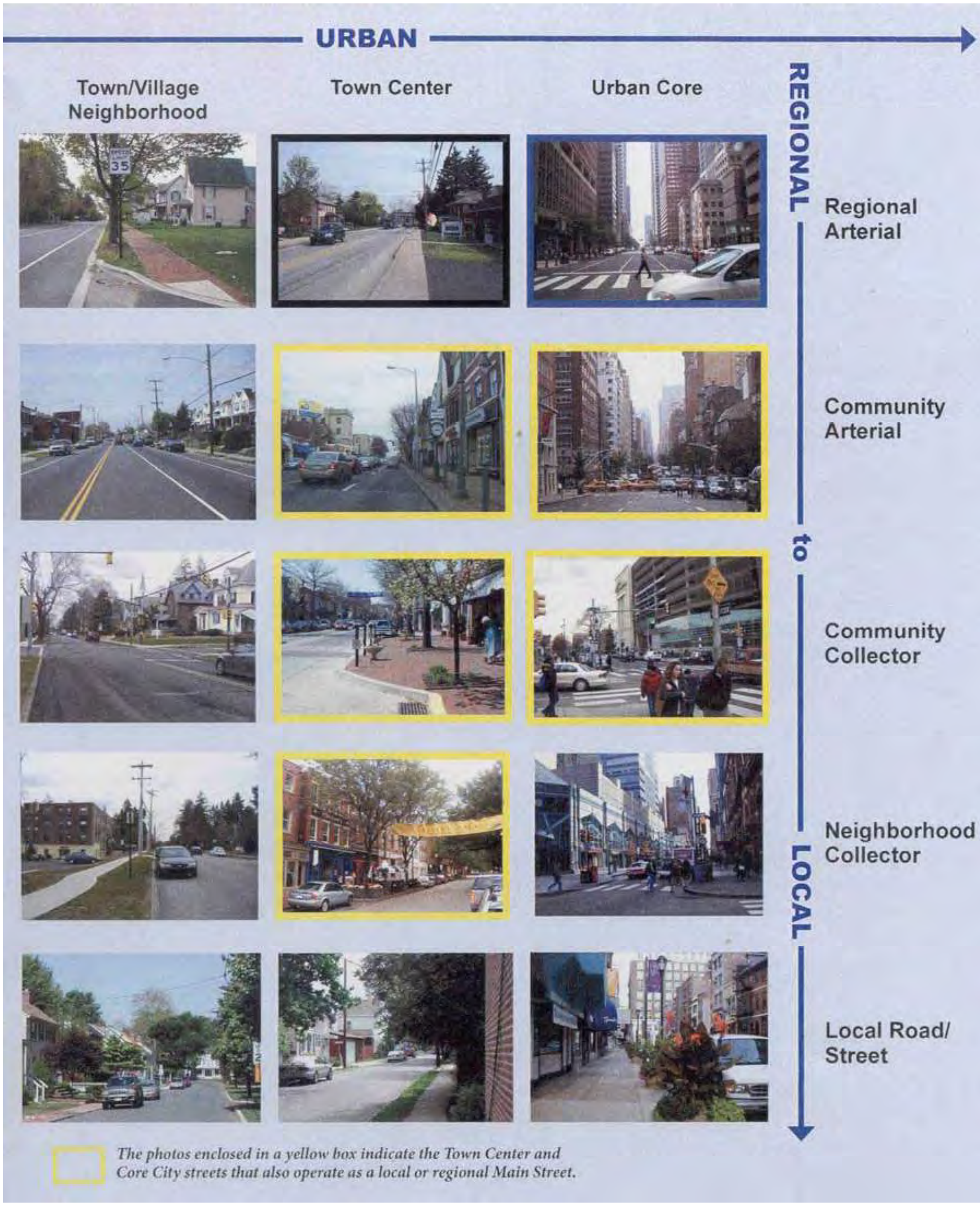


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-9. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 6%**

| Metric | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 20 km/h | $V_d$ = 30 km/h | $V_d$ = 40 km/h | $V_d$ = 50 km/h | $V_d$ = 60 km/h | $V_d$ = 70 km/h | $V_d$ = 80 km/h | $V_d$ = 90 km/h | $V_d$ = 100 km/h | $V_d$ = 110 km/h | $V_d$ = 120 km/h | $V_d$ = 130 km/h |
| $e$ (%) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) |
| NC | 194 | 421 | 738 | 1050 | 1440 | 1910 | 2360 | 2880 | 3510 | 4060 | 4770 | 5240 |
| RC | 138 | 299 | 525 | 750 | 1030 | 1380 | 1710 | 2090 | 2560 | 2970 | 3510 | 3880 |
| 2.2 | 122 | 265 | 465 | 668 | 919 | 1230 | 1530 | 1880 | 2300 | 2670 | 3160 | 3500 |
| 2.4 | 109 | 236 | 415 | 599 | 825 | 1110 | 1380 | 1700 | 2080 | 2420 | 2870 | 3190 |
| 2.6 | 97 | 212 | 372 | 540 | 746 | 1000 | 1260 | 1540 | 1890 | 2210 | 2630 | 2930 |
| 2.8 | 87 | 190 | 334 | 488 | 676 | 910 | 1150 | 1410 | 1730 | 2020 | 2420 | 2700 |
| 3.0 | 78 | 170 | 300 | 443 | 615 | 831 | 1050 | 1290 | 1590 | 1870 | 2240 | 2510 |
| 3.2 | 70 | 152 | 269 | 402 | 561 | 761 | 959 | 1190 | 1470 | 1730 | 2080 | 2330 |
| 3.4 | 61 | 133 | 239 | 364 | 511 | 697 | 882 | 1100 | 1360 | 1600 | 1940 | 2180 |
| 3.6 | 51 | 113 | 206 | 329 | 465 | 640 | 813 | 1020 | 1260 | 1490 | 1810 | 2050 |
| 3.8 | 42 | 96 | 177 | 294 | 422 | 586 | 749 | 939 | 1170 | 1390 | 1700 | 1930 |
| 4.0 | 36 | 82 | 155 | 261 | 380 | 535 | 690 | 870 | 1090 | 1300 | 1590 | 1820 |
| 4.2 | 31 | 72 | 136 | 234 | 343 | 488 | 635 | 806 | 1010 | 1220 | 1500 | 1720 |
| 4.4 | 27 | 63 | 121 | 210 | 311 | 446 | 584 | 746 | 938 | 1140 | 1410 | 1630 |
| 4.6 | 24 | 56 | 108 | 190 | 283 | 408 | 538 | 692 | 873 | 1070 | 1330 | 1540 |
| 4.8 | 21 | 50 | 97 | 172 | 258 | 374 | 496 | 641 | 812 | 997 | 1260 | 1470 |
| 5.0 | 19 | 45 | 88 | 156 | 235 | 343 | 457 | 594 | 755 | 933 | 1190 | 1400 |
| 5.2 | 17 | 40 | 79 | 142 | 214 | 315 | 421 | 549 | 701 | 871 | 1120 | 1330 |
| 5.4 | 15 | 36 | 71 | 128 | 195 | 287 | 386 | 506 | 648 | 810 | 1060 | 1260 |
| 5.6 | 13 | 32 | 63 | 115 | 176 | 260 | 351 | 463 | 594 | 747 | 980 | 1190 |
| 5.8 | 11 | 28 | 56 | 102 | 156 | 232 | 315 | 416 | 537 | 679 | 900 | 1110 |
| 6.0 | 8 | 21 | 43 | 79 | 123 | 184 | 252 | 336 | 437 | 560 | 756 | 951 |

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| $e$ (%) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) |
| NC | 868 | 1580 | 2290 | 3130 | 4100 | 5230 | 6480 | 7870 | 9410 | 11100 | 12600 | 14100 | 15700 | 17400 |
| RC | 614 | 1120 | 1630 | 2240 | 2950 | 3770 | 4680 | 5700 | 6820 | 8060 | 9130 | 10300 | 11500 | 12900 |
| 2.2 | 543 | 991 | 1450 | 2000 | 2630 | 3370 | 4190 | 5100 | 6110 | 7230 | 8200 | 9240 | 10400 | 11600 |
| 2.4 | 482 | 884 | 1300 | 1790 | 2360 | 3030 | 3770 | 4600 | 5520 | 6540 | 7430 | 8380 | 9420 | 10600 |
| 2.6 | 430 | 791 | 1170 | 1610 | 2130 | 2740 | 3420 | 4170 | 5020 | 5950 | 6770 | 7660 | 8620 | 9670 |
| 2.8 | 384 | 709 | 1050 | 1460 | 1930 | 2490 | 3110 | 3800 | 4580 | 5440 | 6200 | 7030 | 7930 | 8910 |
| 3.0 | 341 | 635 | 944 | 1320 | 1760 | 2270 | 2840 | 3480 | 4200 | 4990 | 5710 | 6490 | 7330 | 8260 |
| 3.2 | 300 | 566 | 850 | 1200 | 1600 | 2080 | 2600 | 3200 | 3860 | 4600 | 5280 | 6010 | 6810 | 7680 |
| 3.4 | 256 | 498 | 761 | 1080 | 1460 | 1900 | 2390 | 2940 | 3560 | 4250 | 4890 | 5580 | 6340 | 7180 |
| 3.6 | 209 | 422 | 673 | 972 | 1320 | 1740 | 2190 | 2710 | 3290 | 3940 | 4540 | 5210 | 5930 | 6720 |
| 3.8 | 176 | 358 | 583 | 864 | 1190 | 1590 | 2010 | 2490 | 3040 | 3650 | 4230 | 4860 | 5560 | 6320 |
| 4.0 | 151 | 309 | 511 | 766 | 1070 | 1440 | 1840 | 2300 | 2810 | 3390 | 3950 | 4550 | 5220 | 5950 |
| 4.2 | 131 | 270 | 452 | 684 | 960 | 1310 | 1680 | 2110 | 2590 | 3140 | 3680 | 4270 | 4910 | 5620 |
| 4.4 | 116 | 238 | 402 | 615 | 868 | 1190 | 1540 | 1940 | 2400 | 2920 | 3440 | 4010 | 4630 | 5320 |
| 4.6 | 102 | 212 | 360 | 555 | 788 | 1090 | 1410 | 1780 | 2210 | 2710 | 3220 | 3770 | 4380 | 5040 |
| 4.8 | 91 | 189 | 324 | 502 | 718 | 995 | 1300 | 1640 | 2050 | 2510 | 3000 | 3550 | 4140 | 4790 |
| 5.0 | 82 | 169 | 292 | 456 | 654 | 911 | 1190 | 1510 | 1890 | 2330 | 2800 | 3330 | 3910 | 4550 |
| 5.2 | 73 | 152 | 264 | 413 | 595 | 833 | 1090 | 1390 | 1750 | 2160 | 2610 | 3120 | 3690 | 4320 |
| 5.4 | 65 | 136 | 237 | 373 | 540 | 759 | 995 | 1280 | 1610 | 1990 | 2420 | 2910 | 3460 | 4090 |
| 5.6 | 58 | 121 | 212 | 335 | 487 | 687 | 903 | 1160 | 1470 | 1830 | 2230 | 2700 | 3230 | 3840 |
| 5.8 | 51 | 106 | 186 | 296 | 431 | 611 | 806 | 1040 | 1320 | 1650 | 2020 | 2460 | 2970 | 3560 |
| 6.0 | 39 | 81 | 144 | 231 | 340 | 485 | 643 | 833 | 1060 | 1330 | 1660 | 2040 | 2500 | 3050 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars: Calculated (m) | Intersection Sight Distance for Passenger Cars: Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars: Calculated (ft) | Intersection Sight Distance for Passenger Cars: Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 40 MPH DESIGN CRITERIA

BY: NVA　　DATE: 3/18/2020
CHK'D BY: JDW　　DATE: 4/1/2020

1 **DESIGN CRITERIA MATRIX**
MPMS NO. N/A　Jefferson COUNTY
SR 28 SEC N/A , Clarion COUNTY

2 **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N　　**STRAHNET? (Y/N)** N

3 **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Suburban Neighborhood
TOPOGRAPHY Rolling
REMARKS Distant, PA
North from New Bethlehem

4 **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 7196 (2019)
DESIGN YEAR ADT (Average Daily Traffic) 8274
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 745
D (Directional Distribution) 52
T (Truck Percentage) 8

| 5 Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 40 MPH | 35-40 MPH | 40 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 11'-12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 3'-8' | 8'-10' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | N/A | 38'-44' | N/A | N/A | DM-2, Sec 1.2C | |
| Minimum Horizontal Radius | | | 600' | 340'-485' | 600' | Yes | AASHTO, Table 3-9 | Entering Distant, PA |
| Maximum Superelevation Rate | | | Varies | 6.0% | 6.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 1.50% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 83 |
| | Maximum | | 6.90% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 81 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 250'-305' | 305' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 390'-445' | 445' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | N/A | N/A | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

6
Any pedestrian and bicycle concerns/needs? Explain.
Any ADA compliance issues? Explain.
Any transit issues? Explain.
Any additional design issues? Explain.

## TABLE 1.2
## ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

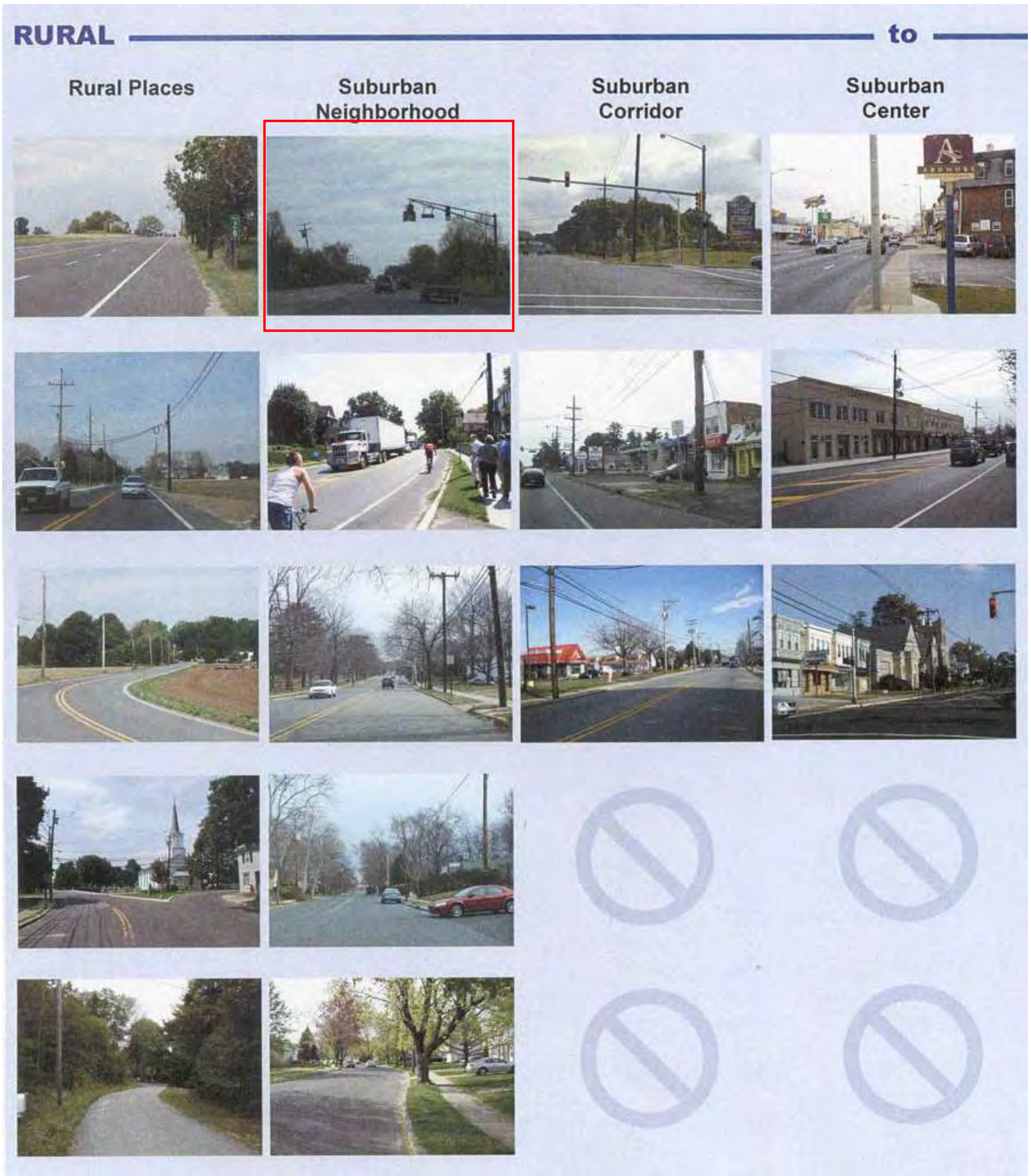
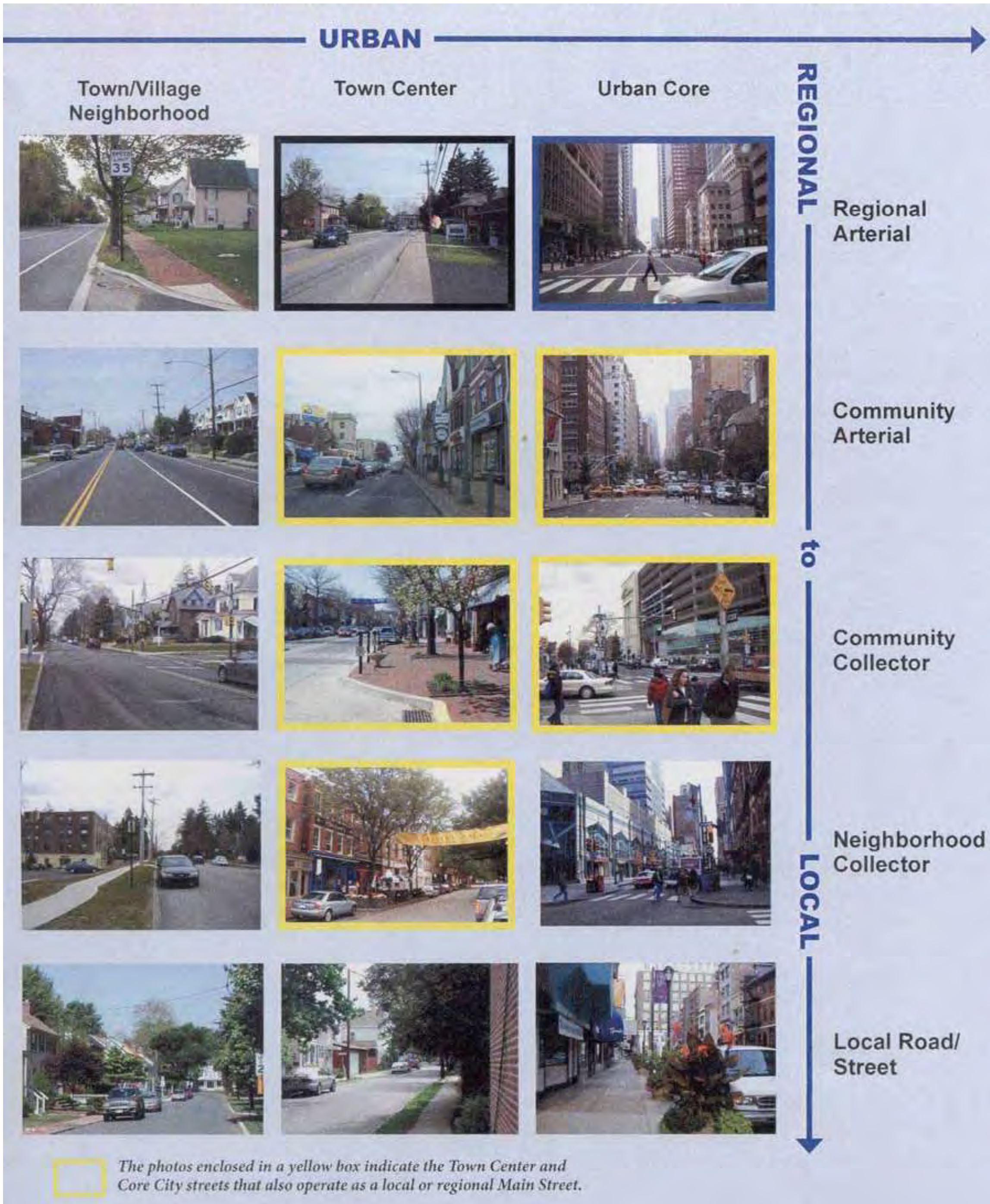


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-9. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 6%**

| Metric | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 20 km/h | $V_d$ = 30 km/h | $V_d$ = 40 km/h | $V_d$ = 50 km/h | $V_d$ = 60 km/h | $V_d$ = 70 km/h | $V_d$ = 80 km/h | $V_d$ = 90 km/h | $V_d$ = 100 km/h | $V_d$ = 110 km/h | $V_d$ = 120 km/h | $V_d$ = 130 km/h |
| $e$ (%) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) |
| NC | 194 | 421 | 738 | 1050 | 1440 | 1910 | 2360 | 2880 | 3510 | 4060 | 4770 | 5240 |
| RC | 138 | 299 | 525 | 750 | 1030 | 1380 | 1710 | 2090 | 2560 | 2970 | 3510 | 3880 |
| 2.2 | 122 | 265 | 465 | 668 | 919 | 1230 | 1530 | 1880 | 2300 | 2670 | 3160 | 3500 |
| 2.4 | 109 | 236 | 415 | 599 | 825 | 1110 | 1380 | 1700 | 2080 | 2420 | 2870 | 3190 |
| 2.6 | 97 | 212 | 372 | 540 | 746 | 1000 | 1260 | 1540 | 1890 | 2210 | 2630 | 2930 |
| 2.8 | 87 | 190 | 334 | 488 | 676 | 910 | 1150 | 1410 | 1730 | 2020 | 2420 | 2700 |
| 3.0 | 78 | 170 | 300 | 443 | 615 | 831 | 1050 | 1290 | 1590 | 1870 | 2240 | 2510 |
| 3.2 | 70 | 152 | 269 | 402 | 561 | 761 | 959 | 1190 | 1470 | 1730 | 2080 | 2330 |
| 3.4 | 61 | 133 | 239 | 364 | 511 | 697 | 882 | 1100 | 1360 | 1600 | 1940 | 2180 |
| 3.6 | 51 | 113 | 206 | 329 | 465 | 640 | 813 | 1020 | 1260 | 1490 | 1810 | 2050 |
| 3.8 | 42 | 96 | 177 | 294 | 422 | 586 | 749 | 939 | 1170 | 1390 | 1700 | 1930 |
| 4.0 | 36 | 82 | 155 | 261 | 380 | 535 | 690 | 870 | 1090 | 1300 | 1590 | 1820 |
| 4.2 | 31 | 72 | 136 | 234 | 343 | 488 | 635 | 806 | 1010 | 1220 | 1500 | 1720 |
| 4.4 | 27 | 63 | 121 | 210 | 311 | 446 | 584 | 746 | 938 | 1140 | 1410 | 1630 |
| 4.6 | 24 | 56 | 108 | 190 | 283 | 408 | 538 | 692 | 873 | 1070 | 1330 | 1540 |
| 4.8 | 21 | 50 | 97 | 172 | 258 | 374 | 496 | 641 | 812 | 997 | 1260 | 1470 |
| 5.0 | 19 | 45 | 88 | 156 | 235 | 343 | 457 | 594 | 755 | 933 | 1190 | 1400 |
| 5.2 | 17 | 40 | 79 | 142 | 214 | 315 | 421 | 549 | 701 | 871 | 1120 | 1330 |
| 5.4 | 15 | 36 | 71 | 128 | 195 | 287 | 386 | 506 | 648 | 810 | 1060 | 1260 |
| 5.6 | 13 | 32 | 63 | 115 | 176 | 260 | 351 | 463 | 594 | 747 | 980 | 1190 |
| 5.8 | 11 | 28 | 56 | 102 | 156 | 232 | 315 | 416 | 537 | 679 | 900 | 1110 |
| 6.0 | 8 | 21 | 43 | 79 | 123 | 184 | 252 | 336 | 437 | 560 | 756 | 951 |

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| $e$ (%) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) |
| NC | 868 | 1580 | 2290 | 3130 | 4100 | 5230 | 6480 | 7870 | 9410 | 11100 | 12600 | 14100 | 15700 | 17400 |
| RC | 614 | 1120 | 1630 | 2240 | 2950 | 3770 | 4680 | 5700 | 6820 | 8060 | 9130 | 10300 | 11500 | 12900 |
| 2.2 | 543 | 991 | 1450 | 2000 | 2630 | 3370 | 4190 | 5100 | 6110 | 7230 | 8200 | 9240 | 10400 | 11600 |
| 2.4 | 482 | 884 | 1300 | 1790 | 2360 | 3030 | 3770 | 4600 | 5520 | 6540 | 7430 | 8380 | 9420 | 10600 |
| 2.6 | 430 | 791 | 1170 | 1610 | 2130 | 2740 | 3420 | 4170 | 5020 | 5950 | 6770 | 7660 | 8620 | 9670 |
| 2.8 | 384 | 709 | 1050 | 1460 | 1930 | 2490 | 3110 | 3800 | 4580 | 5440 | 6200 | 7030 | 7930 | 8910 |
| 3.0 | 341 | 635 | 944 | 1320 | 1760 | 2270 | 2840 | 3480 | 4200 | 4990 | 5710 | 6490 | 7330 | 8260 |
| 3.2 | 300 | 566 | 850 | 1200 | 1600 | 2080 | 2600 | 3200 | 3860 | 4600 | 5280 | 6010 | 6810 | 7680 |
| 3.4 | 256 | 498 | 761 | 1080 | 1460 | 1900 | 2390 | 2940 | 3560 | 4250 | 4890 | 5580 | 6340 | 7180 |
| 3.6 | 209 | 422 | 673 | 972 | 1320 | 1740 | 2190 | 2710 | 3290 | 3940 | 4540 | 5210 | 5930 | 6720 |
| 3.8 | 176 | 358 | 583 | 864 | 1190 | 1590 | 2010 | 2490 | 3040 | 3650 | 4230 | 4860 | 5560 | 6320 |
| 4.0 | 151 | 309 | 511 | 766 | 1070 | 1440 | 1840 | 2300 | 2810 | 3390 | 3950 | 4550 | 5220 | 5950 |
| 4.2 | 131 | 270 | 452 | 684 | 960 | 1310 | 1680 | 2110 | 2590 | 3140 | 3680 | 4270 | 4910 | 5620 |
| 4.4 | 116 | 238 | 402 | 615 | 868 | 1190 | 1540 | 1940 | 2400 | 2920 | 3440 | 4010 | 4630 | 5320 |
| 4.6 | 102 | 212 | 360 | 555 | 788 | 1090 | 1410 | 1780 | 2210 | 2710 | 3220 | 3770 | 4380 | 5040 |
| 4.8 | 91 | 189 | 324 | 502 | 718 | 995 | 1300 | 1640 | 2050 | 2510 | 3000 | 3550 | 4140 | 4790 |
| 5.0 | 82 | 169 | 292 | 456 | 654 | 911 | 1190 | 1510 | 1890 | 2330 | 2800 | 3330 | 3910 | 4550 |
| 5.2 | 73 | 152 | 264 | 413 | 595 | 833 | 1090 | 1390 | 1750 | 2160 | 2610 | 3120 | 3690 | 4320 |
| 5.4 | 65 | 136 | 237 | 373 | 540 | 759 | 995 | 1280 | 1610 | 1990 | 2420 | 2910 | 3460 | 4090 |
| 5.6 | 58 | 121 | 212 | 335 | 487 | 687 | 903 | 1160 | 1470 | 1830 | 2230 | 2700 | 3230 | 3840 |
| 5.8 | 51 | 106 | 186 | 296 | 431 | 611 | 806 | 1040 | 1320 | 1650 | 2020 | 2460 | 2970 | 3560 |
| 6.0 | 39 | 81 | 144 | 231 | 340 | 485 | 643 | 833 | 1060 | 1330 | 1660 | 2040 | 2500 | 3050 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| | | Intersection Sight Distance for Passenger Cars | | | | Intersection Sight Distance for Passenger Cars | |
| Design Speed (km/h) | Stopping Sight Distance (m) | Calculated (m) | Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Calculated (ft) | Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 45 MPH DESIGN CRITERIA

BY: NVA    DATE: 3/18/2020
CHK'D BY: JDW    DATE: 4/1/2020

(1) **DESIGN CRITERIA MATRIX**
MPMS NO. N/A    Armstrong
SR 28 SEC N/A , Clarion COUNTY
Jefferson

(2) **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N    **STRAHNET? (Y/N)** N

(3) **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Rural
TOPOGRAPHY Rolling
REMARKS North of SR85, between New Bethlehem and Hawthrone, North of Summerville

(4) **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 7349 (2019)
DESIGN YEAR ADT (Average Daily Traffic) 8450
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 761
D (Directional Distribution) 59
T (Truck Percentage) 13

| (5) Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 45 MPH | 45 -55 MPH | 45 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 11' to 12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 4' | 8' to 10' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | N/A | 38' to 44' | N/A | N/A | DM-2, Sec 1.2C | |
| Minimum Horizontal Radius | | | 470' | 587' to 960' | 587' | Yes | AASHTO, Table 3-10b | |
| Maximum Superelevation Rate | | | varies | 8.0% | 8.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.10% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 103 |
| | Maximum | | 7.10% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 182 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | varies | 360' to 495' | 360' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | varies | 500' to 610' | 500' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | 16'-6" | Yes | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

(6)
Any pedestrian and bicycle concerns/needs? Explain. 25 mph curve speed reduction at trail crossing north of New Bethleham
Any ADA compliance issues? Explain.
Any transit issues? Explain.
Any additional design issues? Explain.

## TABLE 1.2
## ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

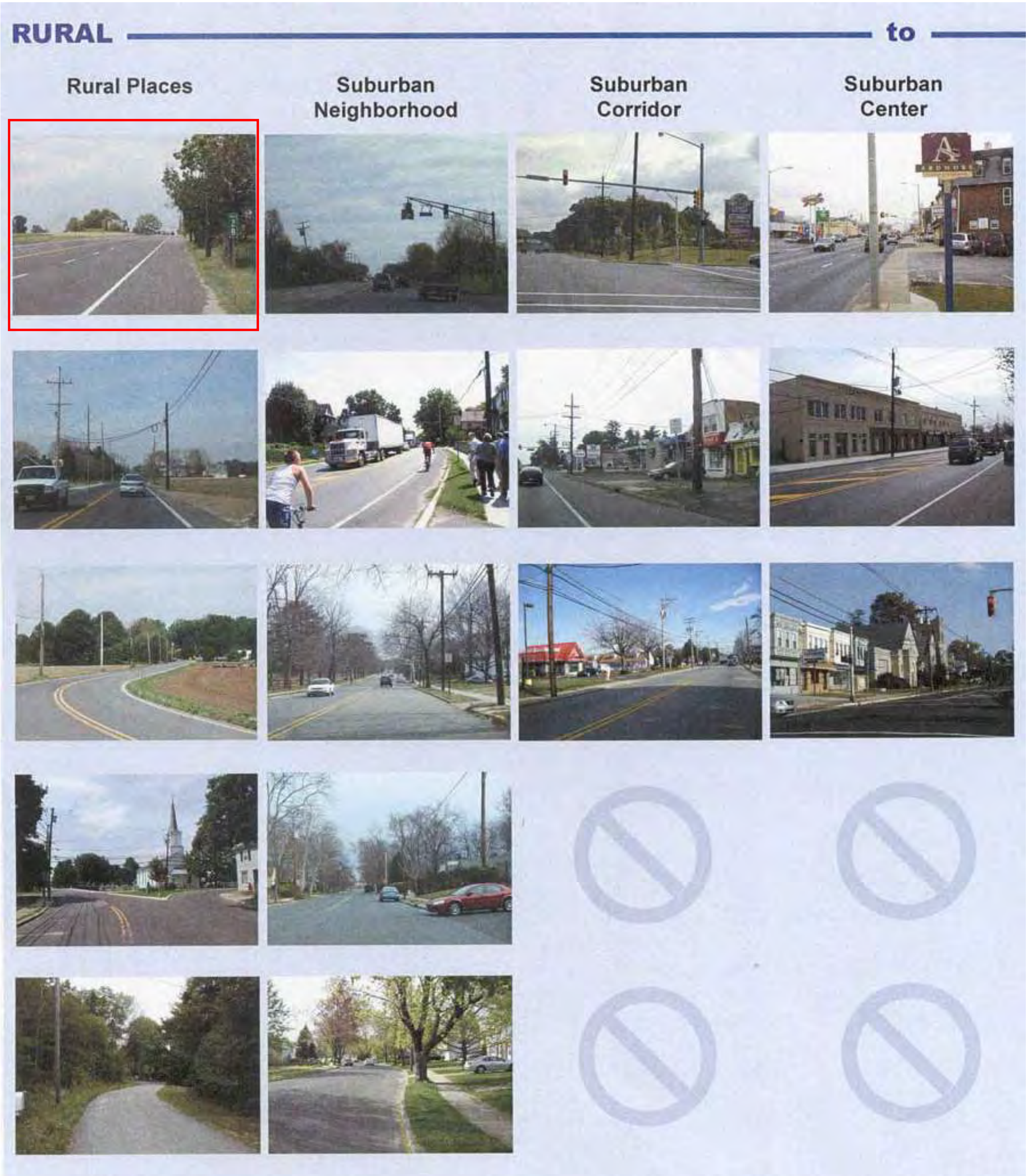
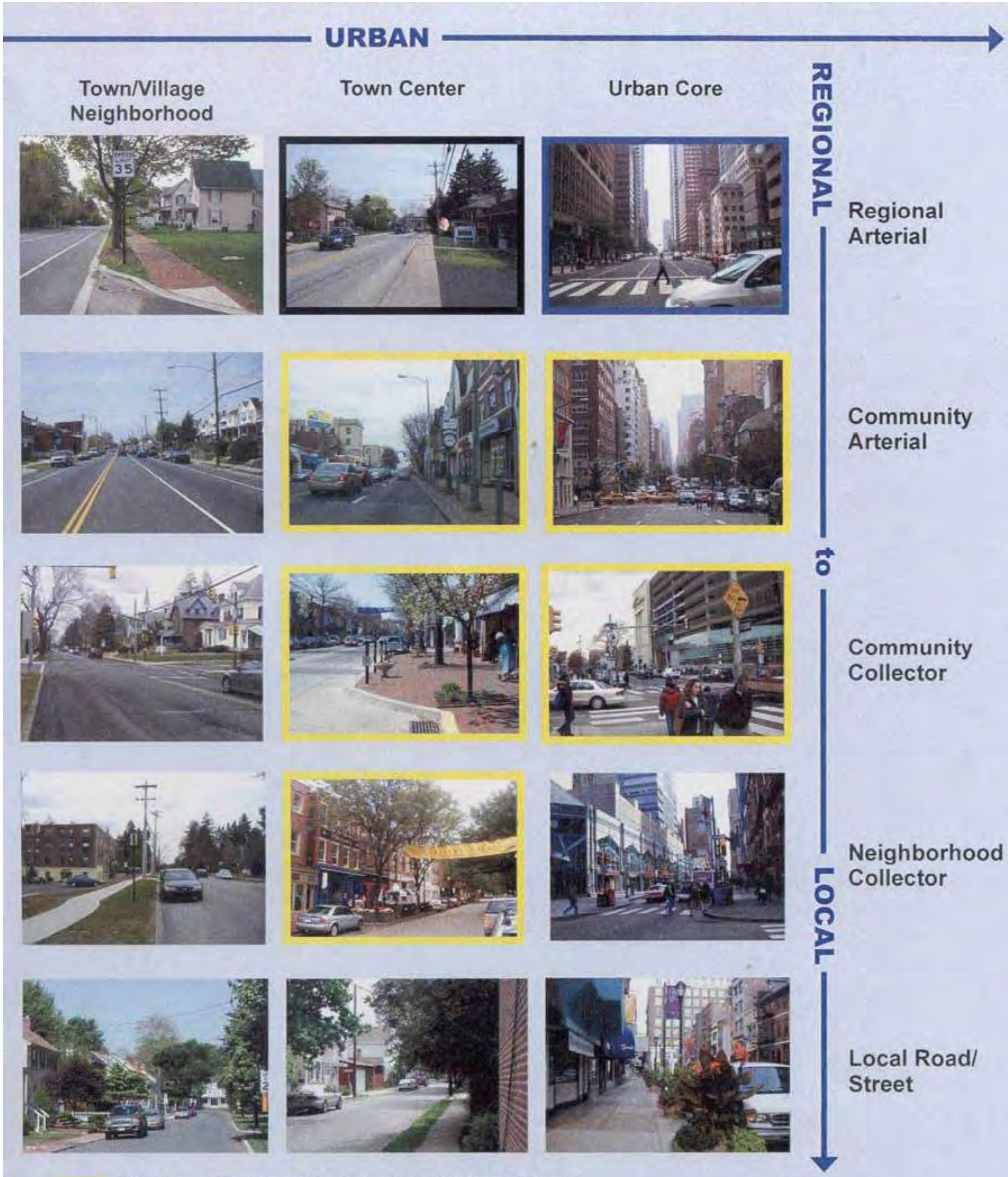


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**




*The photos enclosed in a yellow box indicate the Town Center and Core City streets that also operate as a local or regional Main Street.*

## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-10b. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 8%**

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| *e* (%) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) |
| NC | 932 | 1640 | 2370 | 3240 | 4260 | 5410 | 6710 | 8150 | 9720 | 11500 | 12900 | 14500 | 16100 | 17800 |
| RC | 676 | 1190 | 1720 | 2370 | 3120 | 3970 | 4930 | 5990 | 7150 | 8440 | 9510 | 10700 | 12000 | 13300 |
| 2.2 | 605 | 1070 | 1550 | 2130 | 2800 | 3570 | 4440 | 5400 | 6450 | 7620 | 8600 | 9660 | 10800 | 12000 |
| 2.4 | 546 | 959 | 1400 | 1930 | 2540 | 3240 | 4030 | 4910 | 5870 | 6930 | 7830 | 8810 | 9850 | 11000 |
| 2.6 | 496 | 872 | 1280 | 1760 | 2320 | 2960 | 3690 | 4490 | 5370 | 6350 | 7180 | 8090 | 9050 | 10100 |
| 2.8 | 453 | 796 | 1170 | 1610 | 2130 | 2720 | 3390 | 4130 | 4950 | 5850 | 6630 | 7470 | 8370 | 9340 |
| 3.0 | 415 | 730 | 1070 | 1480 | 1960 | 2510 | 3130 | 3820 | 4580 | 5420 | 6140 | 6930 | 7780 | 8700 |
| 3.2 | 382 | 672 | 985 | 1370 | 1820 | 2330 | 2900 | 3550 | 4250 | 5040 | 5720 | 6460 | 7260 | 8130 |
| 3.4 | 352 | 620 | 911 | 1270 | 1690 | 2170 | 2700 | 3300 | 3970 | 4700 | 5350 | 6050 | 6800 | 7620 |
| 3.6 | 324 | 572 | 845 | 1180 | 1570 | 2020 | 2520 | 3090 | 3710 | 4400 | 5010 | 5680 | 6400 | 7180 |
| 3.8 | 300 | 530 | 784 | 1100 | 1470 | 1890 | 2360 | 2890 | 3480 | 4140 | 4710 | 5350 | 6030 | 6780 |
| 4.0 | 277 | 490 | 729 | 1030 | 1370 | 1770 | 2220 | 2720 | 3270 | 3890 | 4450 | 5050 | 5710 | 6420 |
| 4.2 | 255 | 453 | 678 | 955 | 1280 | 1660 | 2080 | 2560 | 3080 | 3670 | 4200 | 4780 | 5410 | 6090 |
| 4.4 | 235 | 418 | 630 | 893 | 1200 | 1560 | 1960 | 2410 | 2910 | 3470 | 3980 | 4540 | 5140 | 5800 |
| 4.6 | 215 | 384 | 585 | 834 | 1130 | 1470 | 1850 | 2280 | 2750 | 3290 | 3770 | 4310 | 4890 | 5530 |
| 4.8 | 193 | 349 | 542 | 779 | 1060 | 1390 | 1750 | 2160 | 2610 | 3120 | 3590 | 4100 | 4670 | 5280 |
| 5.0 | 172 | 314 | 499 | 727 | 991 | 1310 | 1650 | 2040 | 2470 | 2960 | 3410 | 3910 | 4460 | 5050 |
| 5.2 | 154 | 284 | 457 | 676 | 929 | 1230 | 1560 | 1930 | 2350 | 2820 | 3250 | 3740 | 4260 | 4840 |
| 5.4 | 139 | 258 | 420 | 627 | 870 | 1160 | 1480 | 1830 | 2230 | 2680 | 3110 | 3570 | 4090 | 4640 |
| 5.6 | 126 | 236 | 387 | 582 | 813 | 1090 | 1390 | 1740 | 2120 | 2550 | 2970 | 3420 | 3920 | 4460 |
| 5.8 | 115 | 216 | 358 | 542 | 761 | 1030 | 1320 | 1650 | 2010 | 2430 | 2840 | 3280 | 3760 | 4290 |
| 6.0 | 105 | 199 | 332 | 506 | 713 | 965 | 1250 | 1560 | 1920 | 2320 | 2710 | 3150 | 3620 | 4140 |
| 6.2 | 97 | 184 | 308 | 472 | 669 | 909 | 1180 | 1480 | 1820 | 2210 | 2600 | 3020 | 3480 | 3990 |
| 6.4 | 89 | 170 | 287 | 442 | 628 | 857 | 1110 | 1400 | 1730 | 2110 | 2490 | 2910 | 3360 | 3850 |
| 6.6 | 82 | 157 | 267 | 413 | 590 | 808 | 1050 | 1330 | 1650 | 2010 | 2380 | 2790 | 3240 | 3720 |
| 6.8 | 76 | 146 | 248 | 386 | 553 | 761 | 990 | 1260 | 1560 | 1910 | 2280 | 2690 | 3120 | 3600 |
| 7.0 | 70 | 135 | 231 | 360 | 518 | 716 | 933 | 1190 | 1480 | 1820 | 2180 | 2580 | 3010 | 3480 |
| 7.2 | 64 | 125 | 214 | 336 | 485 | 672 | 878 | 1120 | 1400 | 1720 | 2070 | 2470 | 2900 | 3370 |
| 7.4 | 59 | 115 | 198 | 312 | 451 | 628 | 822 | 1060 | 1320 | 1630 | 1970 | 2350 | 2780 | 3250 |
| 7.6 | 54 | 105 | 182 | 287 | 417 | 583 | 765 | 980 | 1230 | 1530 | 1850 | 2230 | 2650 | 3120 |
| 7.8 | 48 | 94 | 164 | 261 | 380 | 533 | 701 | 901 | 1140 | 1410 | 1720 | 2090 | 2500 | 2970 |
| 8.0 | 38 | 76 | 134 | 214 | 314 | 444 | 587 | 758 | 960 | 1200 | 1480 | 1810 | 2210 | 2670 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

#### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

#### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

### 7.2.3 Cross-Sectional Elements

#### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars: Calculated (m) | Intersection Sight Distance for Passenger Cars: Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars: Calculated (ft) | Intersection Sight Distance for Passenger Cars: Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 55 MPH DESIGN CRITERIA

BY: NVA  DATE: 3/18/2020
CHK'D BY: JDW  DATE: 4/1/2020

1 **DESIGN CRITERIA MATRIX**
MPMS NO. N/A  Armstrong
SR 28 SEC N/A , Clarion COUNTY
Jefferson

2 **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N  **STRAHNET? (Y/N)** N

3 **DESIGN DESIGNATION**

SR 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Rural
TOPOGRAPHY Rolling
REMARKS Most locations along corridor except where other criteria is used

4 **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 7349 (2019)
DESIGN YEAR ADT (Average Daily Traffic) 8450
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 761
D (Directional Distribution) 59
T (Truck Percentage) 13

| 5 Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 55 MPH | 45-55 MPH | 55 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 11' to 12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 6' | 8' to 10' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | N/A | 38' to 44' | N/A | N/A | DM-2, Sec 1.2C | |
| Minimum Horizontal Radius | | | 850' | 587' to 960' | 960' | Yes | AASHTO, Table 3-10b | North of Summerville |
| Maximum Superelevation Rate | | | Varies | 8.0% | 8.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.20% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 132 |
| | Maximum | | 7.10% | 5.00% | 5.00% | Yes | AASHTO, Table 7-2 | line segment 157 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 360' to 495' | 495' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 500' to 610' | 610' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | 16'-6" | Yes | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

6 Any pedestrian and bicycle concerns/needs? Explain.
Any ADA compliance issues? Explain.
Any transit issues? Explain.
Any additional design issues? Explain.

# TABLE 1.2
# ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

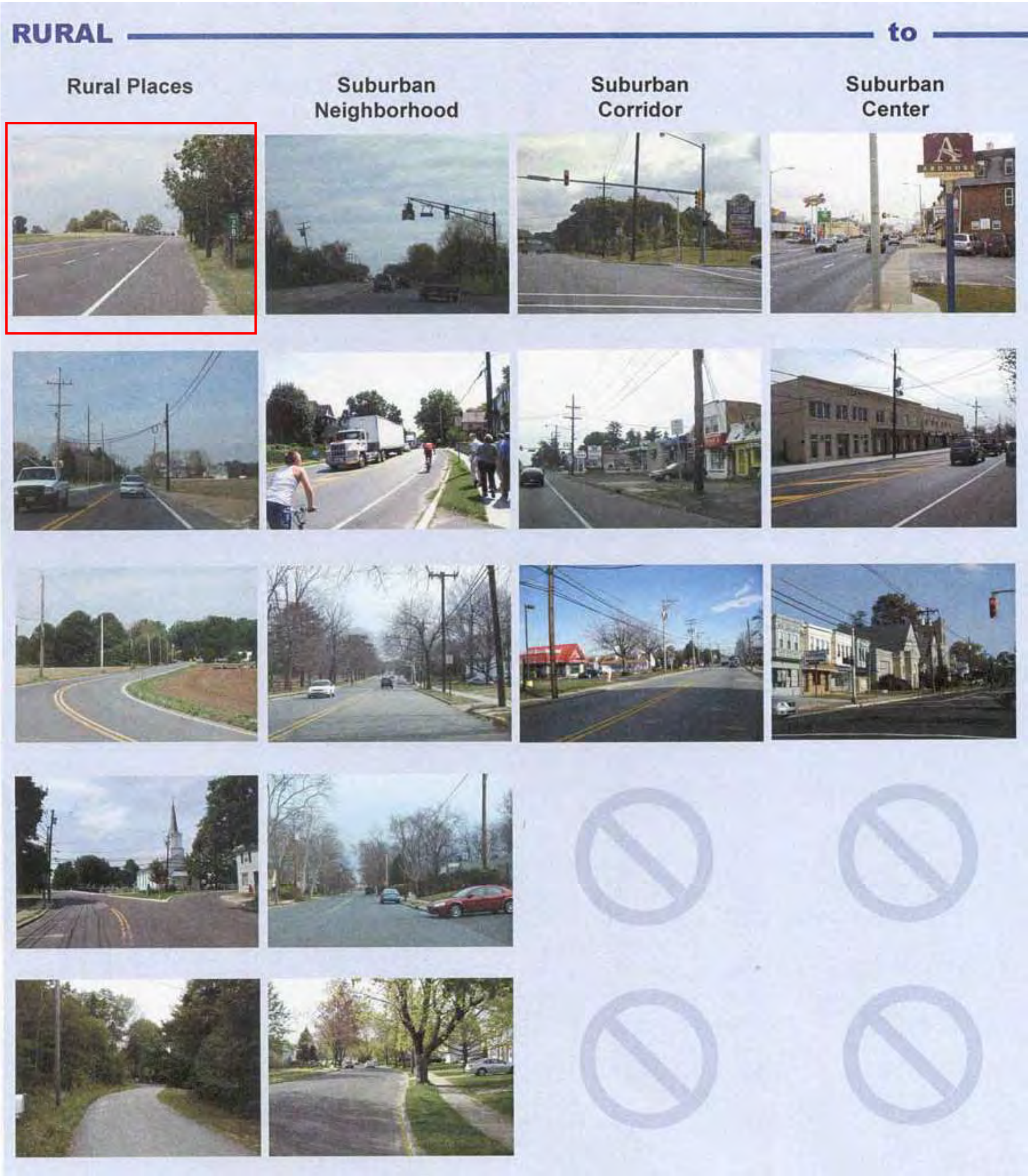
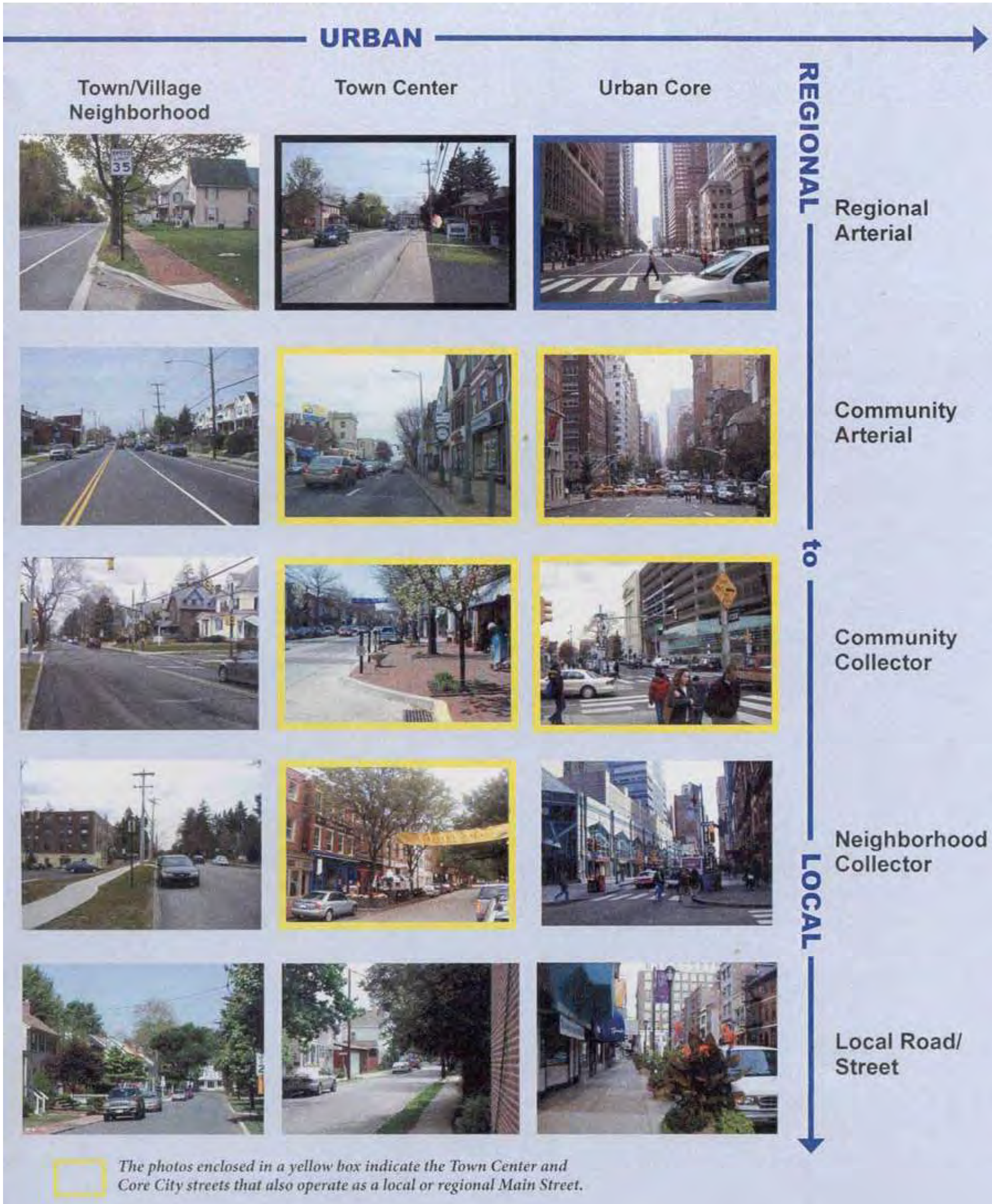


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-10b. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 8%**

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| *e* (%) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) |
| NC | 932 | 1640 | 2370 | 3240 | 4260 | 5410 | 6710 | 8150 | 9720 | 11500 | 12900 | 14500 | 16100 | 17800 |
| RC | 676 | 1190 | 1720 | 2370 | 3120 | 3970 | 4930 | 5990 | 7150 | 8440 | 9510 | 10700 | 12000 | 13300 |
| 2.2 | 605 | 1070 | 1550 | 2130 | 2800 | 3570 | 4440 | 5400 | 6450 | 7620 | 8600 | 9660 | 10800 | 12000 |
| 2.4 | 546 | 959 | 1400 | 1930 | 2540 | 3240 | 4030 | 4910 | 5870 | 6930 | 7830 | 8810 | 9850 | 11000 |
| 2.6 | 496 | 872 | 1280 | 1760 | 2320 | 2960 | 3690 | 4490 | 5370 | 6350 | 7180 | 8090 | 9050 | 10100 |
| 2.8 | 453 | 796 | 1170 | 1610 | 2130 | 2720 | 3390 | 4130 | 4950 | 5850 | 6630 | 7470 | 8370 | 9340 |
| 3.0 | 415 | 730 | 1070 | 1480 | 1960 | 2510 | 3130 | 3820 | 4580 | 5420 | 6140 | 6930 | 7780 | 8700 |
| 3.2 | 382 | 672 | 985 | 1370 | 1820 | 2330 | 2900 | 3550 | 4250 | 5040 | 5720 | 6460 | 7260 | 8130 |
| 3.4 | 352 | 620 | 911 | 1270 | 1690 | 2170 | 2700 | 3300 | 3970 | 4700 | 5350 | 6050 | 6800 | 7620 |
| 3.6 | 324 | 572 | 845 | 1180 | 1570 | 2020 | 2520 | 3090 | 3710 | 4400 | 5010 | 5680 | 6400 | 7180 |
| 3.8 | 300 | 530 | 784 | 1100 | 1470 | 1890 | 2360 | 2890 | 3480 | 4140 | 4710 | 5350 | 6030 | 6780 |
| 4.0 | 277 | 490 | 729 | 1030 | 1370 | 1770 | 2220 | 2720 | 3270 | 3890 | 4450 | 5050 | 5710 | 6420 |
| 4.2 | 255 | 453 | 678 | 955 | 1280 | 1660 | 2080 | 2560 | 3080 | 3670 | 4200 | 4780 | 5410 | 6090 |
| 4.4 | 235 | 418 | 630 | 893 | 1200 | 1560 | 1960 | 2410 | 2910 | 3470 | 3980 | 4540 | 5140 | 5800 |
| 4.6 | 215 | 384 | 585 | 834 | 1130 | 1470 | 1850 | 2280 | 2750 | 3290 | 3770 | 4310 | 4890 | 5530 |
| 4.8 | 193 | 349 | 542 | 779 | 1060 | 1390 | 1750 | 2160 | 2610 | 3120 | 3590 | 4100 | 4670 | 5280 |
| 5.0 | 172 | 314 | 499 | 727 | 991 | 1310 | 1650 | 2040 | 2470 | 2960 | 3410 | 3910 | 4460 | 5050 |
| 5.2 | 154 | 284 | 457 | 676 | 929 | 1230 | 1560 | 1930 | 2350 | 2820 | 3250 | 3740 | 4260 | 4840 |
| 5.4 | 139 | 258 | 420 | 627 | 870 | 1160 | 1480 | 1830 | 2230 | 2680 | 3110 | 3570 | 4090 | 4640 |
| 5.6 | 126 | 236 | 387 | 582 | 813 | 1090 | 1390 | 1740 | 2120 | 2550 | 2970 | 3420 | 3920 | 4460 |
| 5.8 | 115 | 216 | 358 | 542 | 761 | 1030 | 1320 | 1650 | 2010 | 2430 | 2840 | 3280 | 3760 | 4290 |
| 6.0 | 105 | 199 | 332 | 506 | 713 | 965 | 1250 | 1560 | 1920 | 2320 | 2710 | 3150 | 3620 | 4140 |
| 6.2 | 97 | 184 | 308 | 472 | 669 | 909 | 1180 | 1480 | 1820 | 2210 | 2600 | 3020 | 3480 | 3990 |
| 6.4 | 89 | 170 | 287 | 442 | 628 | 857 | 1110 | 1400 | 1730 | 2110 | 2490 | 2910 | 3360 | 3850 |
| 6.6 | 82 | 157 | 267 | 413 | 590 | 808 | 1050 | 1330 | 1650 | 2010 | 2380 | 2790 | 3240 | 3720 |
| 6.8 | 76 | 146 | 248 | 386 | 553 | 761 | 990 | 1260 | 1560 | 1910 | 2280 | 2690 | 3120 | 3600 |
| 7.0 | 70 | 135 | 231 | 360 | 518 | 716 | 933 | 1190 | 1480 | 1820 | 2180 | 2580 | 3010 | 3480 |
| 7.2 | 64 | 125 | 214 | 336 | 485 | 672 | 878 | 1120 | 1400 | 1720 | 2070 | 2470 | 2900 | 3370 |
| 7.4 | 59 | 115 | 198 | 312 | 451 | 628 | 822 | 1060 | 1320 | 1630 | 1970 | 2350 | 2780 | 3250 |
| 7.6 | 54 | 105 | 182 | 287 | 417 | 583 | 765 | 980 | 1230 | 1530 | 1850 | 2230 | 2650 | 3120 |
| 7.8 | 48 | 94 | 164 | 261 | 380 | 533 | 701 | 901 | 1140 | 1410 | 1720 | 2090 | 2500 | 2970 |
| 8.0 | 38 | 76 | 134 | 214 | 314 | 444 | 587 | 758 | 960 | 1200 | 1480 | 1810 | 2210 | 2670 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric — Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | U.S. Customary — Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Type of Terrain** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **40** | **45** | **50** | **55** | **60** | **65** | **70** | **75** | **80** |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

## Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

## Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

## Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars: Calculated (m) | Intersection Sight Distance for Passenger Cars: Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars: Calculated (ft) | Intersection Sight Distance for Passenger Cars: Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# APPENDIX D
## Stakeholder Meeting Minutes

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

**BROOKVILLE**
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
| --- | --- | --- | --- |
| Josh Spano | SPC | jspano@spcregion.org | — |
| Ashley Tracy | McCormick Taylor | autracy@mccormicktaylor.com | |
| Kari Shedlock | French Engineering | Kshedlock@frenchengr.com | |
| Mary Eberhardt | French Engineering | meberhardt@frenchengr.com | |
| Evan Schoss | SPC | eschoss@spcregion.org | |
| Deb Wilson | JCCD | jccd@windstream.net | |
| Amy Kessler | NC R.P.O | Amy@ncentral.com | 814-773-3162 |
| Dave Tomaswick | PennDOT DISTRICT 10 | DTOMASWICK@PA.GOV | 724 357 2845 |
| Jamie Lefever | JCDC | | |
| Steve McPherson | Miller Fabrication Solu. | smcpherson@millerfabricationsolutions.com | 814-715-0691 |
| Joe Barber | Barber Trucking | joe@barbertrucking.com | 814-913-1526 |
| AARON EMHOFF | PENNDOT | aemhoff@pa.gov | 814-939-9167 |
| Jack Matson | Jefferson County | Jmatson@jeffersoncountypa.com | 814-849-1653 |
| Herb Bullers Jr | Jefferson Co. | hbullers@jeffersoncountypa.com | 849-1653 |
| Jeff Pisarcik | Jefferson cty | jpisarcik@jeffersoncountypa | 849-1653 |

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

**BROOKVILLE**
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| Tracy Zents | Jefferson County | tzents@jeffersoncountypa.com | 849.5052 |
| Chris Clark | Jefferson County 911 | cclark@jeffersoncountypa.com | 849-4009 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

ROUTE 28 CORRIDOR STUDY
FROM KITTANNING TO I-80

*Meeting*: Stakeholder Interview Meeting - Brookville *Date:* February 26, 2020

*Location:* Jefferson County Conservation District *Time:* 10:00am to 11:30am

*Attendees:* See attached sign-in sheet

*Purpose:* The purpose of the meeting was to interview a variety of stakeholders for the Route 28 Corridor Study Project to obtain input from their local knowledge for consideration of proposed improvement within the study.

*Discussion:* The format of the meeting followed an intial list of questioned provided to the stakeholders to guide the discussion. This list provided a general outline of project specific question regarding the use, operation and safety within the Route 28 Corridor. The following information provided a summary of the stakeholders input at the meeting and discussion:

- Traffic signals are not synchronized, and during an emergency detour situation, can cause traffic congestion. Presently, municipalities control them, but it would be good if a centralized authority made up of various stakeholders had operational control during emergencies.
- When traffic is detoured on I-80, some vehicles don't use the posted detour, and a lot of traffic is converging in Brookville at the intersection of SR 28 and US 322 near Sheetz. When I-80 is detoured, need coordination in Brookville due to traffic gridlock at that intersection.
- There is no parallel route for I-80 closures, people don't realize the detours and cell phones will just bring them right back into the detour. It was suggested to install message boards on parallel routes to control traffic on SR 28.
- Recently, a tanker had an accident on I-80, and traffic was detoured to SR 28. Traffic was at a standstill for hours and hazardous material freight was coming off the interstate onto SR 28 which creates potential for accident or contamination that close to the Red Bank Creek. There is a need for a spill response team or plan along the corridor.During detour traffic, it is also extremely difficult for local emergency vehicles to get through the detour congestion since the shoulders on the corridor are so narrow. They cannot bypass the traffic.
- I-80 has no signage to show that SR 28 leads to Pittsburgh, and the Pittsburgh Airport.
- Many accidents occur from the Brookville Borough line to Snyder Road.
- Coder Road experiences accidents with commercial vehicles turning into Coder Road.
- There are landslides that occur north of Summerville.
- There are issues on Anderson Creek Road with commercial vehicles in the wintertime getting stuck on the top of the hill due to the steep grade.
- The Redbank Creek runs parallel to SR 28. The main concerns are with its proximity to the roadway, including potential for hazardous materials spills, flooding, ice jams, and narrow shoulders around the Summerville area.
- I-80/SR 322/SR 28 is a potential economic hub/area for development that would benefit from improved alignment and traffic conditions.
- Mendenhall Road is a safety concern due to sight distance/blind curve.
- Mayport Road is a safety concern as trucks have difficulty turning here due to the skew of the intersection, which is compounded by poor sight distance caused by the hill and the curvature of the roadway.
- Amy Kessler asked the question if there would be an increase in freight traffic due to the Shell Pennsylvania Petrochemicals Complex in Beaver County (cracker plant). The consensus was there would not be significant changes, though some minor manufacturing trips to process the plastic pellets could use the corridor.
- Since the turnpike tolls are high, and some trucks use 28 as a connector. This increases commuter and truck traffic on SR 28. Fuel tax is also too high. Many trucks will drop down to take 68 and pay the lower gas tax in Maryland.
- The issue with possible tolling of major highways and its implication on SR 28 was discussed.
- The Potters Mills project further east on US 322 was discussed. It was the consensus that when this project is complete more traffic that would use the Turnpike will instead be using SR 28 as an alternate route since it's a better connection.
- Jefferson County PennDOT maintenance stated that there are several crash clusters along SR 28 due to hills and curves. They also reiterated that congestion becomes an issue when traffic is detoured from I-80, but vehicles are following GPS instead of the posted detour. Noted a need for coordinated overhead messaging signs. Transporting a sign out from the

District office to tell people to stay on the detour route takes too long to be efficient at moving people before it becomes gridlock.

- There is inconsistency in speed limit and prevailing speed on SR 28 for the length of the corridor.
- The Redbank Valley Trail does not have good connections to Route 28. There is a lack of signage denoting where the trail can be accessed. The current trail crossing north New Bethlehem is perceived as particularly challenging.
- The Mayport curve was discussed as having sight distance concerns.
- The Baxter curve was discussed as having issues due to geometry and sight distance. Trucks also speed through Baxter. A possible improvement would be Baxter and Summerville widening and flattening the existing curves.
- It was mentioned that cell phone coverage along SR 28 is inconsistent, which could cause concerns for vehicle breakdowns and for those following GPS.
- Miller Transportation indicated they have daily deliveries on the corridor and speed is an issue for them. They would like to see a 4-lane roadway from Brookville to Kittanning as they are expecting deliveries to grow.
- The Conservation District indicated that water quality and spills were a major concern with the potential for increased traffic and the frequent use of Route 28 as a I-80 detour route.
- Amy Kessler asked about truck parking on the corridor. Generally the consensus was that truck parking presents little concern along the corridor. No one noted designated or unofficial locations of truck parking overnight on the corridor. The representative of the local freight community said that more shippers are providing overnight amenities at their facilities due to the new regulations. Haulers are also considering changes to their hours of operation to take shipments to more effectively meet the regulations.
- Hazen interchange was discussed as a possible future development project that could impact the traffic on SR 28.
- ATV crossings were noted along SR 28. ATV signs in the area around Dewey Road.
- In general, school bus stops along the corridor are hazardous, particularly where there is a 3-lane section with a passing lane. Cars will pass school buses even when they are supposed to stop. For example, south of Coder Hollow, a bus stop is located where the 3-lane road begins. Not an ideal place for a bus stop as people are speeding to get to the 3-lane road and pass slower moving vehicles.
- The guide rail is thought to be insufficient in Summerville and Baxter because you are so close to the water. It was noted that in recent years, a vehicle ran off the road and a woman drowned in the creek.
- In the summer, farming equipment using the road south of Summerville and throughout the corridor often slows traffic.
- The following tourism draws were discussed:
    - Cooks Forest draws a lot of traffic from Pittsburgh
    - Trout season
    - Deer Season
    - Poker Runs
    - Peanut Butter Festival
    - Historic Brookville
    - Laurel Festival
    - Several festivals in the summer
    - Hazen Flea Market
    - Autumn Leaf Festival
- Companies located along the corridor are doing their own shipping which increases the number of trucks on the road. Logging company employs independent drivers.

A list of action items was developed to summarize the stakeholders input and potential improvement areas within the study. The study team will further evaluate these stakeholder concern locations with our existing conditions, crash history, geometric conditions, public input, and operational conditions. The stakeholder action items to be considered are listed below:

Action Item List:

- Determine existing Variable Messaging Signing (VMS) that exists on I-80 and its proximity to the Route 28 Corridor.
- Further discuss areas where VMS placement along the corridor at strategic locations may provide helpful information during an I-80 emergency detour for travelers to consider prior to entering into congested areas to reduce gridlock. Also, this could serve as advanced warning for winter weather events or incidents along Route 28.
- Evaluate potential directional signing updates along I-80 to indicate that Route 28 connects to Pittsburgh and the Pittsburgh International Airport.
- Potential areas where emergency responders may have difficulty getting through congested areas during the use of Rt 28 as an I-80 detour route.
- Further investigate specific concerns noted by stakeholders at the following locations:
  - Brookville Borough line to Snyder Road
  - Route 28 near the Redbank Creek near Summerville
  - Mendenhall Road sight distance
  - Route 28 and Mayport Road sight distance/truck turning concerns with entrance skew
  - Summerville and Baxter potential for deficient guide rail

The meeting was adjourned at approximately 11:15 a.m. by thanking the stakeholders for their feedback and time.

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

**NEW BETHLEHEM**
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| Annie Latour | [illegible] | | |
| Ryan Gordon | SPC | | |
| Tom Seidle | Mahoning Twp | tomseidle@yahoo | 814-319-5600 |
| Terry Beamer | Hawthorn | | |
| Ken Blake | Mahoning Twp | | 814-221-9819 |
| Malinda Little | Hawthorn Boro. | | 814-319-3401 |
| Eric Simko | PSP Kittanning | ESIMKO@PA.GOV | 724-543-2011 |
| Dave Tomaswick | PennDOT District 10 | DTOMASWICK@PA.GOV | 724 357 2845 |
| Kristi Amato | Clarion Co. Planning | kamato@co.clarion.pa.us | 814-226-4000, x2800 |
| Keith Schreckengost | Mahoning Twp Arms | | 814-229-5441 |
| Gordon Barrows | New Bethlehem Mayor | mayor@NewBethlehemBoro.com | 814-275-2003 |
| Josh Clinger | Clarion County PennDOT | jclinger@pa.gov | 814 226-8200 |
| Sandy Mateer | New Beth Boro, Redbank Valley Trails Assn | scmateer1@gmail.com | 814-275-1718 |
| Ashley Tracy, Josh Spano, Evan Schoss, Kari Shedlock, Mary Eberhardt (Project Team) | | | |
| | | | |

ROUTE28 CORRIDOR STUDY FROM KITTANNING TO I-80

*Meeting:* Stakeholder Interview Meeting – New Bethlehem *Date:* February 26, 2020

*Location:* New Bethlehem Public Library Community Room *Time:* 1:00pm to 2:30pm

*Attendees:* See attached sign-in sheet

*Purpose:* The purpose of the meeting was to interview a variety of stakeholders for the Route 28 Corridor Study to obtain input from their local knowledge for consideration of proposed improvement within the study.

*Discussion:* The format of the meeting followed an intial list of questioned provided to the stakeholders to guide the discussion. This list provided a general outline of project specific question regarding the use, operation and safety within the Route 28 Corridor. The following information provided a summary of the stakeholders input at the meeting and discussion:

- The pedestrian crossing at Redbank Valley School is challenging with fast-moving vehicles nearby and many pedestrians. Vehicles typically park across SR 28 from the school and children cross SR 28 to get to their parents. They would like to evaluate a sign and/or traffic signal.
- The trail crossing is under PUC authority because it's a railbanked corridor. The crossing is particularly difficult and would benefit from signing in advance of and at the crossing, flashing lights, as well as a realignment of the trail so that it is perpendicular to the road and shortened, instead of crossing at a diagonal. The painted crosswalk across SR 28 was removed due to driver complaints, but the location has anecdotally had numerous accidents with folks driving off the road.
- The question was also posed if the restrictions on Tourist Oriented Directional Signing (TODS) could be lessened. The town would benefit from markers for economic development of businesses on trail, including B&B's, as well as for parking areas.
- There may be trail counts done by the Redbank Valley Trail Association, though most counters have been damaged or stolen. Study team will look into obtaining previous counts taken of the trail users.
- The Mahoning Township supervisors mentioned a study that was done to look at locations for the trail or roadway in front of Nolf Chrysler, that would side cut the hill, flatten the trail past Chrysler but there was a wetland issue that stopped the study moving forward. Wetland mitigation was mentioned as a potential solution for the project. Study team will look into obtaining this information.
- Redbank Valley High School has issues with pedestrians crossing the street during the school dismissal hour at 3:10pm. Parents park in the Subway and Chiropractor parking lots and then jump onto Route 28. They said there is plenty of parking in the back of the school, but that parents and students don't want to use it. They have crossing guards but are curious if a traffic signal could help. It's primarily drivers, with some walking students crossing to walk down the trail to get back to their homes. Dr. Mastillo, superintendent of the Redbank Valley School District, was supposed to attend but could not at the last minute, study team will follow up with him.
- It was discussed that congestion becomes an issue when traffic is detoured from I-80 but vehicles are following GPS instead of the posted detour.
- There is a operational concern at the SR 28/SR 66 intersection when trying to detour trucks due to geometric constraints. Trucks frequently hit the building and traffic signals at this location. The pole has been hit 8 times since the pedestrian ramp was installed. One day there was a bollard, but it kept getting hit and never came back. Cars also regularly pull beyond the stop bar and this creates congestion because trucks cannot navigate the turn with them there.
- Generally, the PSP has issues along SR 28 due to hills, climbing lanes (or lack of) needed at Hogback Hill and Orchardville Hill toward Exxon Station to Baum Pump Station. Other issues include snow, trucks that get diverted from I-80, and speeding along the corridor.
- PSP said speed along Route 28 is a safety concern, but there is not a high rate of crashes in this area of Route 28 if you compare it to the lower portion of Route 28.

- There is a choke point at the bridge in New Bethlehem over Redbank Creek which causes congestion. Any major crash, spill, or slide would wreak havoc on the transportation system because there is no way around it. The transportation system is very limited in this area.
- It was indicated that there should be improvements to the crosswalks throughout New Bethlehem and Hawthorn.
- Speed is an issue at the mini mall. The speed limit is 35 mph in one direction and 25 mph in the other. PennDOT mentioned that it should not be signed differently in opposing directions, and that the roadway needs to meet certain requirements to be posted at 25mph, including 85$^{th}$ percentile speed and residential density.
- There was another speed limit difference noted in Hawthorn, where it is 45 mph in one direction and 35 mph in the other. PennDOT again stated that it should not be signed as such.
- Along SR 28 from Kittanning, there are issues with erosion which is causing the guiderail to shift.
- Generally, the Redbank Creek runs along SR 28 too close to the road (horizontally and vertically) and during the winter months, ice jams cause issues over the roadway, including flooding. It was suggested that the stream needs to be dredged in some areas to remove debris. The Leisure Run flood is still being cleaned up.
- The 3-lane roadway ends at the Mahoning Creek Bridge.
- There is a 55/40/55 speed differential through difficult geometry which makes traveling through Distant difficult.
- A northbound turning lane begins where a passing lane ends at the crest of a hill at Calhoun School Road. This poses a safety concern for potential rear end and head on collisions. People think this is an extension of the passing lane and use it for passing.
- There is an ice cream shop directly adjacent to SR 28 that is very popular near Distant. Distant Dairy and Dollar General have a lot of traffic and generate pedestrians close to the roadway. Dollar General is noted as a difficultarea to pull out of due to blind curves. Some places in Distant lack sidewalks.
- There are rockslide and hill side erosion issues along the corridor which occur frequently and in many places.
- The intersection of SR 28 and SR 536 Mayport Road has deficient sight distance.
- Smucker's currently has access issues to their plant that could be addressed with a future project. In particular, the intersection of Wood and Penn poses an issue for trucks driving to Smucker's having to use local roads. Trucks get trapped and end up driving into people's yards and break the curb and sidewalk. They would like to see Smucker's have their own access road, but a study was done in the past and there was possibly a problem with sight distance that could not be overcome. Ms. Amato was involved with the Economic Development Commission with this study. The study team will obtain a copy.
- New Bethlehem Borough provided a list of issues that are included as an attachment to this summary.
- The passing lane at Distant is not long enough coming up the hill, then you hit 40mph, and SR 1004 is a quick turn with poor deceleration length.
- Upper/Lower Hayes at 28, and South Main Street could use a turn lane to separate turning vehicles from the general through traffic.
- Parking near the Sunoco/Key Beverage on Broad Street causes issues for traffic traveling WB turning into Sunoco. It could use a turn lane or restrict some parking closer to the area to provide room to turn into these businesses.
- There is acid mine drainage from Summerville to Moore Road in Corsica.
- On the 3 lane sections of SR 28, it has been noticed by PSP that vehicles in the opposing outermost lane do not stop for school buses when they legally are required to.
- There are sight distance issues at the PennDOT maintenance/school bus turnaround location at the Jefferson County line.
- The sidewalks in Distant and South Bethlehem are in poor condition.
- It was suggested that turning lanesare needed at Sloan Hill Road and Calhoun Crest.
- There are little to no issues with freight loading in the downtown New Bethlehem area. There aren't many places that freight has to stop.
- The following tourism draws were discussed:
    - Redbank Valley Trail

- Redbank Creek during trout season
- Bed and Breakfast locations
- Local campgrounds
- The County Fair at the end of July is a large traffic generator
- Poker Runs (ATV event)
- Peanut Butter Festival
- Friday night football games
- Deer season
- I-80/SR 28 in Brookville is a route to the Pittsburgh International Airport

The meeting was adjourned at approximately 1:15 p.m. by thanking the stakeholders for their feedback and time. A list of action items was developed to summarize the stakeholders input and potential improvement areas within the study. The study team will further evaluate these stakeholder concern locations with our existing conditions, crash history, geometric conditions, public input, and operational conditions. The stakeholder action items to be considered are listed below:

Action Item List:

- Consider potential for climbing lanes at Hogback Hill and Orchardville Hill toward Exxon Station to Baum Pump Station.
- Consider potential/need for alternate route to bypass bridge in New Bethlehem over Redbank Creek during an incident.
- Consider designated crosswalk improvements for consistent and safe pedestrian access across Route 28.
- Obtain trail counts and previous studies on crossing locations performed by the Redbank Valley Trail Assocation.
- Obtain Smucker's access study for consideration.
- Connect with school superintendent separately to note New Bethlehem School District's concerns along the corridor.
- Document areas of inconsistent speed limits along Route 28 and in certain area in NB and SB directions.
- Investigate potential narrow shoulders or flooding issues where Redbank Creek is close to Route 28.
- Consider potential turning lanes at Upper/Lower Hayes Road and at South Main Street.
- Consider pedestrian access and sidewalks in Distant and South Bethlehem.
- Consider improvements at Sloan Hill Road and Calhoun School Road to improve sight distance and safety.
- Further investigate specific concerns noted by stakeholders at the following locations:
  - Pedestrian crossing at Redbank Valley High School.
  - Redbank Trail crossing at Route 28.
  - SR 28/SR 66 intersection geometric improvements for trucks to navigate the intersection.
  - Calhoun School Road where the northbound passing lane ends at the crest of a hill and stops in a turning lane.
  - Pedestrian connections and sight distance at Distant Dairy and Dollar General.
  - SR 28 and SR 536 Mayport Road and potential improvements to address deficient sight distance.
  - Hogback Hill potential lengthening of passing lane coming up into Distant.
  - Jefferson County line PennDOT maintenance/school bus turnaround location sight distance issues.

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

Borough of New Bethlehem Identified Areas of Concern

Photos of Meeting

Rt 28 improvements/Corridor Study Comments - Sandy Mateer, 814-275-1718, VP of New Bethlehem Borough Council and President of Redbank Valley Trails Association

**Starting at SR 28/66 at intersection with Rt 85 and Clearfield Pike. (Mile 0)**

1. **From Mile 0 north** – replace guardrails, reduce litter and inspect erosion of northbound side lanes. Some areas are very narrow and don't allow much room for snow removal. The creek alongside some areas is plugged with debris which may cause road to flood in low areas. Consider dredging and deepening water channel.

2. 3 miles up at Pine Creek Church – needs intersection improvements

3. 4 miles up – guard rail appears to be collapsing from hillside erosion.

4. 5 miles up – from Ridge Road to Exxon station and beyond to church. Deer fences might prevent some accidents and plantings might cut some windblown snow from impacting the road. Same comment at around 9 and 10 miles up to old New Bethlehem Wesleyan school area.

5. Dayton Road intersection needs improvement.

6. 11 miles up – the truck stop needs more signage for truckers to let them know about Hogback hill and speed limits.

7. 14 miles up – There needs to be more notice for the lane reduction on the hill and placement of the reduction needs to be reviewed in connection with oncoming (southbound) traffic. Southbound there or previous area where lane reduces the reduction ends at the top of a hill on a curve.

8. Dollar General in Distant – Sight distance is horrible and a bad accident waiting to happen. A different access point should be considered or more warning signage or speed restrictions should be considered.

9. Distant – sidewalks should be considered to improve pedestrian access.

10. Sidewalks in South Bethlehem Borough are in terrible condition and deter pedestrian use.

11. Signage for trail access should be less restrictive and less costly so that more directional signs can be added for tourism attraction.

**Within New Bethlehem Borough** - Improve all cross walk signals in Borough and add stop for pedestrian signage.

**12. Corner of Broad (28/66) and Wood (66).**

a. Move the stop line and treadles for both through and left turn north to Wood back to allow trucks turning west on Broad Street from Wood St to make the turn with out having to worry about running into vehicles stopped to turn north on Wood St. from Broad St.

b. Remove two existing traffic light poles at NW and SE corners and install one double armed traffic light pole on southwest corner of Broad and Wood to handle all traffic so that damage to current light poles and building is eliminated. NW corner traffic pole and it or the protective post have been hit numerous times by trucks and continue to be hit almost once a month. This has occurred more frequently since August 2018 when Penn Dot removed the old curbs and put in flat handicapped accessible curbs. The Borough has installed signage and delimitators in an attempt to keep trucks from cutting the corner too tightly. The pole has been replaced once since then in 2019 and has been hit at least twice again since replacement. We were informed that we can't replace the pole again because of new regulations and that the new pole will cost at least $300,000. The existing NW pole foundation is near utility lines for the Bish Chiropractic/Laurel Eye building on the corner which has also been hit by trucks.

July 2, 2007 – building support pole on NE corner was taken out. Building on west side is the Bish Chiropractic building and pole is at middle top of photo.

2018-2020 damage:


Jan 2020 damage after signage added.

**13. Broad Street in 100 block**. Consider putting in a turn lane from Liberty St. east to at most Maple Street so that traffic can turn into the beer distributor or gas station whether going east or west on Broad St. This might entail eliminating parking on south side of Broad St. from Liberty to Maple or maybe on the north side for part of the distance.

**14. Broad/Rt. 28 from Wood (66) to eastern Borough limit.** Make the speed limit 25 on both sides of the street for safety of pedestrians, customers of businesses and speed monitoring, as 25 mph is the speed limit on Broad from Wood west to Liberty Street.

**15. Lincoln and Broad Street.** Consider recommending that Lincoln be made one way Northbound at Post Office because of sight distance issues with car parking along north side of Broad.

**16. 500 Block of Broad Street.**

a. Work with Smuckers and Redbank Valley Trails Association to create a truck access to plant parking area directly from SR 28 to limit need for trucks to use only current access via Broad and Wood intersection, Wood and Penn (SR 861) intersection, 1920s bridge over Leasure Run on Penn Street and Penn Street residential area. Keep in mind that the corridor is railbanked so that nothing can be done to corridor to prevent rail from returning.

Corner of Wood/66 and Penn St. 861

b. Improve drainage under SR28 at Vine Street bridge for Leasure Run.

**17. SR 28 east of Borough Line through Redbank Township to Fishbasket curve**

a. Improve drainage facilities under 28.

b. Mitigate flood and ice jam damage by dredging creek to deepen channel and perhaps armoring the channel. This might prevent closure of SR 28 in high water and ice jam situations.

c. Invasive species remediation – Bank is lined with Japanese Knotweed which causes erosion and prevents other native plants from growing.

**18. Fishbasket Curve**

a. Work with Redbank Valley Trails Association and PUC to improve crossing. Keep in mind that the corridor is railbanked so that nothing can be done to corridor to prevent rail from returning such as major changes to grade without PUC and Buffalo & Pittsburgh Rail Road approval. Suggested improvements include a flashing light triggered by trail users from either direction toward crossing. Move the crossing slightly to the west to shorten the crossing distance instead of being on a diagonal. Add additional signage in both directions at further distance than existing signage to indicate trail crossing ahead. Consider crosswalk markings.

19. **Hawthorn** – allow directional signage to trail before and/or at Walker Flat Road.

20. **Shannondale Flats** – Speed and intersections are a concern.

21. **Summerville – Carrier Street** - allow directional signage to trail before and at Carrier Street in both directions.

22. **Summerville to Moore Road** – There appears to be a lot of acid mine drainage coming from hillside that drains along the road and then works it way into the Red Bank Creek.

23. **Moore Road** - allow directional signage to trail before and/or at Moore Road in Corsica in both directions.

24. **South Main Street, Brookville** – Consider adding a turn lane on sharp town to S. Main Street leading to hospital.

25. **Main Street/322 intersection** - Allow directional signage to trail before and at intersection from both directions.

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

Stakeholder Outreach
**INTERVIEW INVITATION SIGN IN SHEET**

KITTANNING
February 26, 2020

| NAME | ORGANIZATION | EMAIL | PHONE |
|---|---|---|---|
| ALFRED S. KAMMERDIENER | BOGGS TWP. | | 724-545-7142 |
| Allie Pence | Armstrong Co. Planning | arpence@co.armstrong.pa.us | 724-548-3734 |
| Carmen Johnson | Arm. Co. Planning & Development | cejohnson@co.armstrong.pa.us | 724.548.3721 |
| Dave Tomaswick | PennDOT District 10 | DTOMASWICK@PA.GOV | 724 357 2845 |
| Bill Clark | Boggs Twp / Manet Twp Fire | WCST87@yahoo.com | 724 954 6791 |
| Lynda Pozzuto | Armstrong Chamber | lynda@akstrong.com | 724-224-3400 |
| Mike Coonley | Arm. Co. Economic Dev | mpcoonley@co.armstrong.pa.us | 724 548 1500 |
| Steven Baker | Kittanning Twp VFD | steli baker @ yahoo.com | 724-664-3995 |
| Keith Bousee | Bradigans Inc | keith@bradigansinc | 724-525-3562 |
| Andy Bradigan | Bradigan's Inc | andy@bradigans.com | 724-525-8956 |
| Jason Orton | ACMH | jason.orton@AHN.org | 412-491-9256 |
| Justin Nolder | Arm. Co. Econ. Dev. | jrnolder@co.armstrong.pa.us | 724-548-1500 |
| Ryan Gordon, Ashley Tracy, Kari Shedlock, Mary Eberhart (Project Team) | | | |
| | | | |
| | | | |

ROUTE28 CORRIDOR STUDY
FROM KITTANNING TO I-80

| | | | |
|---|---|---|---|
| *Meeting:* | Stakeholder Interview Meeting - Kittanning | *Date:* | February 26, 2020 |
| *Location:* | The Belmont Complex | *Time:* | 4:00pm to 5:30pm |

*Attendees:* See attached sign-in sheet

*Purpose:* The purpose of the meeting was to interview a variety of stakeholders for the Route 28 Corridor Study Project.

*Discussion:* The following outlines the highlights of the discussion:

- The concerns expressed by the EMS/Ambulance representative were that the hills and geometry of SR 28 present a challenge in getting patients to the most appropriate local hospital. The Armstrong Hospital has advanced cardiac technologies that other local hospitals do not, and many times flights are needed to get patients to the Armstrong Hospital.
- Truck traffic presents an operational and safety concern due to speed differentials between cars and trucks. Many times, vehicles pass slow moving trucks in a no passing zone. Suggested a need for additional truck climbing lanes near Orchardville.
- Spacious Corners / Sloan Hill Road has poor sight distance due to the hill and curve.
- At the top of Hogback Hill at the truck weigh station, sight distance is poor, and trucks are slowing down, stopping, pulling over in this location. Trucks also sometimes don't stop as directed and roll through the brake check area and pull out in front of cars.
- Goheenville – speeding issues are noted. An improved project in this area is currently being designed by PennDOT.
- The concerns expressed by the local trucking company, who delivers heating oil and other seasonal products, were that houses are too close to the road in many locations. Other areas of concern were brake check stops, the Baum Pump Station, and the "tickle turn" by Horse Trader just north of SR 85 that has a sharp turn that is difficult for trucks to maneuver at high speeds. There was a recent project that fixed some geometric issues but the project limits did not address that turn. They would like to see the improvements continued to address the sharp turn.
- The crosswalk at Fish Basket needs to be straight across the road. (This is the New Bethlehem crossing of the Redbank Valley Trail).
- Speeding is a concern at the 15 mph curve in South Bethlehem. Trucks frequently overtrack and sometimes roll over.
- The discussion regarding the traffic models incorporating drawing additional freight traffic from other major adjacent highways such as I-79, I-80, Route 8, and US 119 was discussed. It was determined that the tools to address this quantitatively are limited, so this would be considered qualitatively..
- There are sight distance and access concerns coming out of Oscar Road.
- There is significant congestion in the afternoon in New Bethlehem. Better coordination of the two signals in New Bethlehem was suggested.
- There is a crash history in Distant due to the narrow roadway/shoulders and the stream located so close to the road, north of Wadding Road to Redding Road.
- There is an active slide at the Pine Creek Bridge.
- Other general concerns included narrow shoulders, lack of truck lanes, trout and deer season congestion, Sloan Hill Road blind curve with buses pulling out, sight distance at Lower Hays to Upper Hays Run, and SR 28 near SR 1035 Oscar Rd needs truck lanes and wider shoulders.
- The following tourism draws were discussed:
    - Port Armstrong Folk Fest
    - Armstrong Festival
    - Arts on Allegheny
    - ATV events
    - Cooks Forest

- Autumn Leaf Festival
- Peanut Butter Festival
- Proposed ATV Facilities – large scale improvements, Poker Runs, Scrubgrass Run, a big draw

The meeting was adjourned at approximately 5:15 p.m. by thanking the stakeholders for their feedback and time. A list of action items was developed to summarize the stakeholders input and potential improvement areas within the study. The study team will further evaluate these stakeholder concern locations with our existing conditions, crash history, geometric conditions, public input, and operational conditions. The stakeholder action items to be considered are listed below:

Action Item List:

- Consider EMS provider concerns with Route 28 geometry and access to Armstrong Hospital.
- Consider local freight provider concerns with Route 28.
- Consider a need for additional truck climbing lanes near Orchardville.
- Consider better coordination of the two signals through New Bethlehem.
- Further investigate specific concerns noted by stakeholders at the following locations:
  - Sloan Hill Road sight distance.
  - Hogback Hill in general at the truck weigh station.
  - Route 28 at the Redbank Trail concerns for pedestrians crossing.
  - 15mph curve south of New Bethlehem where trucks frequently overtrack and sometimes roll over.
  - Oscar Road sight distance and truck access concerns.
  - Lower Hayes Run turning vehicle provisions.
  - Discuss with School District separately their concerns along the corridor.
  - Coordinate with Armstrong County on planned and potential future developments.

Prepared by:

*McCORMICK TAYLOR, INC.*

Copies:

Attendees

MT Project File

Attachments:

Meeting Sign-in Sheet

Photos of Meeting

# APPENDIX E
## Survey Questions

**Route 28 Corridor Study**
**Wiki-map Survey Questions**
*01.17.20*

ADD PROBLEM OR OPPORTUNITY

1. Select a point type and then place on map.
   [Each point type receives a different list of concerns Q4-7]
   - Traveling via a car
   - Traveling via bike
   - Traveling via walking
   - Traveling via truck/freight vehicle

2. I use this area for: (Select all that apply)
   - Local commuting (Less than 10 miles each way)
   - Regional commuting (More than 10 miles each way)
   - Business travel (Deliveries, moving freight, etc.)
   - Accessing government services
   - Accessing Redbank Valley Trail
   - Accessing local schools
   - Accessing stores, services, goods, healthcare
   - Accessing recreational opportunities

3. How frequently do you use this facility?
   - Daily
   - Weekly
   - Monthly

4. What about this location causes you concerns? [CARS]
   - Pedestrian Safety
   - Cyclist Safety
   - Vehicle speeds
   - Slow moving vehicles
   - Congestion
   - Stopping or turning vehicles
   - Lack of connectivity
   - Interstate access
   - Roadway safety
   - Drainage
   - Parking
   - Signal timing
   - Roadway or bridge maintenance
   - Sight Distance

5. What about this location causes you concerns? [BIKES]
   - No shoulder

- Shoulder is too narrow
- Poor shoulder condition
- Debris
- Lack of bike lane
- Lack of protected bike lane
- Travel lanes are too narrow
- Drainage
- Vehicle speeds
- Roadway safety
- Proximity to large trucks/vehicles
- Connectivity to regional trail system
- Aesthetics

6. What about this location causes you concerns? [FREIGHT]
   - Pedestrian Safety
   - Cyclist Safety
   - Vehicle speeds
   - Roadway incline/grade
   - No climbing lane on steep grade
   - Travel lanes are too narrow
   - Intersection too narrow to safely turn
   - General congestion
   - Stopping or turning vehicles
   - Lack of connectivity
   - Shoulder width/condition

7. What about this location causes you concerns? [WALKING]
   - Sidewalk ends/no sidewalk
   - Sidewalk condition
   - Pedestrian safety/visibility
   - Roadway safety
   - No shoulder
   - Shoulder condition
   - Drainage
   - Vehicle speeds
   - Proximity to large trucks/vehicles
   - Crosswalk
   - Sidewalk not Americans with Disabilities Act (ADA) compliant
   - Connectivity
   - Aesthetics

8. Please explain your concern. (open-ended)

9. Do you have a photo of this area of concern for us to consider? Please upload it here.

10. Is there any other information you would like us to know about the Route 28 corridor? (open-ended)

Click submit to return to the map to add any additional problems or concerns.

# APPENDIX F

## Field Notes

# REDBANK VALLEY TRAIL

The trail is well-supported, has free parking, and even had a few folks using it during the field work day which was approximately a 50-degree day in January. It was awarded “Trail of the Year 2014”. The field work included 3 locations along the trail:

- South Bethlehem trailhead bridge
- New Bethlehem
- Brookeville Depot St Spur

The trail is advertised in Brookeville and New Bethlehem. There is free parking in the north at the Depot Street Spur near Brookville, free parking in downtown New Bethlehem, and a small gravel area in South Bethlehem where a bridge takes you to the trail just west of the 15mph curve sign (see image). The parking area is limited (see image).


*View from the bridge over Redbank Creek*

*Parking near the trail head is limited*

The houses along the trail in New Bethlehem don't appear to have any other access (roadway or sidewalk). There is significant public art and continuous access to the trail throughout New Bethlehem.

Public art invites trail users to stop and explore

Bicycles parked along the trail in New Bethlehem

Some residences along the trail have no offstreet parking

Some residences only access is via the trail

The New Bethlehem trailhead offers bike racks, free parking, a portapotty, and wayfinding signage


*View from Above and Below Trail Overpass in New Bethlehem, which also leads to JM Smucker's Facility*


Redbank Valley Trail Sign from Brookville

## Signage

Many signs on the corridor have been struck – particularly at SR 0536, SR 85, and US 322. Trucks were observed overtracking due to the tight geometry of the roadway and intersection approaches. A few areas of damaged guiderail were noted.

A relatively flat, straight segment of roadway exists between New Bethlehem and Brookville where most of the passing zones are.



*Sign damage at SR 536 Mayport Road*

*Sign damage at SR 85 and at US 322*

## DOWNTOWN NEW BETHLEHEM

In downtown New Bethlehem, Route 28 is Broad Street. There are two signals in close proximity, at Lafayette Street and at Wood Street. They appear to operate well. No significant queueing was observed. Both signals had pedestrian signal heads. At Wood Street, some pedestrian heads are outdated and burnt out. Trucks were observed overtracking turning EBL to Route 66 at Wood Street (see image). There are delineators to keep them from coming up on the curb, but not bollards. I had to jump back from the corner as this truck nearly overtracked onto the sidewalk. Lafayette Street crossing is short and easier to cross.

*New Bethlehem approach to Wood Street Signal*


*Truck Overtracking at Wood Street in New Bethlehem*

Sidewalks and DWS Present, Pedestrian Head Burnt Out


Traffic Signal at Lafayette Street

## TRUCKS AND FREIGHT

The Route 28 corridor is home to industry and trucking facilities. Some noticeable include McCauley trucking and warehousing, Glen Gary. There is a noticeable amount of timber hauling in the area. JM Smucker's is in downtown New Bethlehem. At the northern end of the corridor, the Brookville Travel Center provides facilities for trucks using the I-80 and SR 28/SR 36 corridors.

On the field view, steep grades were found in excess of 9%. There is an area for heavy trucks to pull off and stop before beginning their descent. Truck speed limits on the downgrade are posted at 35 mph. The smell of brakes and sound of engine braking was ubiquitous through the mountainous and rolling parts of the corridor. A few hills were noted as good candidates for truck climbing lanes, including the hill near Baum Pump Station/Orchardville, and Hogback Hill.


*9% Grade Next 2 MI*


*Pull off for trucks going NB on SR 28 before the 9% grade*

*Northbound downhill following*

*Northbound climbing lane begins*


*Trucks at the Brookville Travel Center*

*Glen-Gary is located at Carrier Street*

*Timber hauling is a noticeable industry along the corridor*


*Smucker's Facility in New Bethlehem*

## Safety Countermeasures

Generally the corridor has centerline rumblestrips, but shoulder rumblestrips were not observed. In most places, the rumblestrips have worn and are not effective.

Curve warning signs often have no advisory speeds and no chevrons.

## Retroreflectivity

The corridor was driven in the evening and the paint and signs varied in retroreflectivity, poor. Most night time reflection comes from bridge and curve delineators. A southbound corridor video is available in nighttime conditions.

Traveling SB on Route 28 north of New Bethlehem

Traveling SB at the New Bethlehem / Hawthorn sign

Traveling SB south of New Bethlehem

A typical night-time scene traveling SB on Route 28

## SPEEDS

Significant speed differentials were observed along the corridor. Some passenger vehicles were observed speeding, traveling between 65 and 70 mph on 55 mph segments. Improper passing of slow-moving vehicles in non-passing zones was also observed.

Other vehicles, both cars and trucks, were observed driving 5-10 mph below the speed limit. Speed limits change frequently throughout the corridor, from 55 mph on most sections, to 35 mph through most villages, and 25 mph through New Bethlehem.


15mph Curve Advisory Sign


Speed limit is 35 mph in South Bethlehem


Speed limit drops to 25mph through New Bethlehem

Speed limit rises again to 55mph

## Sight Distance

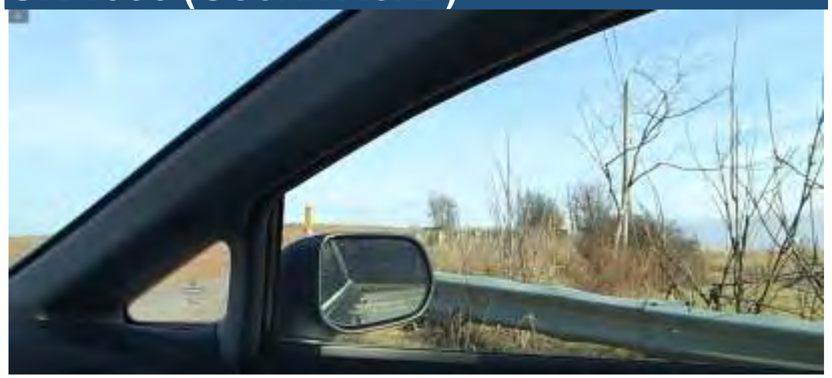
Sight distance turning onto Route 28 is limited for many intersections due to horizontal and vertical curvature. Other sight distance obstructions noted include hillsides, guide rail and bridge barriers, trees and brush, signs, and houses. There are many minor intersections along the approximately 40-mile corridor with sight distance concerns; however, the major intersections that were identified observed during this round of field observations were:

- Sloan Hill Road
- SR 1035 (Oscar Road)
- SR 1004 (Kohlersburg/Madison Rd)
- SR 1025 (Putneyville Road)
- SR 0536 (Mayport Road)
- South Main Street near Brookville

## Sloan Hill Road

*Sloan Hill Road looking north on Route 28*

## SR 1035 (Oscar Road)



*Sight distance limited from crest and guide rail looking north at the stop on SR 1035*

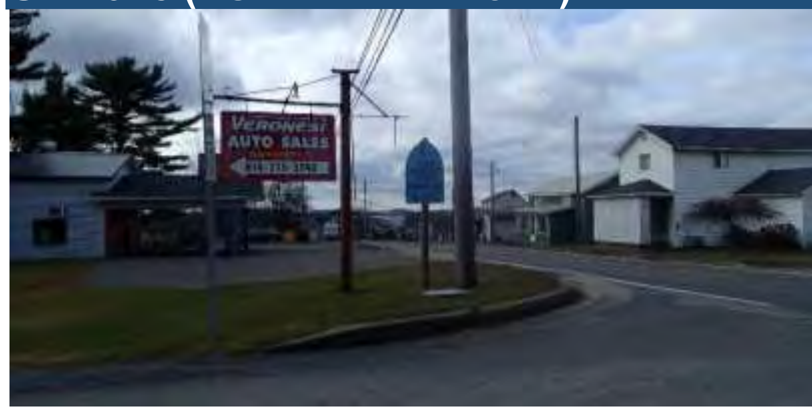
*Sight distance looking south at the stop sign on SR 1035*

## SR 1004 (Kohlersburg/Madison Rd)

*Looking southbound on Route 28*

*Looking northbound on Madison Road*

## SR 1025 (Putneyville Road)

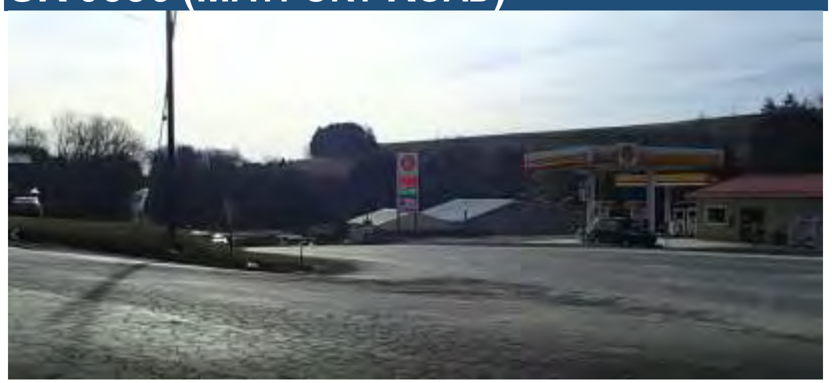



Looking south from the stop


Looking north from the stop


Sight distance looking north from stop at Mayport Rd

## SR 0536 (Mayport Road)


Sight distance looking south from stop at Mayport Rd

## South Main Street


*Main Street Sight distance looking south*

*Main Street Sight distance looking north*

## POVERTY HILL ROAD

The intersection of Poverty Hill Road, McGregor Road and SR 28 is a skewed intersection north of the end of the freeway. At this intersection, geometric and roadway conditions were observed. In general, the intersection and surrounding area to the south is relatively flat with some residential buildings, commercial buildings, and billboards. To the north, SR 28 begins a steep climb while Poverty Hill Road has a short, steep grade.

Looking at the roadway conditions, the guide rail in the area was in good condition. The edge of the shoulder is beginning to deteriorate and there is a pothole located on the southwest corner along McGregor Road (see image). Several traffic and roadway signs were located at the intersection including stop signs and weight limit signs on the minor legs.

*Roadside deterioration at McGregor Road*

Heavy truck traffic was observed and there is evidence of overtracking on the corner of SR 28 and McGregor Road. The sight distance to and from McGregor Road appears to be sufficient. The sight distance from Poverty Hill Road was insufficient due to the hills along the road and several residential buildings to the south (see image). Being so close to the end of the freeway, there were no speed limit signs observed northbound on SR 28 but there was a 45 mph speed limit sign on the downhill grade going southbound on SR 28.

*Sight line at stop sign from Poverty Hill Road facing south on SR 28*

## SR 28 AND JARALY LANE GUIDE RAIL

While traveling north from Poverty Hill Road to Jaraly Lane, roadway conditions were observed. The guide rail along the road was in good condition but some locations had evidence of minor erosion under the guide rail. The shoulders varied in width down to about two feet.

Just south of Jaraly Lane, there is heavy erosion under the guide rail. Along the northbound lanes, the shoulder is beginning to crumble and larger pieces of pavement have broken off from the roadway. There is heavy erosion under the guide rail and around the posts. There is a path under the guide rail of erosion from water. Some of the guide rail is beginning to lean into the slope (see image).

*Erosion and deteriorating shoulder on northbound lanes of SR 28 (looking south)*

Along the southbound lanes, the guide rail is in better condition. While some of the posts appear to be leaning into the slope, a section about fifty feet long was reinforced with bituminous material. Minor erosion is evident along the shoulder. The impact attenuator appears to have been replaced recently.

## SR 1028 AND SR 28

While travelling north from Jaraly Lane to SR 1028, roadway conditions were observed. Minor erosion along the shoulders were evident along with minor deterioration of the edge of pavement.

At SR 1028, insufficient sight distance was observed. When turning from SR 1028, there is a stop sign for SR 1028 only. Facing south, SR 28 curves away from SR 1028 and has a steep grade of 8.7% (field measured). The combination of the horizontal curve, downhill grade, and trees limits the sight distance (see image). Facing north, the roadway is relatively flat but there is a small hill and a large tree, which are located at the edge of the pavement. Behind the tree, there is a residential building, which limits sight distance as a vehicle approaches the intersection (see image).

*Large tree and Residence at the stop sign on SR1035, facing north on SR 28*

*Sight line facing south on SR 28*

The roadway along SR 28 is in good condition but the pavement along SR 1028 is beginning to deteriorate, especially along the edge of shoulder.

## Near the Address of 742 SR 28 and 66

Traveling a short distance north from SR 1028, heavy erosion and a large skid mark were observed on SR 28. The erosion along the guide rail on the northbound side is about 125 feet in length and several inches deep. The erosion travels under the guide rail and washes out on the hillside to a creek at the bottom of the hill (see image). The skid mark is along the northbound lanes and is about 75 feet long. It is a single tire width suggesting a car or pickup caused it.

*Heavy erosion on Section 742 of Route 28 from edge of pavement down to stream*

## Crissman Lane and SR 28

Traveling north from 742 SR 28, guide rail damage and poor sight distance was observed. The guide rail had evidence of damage from a vehicle brushing the guide rail and from large branches falling on top of the guide rail. The sight distance was limited due to horizontal curves and skewed intersections with local roads. The large cut slopes along the roadway looked to be in good condition with minimal erosion. The area was mostly farm or residential with some community centers such as a church and a school.

Just north of Crissman Lane, there is a large section of damaged guide rail. The slope was reinforced with bituminous material and large rocks. The guide rail posts are beginning to slide down the slopes and are out of line. Washouts and erosion are present under the guiderail and along the shoulder (see image).

*Damaged guide rail and slope repair*

## SR 1035 and SR 28

Traveling north from Crissman Lane, poor sight distance at intersections with local roads and driveways and reinforced rock slopes behind the guide rail were observed. The shoulders along SR 28 vary in width and at times are about two feet wide.

At the intersection of SR 1035, SR 28 is curving away from SR 1035 with a cresting vertical curve just north of the intersection. Looking right from SR 1035 approach, there is poor sight distance due to guide rail along the northbound lanes of SR 28, which is higher than the driver's eyes on SR 1035. There is also a cresting vertical curve making it difficult to see any vehicles traveling south on SR 28 (see image). Looking left from SR 1035 approach, there are several trees in the sight line, which limits the sight distance. Along SR 1035, there is broken pavement and recently repaired patches on the shoulders. The guiderail on the northbound side of SR 28, along the curve radius from SR 1035, appears to have damage on the top by a vehicle that did not turn wide enough form SR 1035 to travel north.

*Facing north on SR 28 from SR 1035*

## SR 1004 and SR 28

Travelling north from SR 1035, the roadway is in good condition. There are some sharp curves and steep grades with truck climbing lanes, but the guide rail is in good condition and there is only minor erosion along the guide rail.

The intersection of SR 1004 and SR 28 is a five-way intersection with a channelized right turn lane from southbound SR 28. The three minor roads converge to one intersection with the channelized right turn lane and a bidirectional lane to SR 28 (see image). The sight distance to and from SR 28 is good from the bidirectional lane and the channelized lane. Approaching the five-way intersection with SR 1004, there is a sharp curve along one of the three minor roads. There is a short distance from this intersection and the travel lanes on SR 28. Approaching the intersection from the south along SR 28, there is a steep grade, which flattens out at the intersection and enters a residential area.

*Approaching intersection from SR 1004, facing north. Vehicle is located on bidirectional lane.*

## 15 MPH Curve in South Bethlehem

Leaving SR 1004 and traveling north along SR 28, there is a section of damaged guide rail from falling branches. The speed limit also changed several times from 45 mph to 55 mph to 35 mph as SR 28 approaches New Bethlehem.

Entering South Bethlehem, there is a sharp curve with a 15 mph advisory speed at the T intersection of Broad Street (see image). At the intersection, there is damaged guide rail along Broad Street, which is a minor road leading to residences and a Redbank Valley Trailhead. At the two corners of the intersection, there is a gas station with several pumps. Large trucks from single unit trucks to WB-67s were observed to overtrack when heading both north and south along SR 28. When travelling south, trucks generally tracked into the northbound lanes. When traveling north, trucks either oversteered into the southbound lanes or ran over the curb.

*Facing east on SR 28 from gas station*

## ADA Ramps in New Bethleham

Along SR 28 (Broad Street) though New Bethleham, the ADA ramps were check to verify that they meet the standards for grade and width. All ramps at the following cross streets were checked:

- Liberty Street
- Maple Street
- LaFayette Street
- Wood Street
- Vine Street

The ADA ramps for two crossing were also checked near the following businesses:

- Klingensmith's Drug Store
- United States Post Office

All ramps met standards and were in good condition.

*ADA Ramp crossing the entrance from Klingensmith's Drug Store*

## Redbank Valley Trail Crossing

After travelling through New Bethlehem and its commercial district, the Redbank Valley Trail crosses SR 28. The trail crossing is skewed to SR 28, which is an S-bend on either side of the crossing. The sight distance is minimal from both the roadway and the trail. Approaching the trail crossing along SR 28, there are several signs warning of the crossing and an advisory speed reduction sign for 25 mph through the curves. To the north of the crossing, there is an uphill grade (see image).. South of the crossing, the roadway is relatively flat but is lower in elevation than the trail (see image). Brush and trees separate the trail and roadway along the slopes. Visibility is poor from the trail and from the roadway. To cross SR 28, a trail user must travel about 30 feet. There are no warning lights for the trail crossing. The sight distance for pedestrians and vehicles approaching the crossing is only a few hundred feet. Vehicles were difficult to see from the detectable warning surface on the trail due to the slopes along the roadway. Vehicles were observed to be speeding through the S-bend even though it is a 25 mph advisory speed curve.

*Redbank Valley Trail Crossing, facing south on SR 28*

*Redbank Valley Trail Crossing, facing north on SR 28*


*Approaching Redbank Valley Trail Crossing, southbound on SR 28 (Image from Google Street View)*

## ADA Ramps in Hawthron

In Hawthron, there are three ADA ramps along SR 28 at the cross roads of Center Street and Arch Street. They were measured for grade and width and found to be within standards. At Arch Street, there is only one ADA ramp. There is no ADA at the corner where Alcorn Funeral Home is located.

*ADA Ramp across from Alcorn Funeral Home at Arch Street*

## SR 0536, TR 0506, and SR 28

Traveling north from the trail crossing to SR 0536, guide rail, is in good condition or appears to have recently been replaced. The speed limit increases from 45 mph to 55 mph north of Hawthorn.

At the intersection of SR 0536, there is deteriorating pavement in several locations. Most of this pavement is on SR 0536 and on the curve returns of the intersection. The intersection with SR 0536 is skewed and northbound traffic from SR 28 has to make a sharp turn to travel east on SR 0536. There is evidence of overtracking at this corner. In addition, at this corner, the slope is beginning to deteriorate. This could be due to natural erosion but there were tracks on the grass, which suggest a trailer was brought up on the hill and taken off the hill at the corner.

*From SR 0536, facing south on SR 28*

Across from SR 0536 is TR 0506, a gravel road leading to several residential properties. Near the intersection, there is a weight limit sign for the bridge, which is farther down the road.

## Near the Address of 5934 SR 28

Just north of the intersection of SR 0536 and SR 28, there is an impact attenuator on the southbound side, which was recently damaged. The impact attenuator was crushed and debris remains from the accident. About 25 feet of guide rail was curled over itself and snapped from the wooden posts due to the impact attenuator (see image). There is a 55 mph speed limit along this stretch of road. Sight distance for vehicles traveling southbound is good due to the open fields and relatively flat terrain.

*Used impact attenuator on southbound side of SR 28*

## Toadtown Road, Anderson Road, Creek Street, and SR 28

Traveling from 5934 SR 28 to Toadtown Road, the roadway was in good condition. The guide rail was in fair condition with some erosion evident along the shoulder. There were several locations where the slope was reinforced with gabions along the southbound lanes.

At the intersection of Toadtown Road, two other minor roads that create a 5-way intersection. Anderson Road and Creek Street intersect SR 28 and are parallel with each other. Toadtown Road and Creek Street lead to residential areas immediately while Anderson Road turns away from Creek Street to a residential area along the Redbank Creek.

The speed limit along the minor roads are 15 to 25 mph while SR 28 has a speed limit of 55 mph. The pavement on the minor roads are deteriorating and have potholes. The guide rail along SR 28 is in good condition but the radius to Toadtown road is in poor condition (see image).

Sight distance at this location is fair. The terrain is mostly flat to the north, east, and west. To the south, there is downhill approaching the intersection. While the stop signs are a short distance from the intersection on the minor roads, vehicles were observed to move closer to SR 28 to see better around the brush and utility poles if traveling north or crossing SR 28 (see image). To travel south or cross the road, there are no obstructions in the sight line.


*Facing east at SR 28 on Toadtown Road*


*Facing south on Toadtown Road*

## SR 322 AND SR 28

Traveling north from Summerville, the roadway varies in condition. Most of the roadway is in good condition but there is evidence of a small slide and cliff overhangs on the southbound side of SR 28. Several smaller intersections are skewed along SR 28. These could potentially have insufficient sight distance. The speed limit changes several times from 55 mph to 45 mph to 35 mph as vehicles approach Brookville. Several S-bends have a 40 mph advisory speed.

The intersection of SR 322 and SR 28 is a signalized intersection with channelized right turn lanes on all four corners. The pavement at the intersection is in good condition as is the concrete used for the islands in the intersection. The last 135 feet of guide rail on the southeast corner is heavily damaged on the radius (see image). The 100 feet of the guide rail appears to have been pulled from the posts and dragged into the parking lot just past the corner. There is 25 feet of guide rail that is damaged, but still connected to the posts.

Along the guide rail radius, there is heavy erosion which has damaged the edge of pavement and leads down the slope behind the guide rail (see image).

*Damaged guide rail on SR 322/SR 28*

*Heavy erosion under guide rail on northbound channelized right turn*

# APPENDIX G

## Intersection Level of Service
## 2019 AM/PM and 2045 AM/PM

## *Exhibit 1 - Intersection Level of Service (2019 AM)*

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SR 28 at SR 85 (Signalized) | SR 85 | EB | EBL | 67.3 | E | 51.7 | D | 38.3 | D |
| | | | | EBT/R | 40.9 | D | | | | |
| | | SR 85 | WB | WBL | 47.8 | D | 41.4 | D | | |
| | | | | WBT/R | 26.3 | C | | | | |
| | | SR 28 | NB | NBL | 319.2 | F | 29.7 | C | | |
| | | | | NBT | 18.8 | B | | | | |
| | | | | NBR | 0 | A | | | | |
| | | SR 28 | SB | SBL | 129.6 | F | 37.5 | D | | |
| | | | | SBT/R | 28.7 | C | | | | |
| 2 | SR 28 at SR 1004 Madison Rd | SR 1004 | EB | EBL/R | 12.6 | B | 12.6 | B | 3 | A |
| | | SR 28 | NB | NBL/T | 9.3(L) | A | 0.5 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 21 | Kohlersburg Rd at SR 1004 Madison Rd | SR 1004 | EB | EBL/T/R | 6.8 | A | 6.8 | A | 7.1 | A |
| | | Slip Ramp | WB | WBL/T/R | 7.4 | A | 7.4 | A | | |
| | | SR 1004 | NB | NBL/T/R | 7.9 | A | 7.9 | A | | |
| | | Kburg Rd | SB | SBL/T/R | 7.3 | A | 7.3 | A | | |
| 3 | SR 28 at Kohlersburg Rd | Kburg Rd | EB | EBL/R | 13.4 | B | 13.4 | B | 0.2 | A |
| | | SR 28 | NB | NBL/T | 8.7(L) | A | 0 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 4 | SR 28 at SR 839 | SR 28 | EB | EBL/T/R | 8.9(L) | A | 0.1 | A | 2.1 | A |
| | | SR 28 | WB | WBL | 9.4 | A | 1.2 | A | | |
| | | | | WBT/R | 0 | A | | | | |
| | | SR 839 | NB | NBL/T/R | 11 | B | 11 | B | | |
| | | Short St | SB | SBL/T/R | 24.9 | C | 24.9 | C | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | SR 28 at SR 66 (Signalized) | SR 28 | EB | EBL | 9 | A | 8.1 | A | 14.6 | B |
| | | | | EBT/R | 7.7 | A | | | | |
| | | SR 28 | WB | WBL/T/R | 19.1 | B | 19.1 | B | | |
| | | Wood St | NB | NBL/T/R | 13.5 | B | 13.5 | B | | |
| | | SR 66 | SB | SBL/T/R | 19.1 | B | 19.1 | B | | |
| 7 | SR 28 at Center St | SR 28 | EB | EBL/T/R | 9.5 (L) | A | 0.3 | A | 1.2 | A |
| | | SR 28 | WB | WBL/T/R | 9.6(L) | A | 0.2 | A | | |
| | | Walker Flat Rd | NB | NBL/T/R | 13.3 | B | 13.3 | B | | |
| | | Center St | SB | SBL/T/R | 12.1 | B | 12.1 | B | | |
| 8 | SR 28 at Mayport Rd SR 536 | SR 28 | EB | EBL/T/R | 9(L) | A | 0.2 | A | 2.6 | A |
| | | SR 28 | WB | WBL/T/R | 9.3(L) | A | 0.6 | A | | |
| | | Mayport Rd | NB | NBL/T/R | 11.1 | B | 11.1 | B | | |
| | | Driveway | SB | SBL/T/R | 12 | B | 12 | B | | |
| 9 | SR 28 at Carrier St | SR 28 | EB | EBL/T/R | 8.8(L) | A | 0.3 | A | 2.3 | A |
| | | SR 28 | WB | WBL/T/R | 9.1(L) | A | 1.3 | A | | |
| | | Carrier St | NB | NBL/T/R | 9.8 | A | 9.8 | A | | |
| | | Carrier St | SB | SBL/T/R | 10.5 | B | 10.5 | B | | |
| 10 | SR 28 at S Main St | Driveway | EB | EBL/T/R | 10.8 | B | 10.8 | B | 2.3 | A |
| | | S. Main St | WB | WBL/T/R | 10 | B | 10 | B | | |
| | | SR 28 | NB | NBL/T/R | 8.2(L) | A | 0 | A | | |
| | | SR 28 | SB | SBL/T/R | 8.7(L) | A | 2.7 | A | | |
| 11 | SR 28 at SR 322 (Signalized) | SR 322 | EB | EBL/T/R | 16.6 | B | 16.6 | B | 12.9 | B |
| | | SR 322 | WB | WBL/T/R | 14.9 | B | 14.9 | B | | |
| | | SR 28 | NB | NBL | 10.7 | B | 13.6 | B | | |
| | | | | NBT/R | 14 | B | | | | |
| | | SR 36 | SB | SBL | 9.4 | A | 9.7 | A | | |
| | | | | SBT | 10.2 | B | | | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SBR | 0 | A | | | | |
| 12 | SR 36 at I-80 EB Ramps (Signalized) | I-80 Ramps | EB | EBL/T | 31.1 | C | 33 | C | 11.1 | B |
| | | | | EBR | 34.5 | C | | | | |
| | | SR 36 | NB | NBT/R | 7 | A | 6.8 | A | | |
| | | SR 36 | SB | SBL | 4 | A | 7.1 | A | | |
| | | | | SBT | 8.4 | A | | | | |
| 13 | SR 36 at I-80 WB Ramps (Signalized) | I-80 Ramps | WB | WBL/T | 30.2 | C | 32.2 | C | 10.5 | B |
| | | | | WBR | 34.4 | C | | | | |
| | | SR 36 | NB | NBL | 3.7 | A | 0.9 | A | | |
| | | | | NBT | 0.1 | A | | | | |
| | | SR 36 | SB | SBT/R | 7.6 | A | 7.5 | A | | |
| 14 | SR 28 at Waterford Pike | SR 28 | EB | EBL/T | 9(L) | A | 0.1 | A | 0.1 | A |
| | | SR 28 | WB | WBT/R | 0 | A | 0 | A | | |
| | | Waterford Pike | SB | SBL/R | 9.8 | A | 9.8 | A | | |
| 15 | SR 28 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T/R | 10.1 | B | 10.1 | B | 3.6 | A |
| | | SR 28 | NB | NBT/R | 0 | A | 0 | A | | |
| | | SR 28 | SB | SBL/T | 8.3(L) | A | 0.2 | A | | |
| 16 | SR 28 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T/R | 9.8 | A | 9.8 | A | 2.8 | A |
| | | SR 28 | NB | NBL/T | 8.3(L) | A | 1.7 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 81 | SR 28 at Dairy Rd | SR 28 | EB | EBT/R | 0 | A | 0 | A | 0.2 | A |
| | | SR 28 | WB | WBL/T | 9.2(L) | A | 0.1 | A | | |
| | | Dairy Rd | NB | NBL/R | 10.6 | B | 10.6 | B | | |

### *Exhibit 2 - Intersection Level of Service (2019 PM)*

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SR 28 at SR 85 (Signalized) | SR 85 | EB | EBL | 51.7 | D | 47.7 | D | 34.9 | C |
| | | | | EBT/R | 44.3 | D | | | | |
| | | SR 85 | WB | WBL | 50.5 | D | 45 | D | | |
| | | | | WBT/R | 29.2 | C | | | | |
| | | SR 28 | NB | NBL | 108.3 | F | 26.8 | C | | |
| | | | | NBT | 24.1 | C | | | | |
| | | | | NBR | 0 | A | | | | |
| | | SR 28 | SB | SBL | 117.2 | F | 29.2 | C | | |
| | | | | SBT/R | 23.3 | C | | | | |
| 2 | SR 28 at SR 1004 Madison Rd | SR 1004 | EB | EBL/R | 13.3 | B | 13.3 | B | 2 | A |
| | | SR 28 | NB | NBL/T | 9.2(L) | A | 0.7 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 21 | Kohlersburg Rd at SR 1004 Madison Rd | SR 1004 | EB | EBL/T/R | 7.3 | A | 7.3 | A | 7.5 | A |
| | | Slip Ramp | WB | WBL/T/R | 7.6 | A | 7.6 | A | | |
| | | SR 1004 | NB | NBL/T/R | 7.8 | A | 7.8 | A | | |
| | | Kburg Rd | SB | SBL/T/R | 7.3 | A | 7.3 | A | | |
| 3 | SR 28 at Kohlersburg Rd | Kburg Rd | EB | EBL/R | 14.6 | B | 14.6 | B | 0.2 | A |
| | | SR 28 | NB | NBL/T | 8.9(L) | A | 0 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 4 | SR 28 at SR 839 | SR 28 | EB | EBL/T/R | 9.1(L) | A | 0 | A | 1.8 | A |
| | | SR 28 | WB | WBL | 9.5 | A | 1.9 | A | | |
| | | | | WBT/R | 0 | A | | | | |
| | | SR 839 | NB | NBL/T/R | 10.6 | B | 10.6 | B | | |
| | | Short St | SB | SBL/T/R | 24.8 | C | 24.8 | C | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | SR 28 at SR 66 (Signalized) | SR 28 | EB | EBL | 9.4 | A | 8.6 | A | 15.6 | B |
| | | | | EBT/R | 8.3 | A | | | | |
| | | SR 28 | WB | WBL/T/R | 19.3 | B | 19.3 | B | | |
| | | Wood St | NB | NBL/T/R | 13.5 | B | 13.5 | B | | |
| | | SR 66 | SB | SBL/T/R | 19.7 | B | 19.7 | B | | |
| 7 | SR 28 at Center St | SR 28 | EB | EBL/T/R | 9.7(L) | A | 0.5 | A | 1.4 | A |
| | | SR 28 | WB | WBL/T/R | 9.5(L) | A | 0.4 | A | | |
| | | Walker Flat Rd | NB | NBL/T/R | 15.3 | C | 15.3 | C | | |
| | | Center St | SB | SBL/T/R | 12.5 | B | 12.5 | B | | |
| 8 | SR 28 at Mayport Rd SR 536 | SR 28 | EB | EBL/T/R | 9.2(L) | A | 0.1 | A | 3.3 | A |
| | | SR 28 | WB | WBL/T/R | 9.4(L) | A | 1.4 | A | | |
| | | Mayport Rd | NB | NBL/T/R | 13.1 | B | 13.1 | B | | |
| | | Driveway | SB | SBL/T/R | 14 | B | 14 | B | | |
| 9 | SR 28 at Carrier St | SR 28 | EB | EBL/T/R | 9.3(L) | A | 0.1 | A | 2.4 | A |
| | | SR 28 | WB | WBL/T/R | 9.1(L) | A | 1.4 | A | | |
| | | Carrier St | NB | NBL/T/R | 11.4 | B | 11.4 | B | | |
| | | Carrier St | SB | SBL/T/R | 12.1 | B | 12.1 | B | | |
| 10 | SR 28 at S Main St | Driveway | EB | EBL/T/R | 11.2 | B | 11.2 | B | 4 | A |
| | | S. Main St | WB | WBL/T/R | 12.4 | B | 12.4 | B | | |
| | | SR 28 | NB | NBL/T/R | 8.6(L) | A | 0.1 | A | | |
| | | SR 28 | SB | SBL/T/R | 8.6(L) | A | 0.8 | A | | |
| 11 | SR 28 at SR 322 (Signalized) | SR 322 | EB | EBL/T/R | 18.5 | B | 18.5 | B | 14.1 | B |
| | | SR 322 | WB | WBL/T/R | 16.4 | B | 16.4 | B | | |
| | | SR 28 | NB | NBL | 12.4 | B | 15.4 | B | | |
| | | | | NBT/R | 16 | B | | | | |
| | | SR 36 | SB | SBL | 9.3 | A | 10 | A | | |
| | | | | SBT | 11.1 | B | | | | |
| | | | | SBR | 0 | A | | | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | SR 36 at I-80 EB Ramps (Signalized) | I-80 Ramps | EB | EBL/T | 29.5 | C | 33.9 | C | 13.2 | B |
| | | | | EBR | 36.8 | D | | | | |
| | | SR 36 | NB | NBT/R | 8.7 | A | 8.5 | A | | |
| | | SR 36 | SB | SBL | 5.1 | A | 8.2 | A | | |
| | | | | SBT | 9.4 | A | | | | |
| 13 | SR 36 at I-80 WB Ramps (Signalized) | I-80 Ramps | WB | WBL/T | 174 | F | 97.1 | F | 29.7 | C |
| | | | | WBR | 32.7 | C | | | | |
| | | SR 36 | NB | NBL | 5.7 | A | 1.5 | A | | |
| | | | | NBT | 0.2 | A | | | | |
| | | SR 36 | SB | SBT/R | 10.9 | B | 10.8 | B | | |
| 14 | SR 28 at Waterford Pike | SR 28 | EB | EBL/T | 9.6(L) | A | 0.2 | A | 0.2 | A |
| | | SR 28 | WB | WBT/R | 0 | A | 0 | A | | |
| | | Waterford Pike | SB | SBL/R | 13.4 | B | 13.4 | B | | |
| 15 | SR 28 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T/R | 10.1 | B | 10.1 | B | 2.4 | A |
| | | SR 28 | NB | NBT/R | 0 | A | 0 | A | | |
| | | SR 28 | SB | SBL/T | 8.7(L) | A | 0.5 | A | | |
| 16 | SR 28 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T/R | 12.6 | B | 12.6 | B | 3.3 | A |
| | | SR 28 | NB | NBL/T | 8.6(L) | A | 3.1 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 81 | SR 28 at Dairy Rd | SR 28 | EB | EBT/R | 0 | A | 0 | A | 0.1 | A |
| | | SR 28 | WB | WBL/T | 9.2(L) | A | 0 | A | | |
| | | Dairy Rd | NB | NBL/R | 11.1 | B | 11.1 | B | | |

### *Exhibit 3 - Intersection Level of Service (2045 AM)*

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SR 28 at SR 85 (Signalized) | SR 85 | EB | EBL | 75.2 | E | 60.0 | E | 43.3 | D |
| | | | | EBT/R | 49.7 | D | | | | |
| | | SR 85 | WB | WBL | 60.2 | E | 50.8 | D | | |
| | | | | WBT/R | 28.6 | C | | | | |
| | | SR 28 | NB | NBL | 158.7 | F | 25.6 | C | | |
| | | | | NBT | 20.0 | C | | | | |
| | | | | NBR | 0.0 | A | | | | |
| | | SR 28 | SB | SBL | 149.1 | F | 43.0 | D | | |
| | | | | SBT/R | 33.0 | C | | | | |
| 2 | SR 28 at SR 1004 Madison Rd | SR 1004 | EB | EBL/R | 13.8 | B | 13.8 | B | 3.2 | A |
| | | SR 28 | NB | NBL/T | 9.5(L) | A | 0.5 | A | | |
| | | SR 28 | SB | SBT/R | 0.0 | A | 0.0 | A | | |
| 21 | Kohlersburg Rd at SR 1004 Madison Rd | SR 1004 | EB | EBL/T/R | 6.9 | A | 6.9 | A | 7.2 | A |
| | | Slip Ramp | WB | WBL/T/R | 7.5 | A | 7.5 | A | | |
| | | SR 1004 | NB | NBL/T/R | 7.9 | A | 7.9 | A | | |
| | | Kburg Rd | SB | SBL/T/R | 7.4 | A | 7.4 | A | | |
| 3 | SR 28 at Kohlersburg Rd | Kburg Rd | EB | EBL/R | 14.7 | B | 14.7 | B | 0.2 | A |
| | | SR 28 | NB | NBL/T | 8.8(L) | A | 0.0 | A | | |
| | | SR 28 | SB | SBT/R | 0.0 | A | 0.0 | A | | |
| 4 | SR 28 at SR 839 | SR 28 | EB | EBL/T/R | 9.0(L) | A | 0.1 | A | 2.2 | A |
| | | SR 28 | WB | WBL | 9.6 | A | 1.2 | A | | |
| | | | | WBT/R | 0.0 | A | | | | |
| | | SR 839 | NB | NBL/T/R | 11.7 | B | 11.7 | B | | |
| | | Short St | SB | SBL/T/R | 31.5 | D | 31.5 | D | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | SR 28 at SR 66 (Signalized) | SR 28 | EB | EBL | 10.4 | B | 9.5 | A | 17.2 | B |
| | | | | EBT/R | 9.0 | A | | | | |
| | | SR 28 | WB | WBL/T/R | 22.8 | C | 22.8 | C | | |
| | | Wood St | NB | NBL/T/R | 15.1 | B | 15.1 | B | | |
| | | SR 66 | SB | SBL/T/R | 22.5 | C | 22.5 | C | | |
| 7 | SR 28 at Center St | SR 28 | EB | EBL/T/R | 9.7(L) | A | 0.3 | A | 1.3 | A |
| | | SR 28 | WB | WBL/T/R | 9.8(L) | A | 0.2 | A | | |
| | | Walker Flat Rd | NB | NBL/T/R | 14.6 | B | 14.6 | B | | |
| | | Center St | SB | SBL/T/R | 12.9 | B | 12.9 | B | | |
| 8 | SR 28 at Mayport Rd SR 536 | SR 28 | EB | EBL/T/R | 9.1(L) | A | 0.2 | A | 2.7 | A |
| | | SR 28 | WB | WBL/T/R | 9.4(L) | A | 0.6 | A | | |
| | | Mayport Rd | NB | NBL/T/R | 11.8 | B | 11.8 | B | | |
| | | Driveway | SB | SBL/T/R | 12.7 | B | 12.7 | B | | |
| 9 | SR 28 at Carrier St | SR 28 | EB | EBL/T/R | 8.8(L) | A | 0.3 | A | 2.4 | A |
| | | SR 28 | WB | WBL/T/R | 9.2(L) | A | 1.4 | A | | |
| | | Carrier St | NB | NBL/T/R | 10.1 | B | 10.1 | B | | |
| | | Carrier St | SB | SBL/T/R | 10.7 | B | 10.7 | B | | |
| 10 | SR 28 at S Main St | Driveway | EB | EBL/T/R | 11.2 | B | 11.2 | B | 2.4 | A |
| | | S. Main St | WB | WBL/T/R | 10.4 | B | 10.4 | B | | |
| | | SR 28 | NB | NBL/T/R | 8.3(L) | A | 0.0 | A | | |
| | | SR 28 | SB | SBL/T/R | 8.8(L) | A | 2.8 | A | | |
| 11 | SR 28 at SR 322 (Signalized) | SR 322 | EB | EBL/T/R | 17.5 | B | 17.5 | B | 13.4 | B |
| | | SR 322 | WB | WBL/T/R | 15.4 | B | 15.4 | B | | |
| | | SR 28 | NB | NBL | 10.9 | B | 14.4 | B | | |
| | | | | NBT/R | 14.8 | B | | | | |
| | | SR 36 | SB | SBL | 9.4 | A | 9.7 | A | | |
| | | | | SBT | 10.4 | B | | | | |
| | | | | SBR | 0.0 | A | | | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | SR 36 at I-80 EB Ramps (Signalized) | I-80 Ramps | EB | EBL/T | 30.7 | C | 33.5 | C | 11.8 | B |
| | | | | EBR | 35.7 | D | | | | |
| | | SR 36 | NB | NBT/R | 7.8 | A | 7.7 | A | | |
| | | SR 36 | SB | SBL | 4.5 | A | 7.6 | A | | |
| | | | | SBT | 8.9 | A | | | | |
| 13 | SR 36 at I-80 WB Ramps (Signalized) | I-80 Ramps | WB | WBL/T | 29.7 | C | 32.0 | C | 10.9 | B |
| | | | | WBR | 34.6 | C | | | | |
| | | SR 36 | NB | NBL | 4.1 | A | 1.0 | A | | |
| | | | | NBT | 0.2 | A | | | | |
| | | SR 36 | SB | SBT/R | 8.4 | A | 8.3 | A | | |
| 14 | SR 28 at Waterford Pike | SR 28 | EB | EBL/T | 9.2(L) | A | 0.1 | A | 0.1 | A |
| | | SR 28 | WB | WBT/R | 0.0 | A | 0.0 | A | | |
| | | Waterford Pike | SB | SBL/R | 10.1 | B | 10.1 | B | | |
| 15 | SR 28 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T/R | 10.5 | B | 10.5 | B | 3.7 | A |
| | | SR 28 | NB | NBT/R | 0.0 | A | 0.0 | A | | |
| | | SR 28 | SB | SBL/T | 8.3(L) | A | 0.2 | A | | |
| 16 | SR 28 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T/R | 10.2 | B | 10.2 | B | 2.8 | A |
| | | SR 28 | NB | NBL/T | 8.4(L) | A | 1.7 | A | | |
| | | SR 28 | SB | SBT/R | 0.0 | A | 0.0 | A | | |
| 81 | SR 28 at Dairy Rd | SR 28 | EB | EBT/R | 0.0 | A | 0.0 | A | 0.2 | A |
| | | SR 28 | WB | WBL/T | 9.3(L) | A | 0.1 | A | | |
| | | Dairy Rd | NB | NBL/R | 11.1 | B | 11.1 | B | | |

### *Exhibit 4 - Intersection Level of Service (2045 PM)*

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SR 28 at SR 85 (Signalized) | SR 85 | EB | EBL | 54 | D | 51.8 | D | 39.8 | D |
| | | | | EBT/R | 49.8 | D | | | | |
| | | SR 85 | WB | WBL | 64.3 | E | 56 | E | | |
| | | | | WBT/R | 32.1 | C | | | | |
| | | SR 28 | NB | NBL | 97.5 | F | 30.1 | C | | |
| | | | | NBT | 27.9 | C | | | | |
| | | | | NBR | 0 | A | | | | |
| | | SR 28 | SB | SBL | 113.8 | F | 31.5 | C | | |
| | | | | SBT/R | 26 | C | | | | |
| 2 | SR 28 at SR 1004 Madison Rd | SR 1004 | EB | EBL/R | 14.7 | B | 14.7 | B | 2.2 | A |
| | | SR 28 | NB | NBL/T | 9.3(L) | A | 0.7 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 21 | Kohlersburg Rd at SR 1004 Madison Rd | SR 1004 | EB | EBL/T/R | 7.4 | A | 7.4 | A | 7.7 | A |
| | | Slip Ramp | WB | WBL/T/R | 7.8 | A | 7.8 | A | | |
| | | SR 1004 | NB | NBL/T/R | 7.9 | A | 7.9 | A | | |
| | | Kburg Rd | SB | SBL/T/R | 7.4 | A | 7.4 | A | | |
| 3 | SR 28 at Kohlersburg Rd | Kburg Rd | EB | EBL/R | 16.4 | C | 16.4 | C | 0.2 | A |
| | | SR 28 | NB | NBL/T | 9.1(L) | A | 0 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 4 | SR 28 at SR 839 | SR 28 | EB | EBL/T/R | 9.2(L) | A | 0 | A | 1.9 | A |
| | | SR 28 | WB | WBL | 9.8 | A | 1.9 | A | | |
| | | | | WBT/R | 0 | A | | | | |
| | | SR 839 | NB | NBL/T/R | 11.1 | B | 11.1 | B | | |
| | | Short St | SB | SBL/T/R | 30.9 | D | 30.9 | D | | |
| 5 | SR 28 at SR 66 (Signalized) | SR 28 | EB | EBL | 10.7 | B | 10 | B | 19.2 | B |
| | | | | EBT/R | 9.7 | A | | | | |
| | | SR 28 | WB | WBL/T/R | 24.7 | C | 24.7 | C | | |
| | | Wood St | NB | NBL/T/R | 15 | B | 15 | B | | |
| | | SR 66 | SB | SBL/T/R | 23.7 | C | 23.7 | C | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | SR 28 at Center St | SR 28 | EB | EBL/T/R | 9.9(L) | A | 0.5 | A | 1.5 | A |
| | | SR 28 | WB | WBL/T/R | 9.7(L) | A | 0.4 | A | | |
| | | Walker Flat Rd | NB | NBL/T/R | 17.5 | C | 17.5 | C | | |
| | | Center St | SB | SBL/T/R | 13.6 | B | 13.6 | B | | |
| 8 | SR 28 at Mayport Rd SR 536 | SR 28 | EB | EBL/T/R | 9.3(L) | A | 0.1 | A | 3.5 | A |
| | | SR 28 | WB | WBL/T/R | 9.6(L) | A | 1.4 | A | | |
| | | Mayport Rd | NB | NBL/T/R | 14.5 | B | 14.5 | B | | |
| | | Driveway | SB | SBL/T/R | 15.5 | C | 15.5 | C | | |
| 9 | SR 28 at Carrier St | SR 28 | EB | EBL/T/R | 9.5(L) | A | 0.2 | A | 2.6 | A |
| | | SR 28 | WB | WBL/T/R | 9.2(L) | A | 1.4 | A | | |
| | | Carrier St | NB | NBL/T/R | 12 | B | 12 | B | | |
| | | Carrier St | SB | SBL/T/R | 12.9 | B | 12.9 | B | | |
| 10 | SR 28 at S Main St | Driveway | EB | EBL/T/R | 11.8 | B | 11.8 | B | 4.3 | A |
| | | S. Main St | WB | WBL/T/R | 13.7 | B | 13.7 | B | | |
| | | SR 28 | NB | NBL/T/R | 8.6(L) | A | 0.1 | A | | |
| | | SR 28 | SB | SBL/T/R | 8.6(L) | A | 0.8 | A | | |
| 11 | SR 28 at SR 322 (Signalized) | SR 322 | EB | EBL/T/R | 19.3 | B | 19.3 | B | 15.0 | B |
| | | SR 322 | WB | WBL/T/R | 16.8 | B | 16.8 | B | | |
| | | SR 28 | NB | NBL | 13.6 | B | 17.2 | B | | |
| | | | | NBT/R | 17.9 | B | | | | |
| | | SR 36 | SB | SBL | 10.2 | B | 10.9 | B | | |
| | | | | SBT | 11.9 | B | | | | |
| | | | | SBR | 0 | A | | | | |
| 12 | SR 36 at I-80 EB Ramps (Signalized) | I-80 Ramps | EB | EBL/T | 29 | C | 35.2 | D | 14.2 | B |
| | | | | EBR | 39.3 | D | | | | |
| | | SR 36 | NB | NBT/R | 9.9 | A | 9.8 | A | | |
| | | SR 36 | SB | SBL | 5.9 | A | 8.9 | A | | |
| | | | | SBT | 10.1 | B | | | | |

| ID | Intersection | Roadway | Approach | Lane Config | Movement Delay (s) | Movement LOS | Approach Delay (s) | Approach LOS | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|---|---|
| 13 | SR 36 at I-80 WB Ramps (Signalized) | I-80 Ramps | WB | WBL/T | 232.9 | F | 127.4 | F | 37.7 | D |
| | | | | WBR | 38.9 | D | | | | |
| | | SR 36 | NB | NBL | 5.9 | A | 1.6 | A | | |
| | | | | NBT | 0.2 | A | | | | |
| | | SR 36 | SB | SBT/R | 11.5 | B | 11.3 | B | | |
| 14 | SR 28 at Waterford Pike | SR 28 | EB | EBL/T | 9.9(L) | A | 0.3 | A | 0.2 | A |
| | | SR 28 | WB | WBT/R | 0 | A | 0 | A | | |
| | | Waterford Pike | SB | SBL/R | 14.8 | B | 14.8 | B | | |
| 15 | SR 28 at I-80 EB Ramps | I-80 Ramps | EB | EBL/T/R | 10.6 | B | 10.6 | B | 2.5 | A |
| | | SR 28 | NB | NBT/R | 0 | A | 0 | A | | |
| | | SR 28 | SB | SBL/T | 8.8(L) | A | 0.6 | A | | |
| 16 | SR 28 at I-80 WB Ramps | I-80 Ramps | WB | WBL/T/R | 13.8 | B | 13.8 | B | 3.5 | A |
| | | SR 28 | NB | NBL/T | 8.7(L) | A | 3.2 | A | | |
| | | SR 28 | SB | SBT/R | 0 | A | 0 | A | | |
| 81 | SR 28 at Dairy Rd | SR 28 | EB | EBT/R | 0 | A | 0 | A | 0.1 | A |
| | | SR 28 | WB | WBL/T | 9.3(L) | A | 0 | A | | |
| | | Dairy Rd | NB | NBL/R | 11.7 | B | 11.7 | B | | |

# APPENDIX H

## Design Criteria

# 25 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

1 **DESIGN CRITERIA MATRIX**
MPMS NO. N/A
SR 28 SEC N/A , Clarion COUNTY

2 **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

3 **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Suburban Center
TOPOGRAPHY Rolling
REMARKS New Bethlehem

4 **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 8896 (2017)
DESIGN YEAR ADT (Average Daily Traffic) 10229
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 818
D (Directional Distribution) 55
T (Truck Percentage) 5

| 5 Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 25 MPH | 30-35 MPH | 25 MPH | No | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 10' to 12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 8' | 4'-6' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | 44' | 28'-36' | 44' | Yes | DM-2, Sec. 1.2C | |
| Minimum Horizontal Radius | | | 600' | 231' to 340' | 600' | No | AASHTO, Table 3-9 | * 25 mph, minimum radius is 144' |
| Maximum Superelevation Rate | | | Varies | 6.0% | 6.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.10% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 103 |
| | Maximum | | 2.90% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 90 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 200'-250' | 200' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 335' to 390' | 280' | No | AASHTO, Table 9-6 | * 25 mph, minimum ISD is 280' |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2. Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | N/A | N/A | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

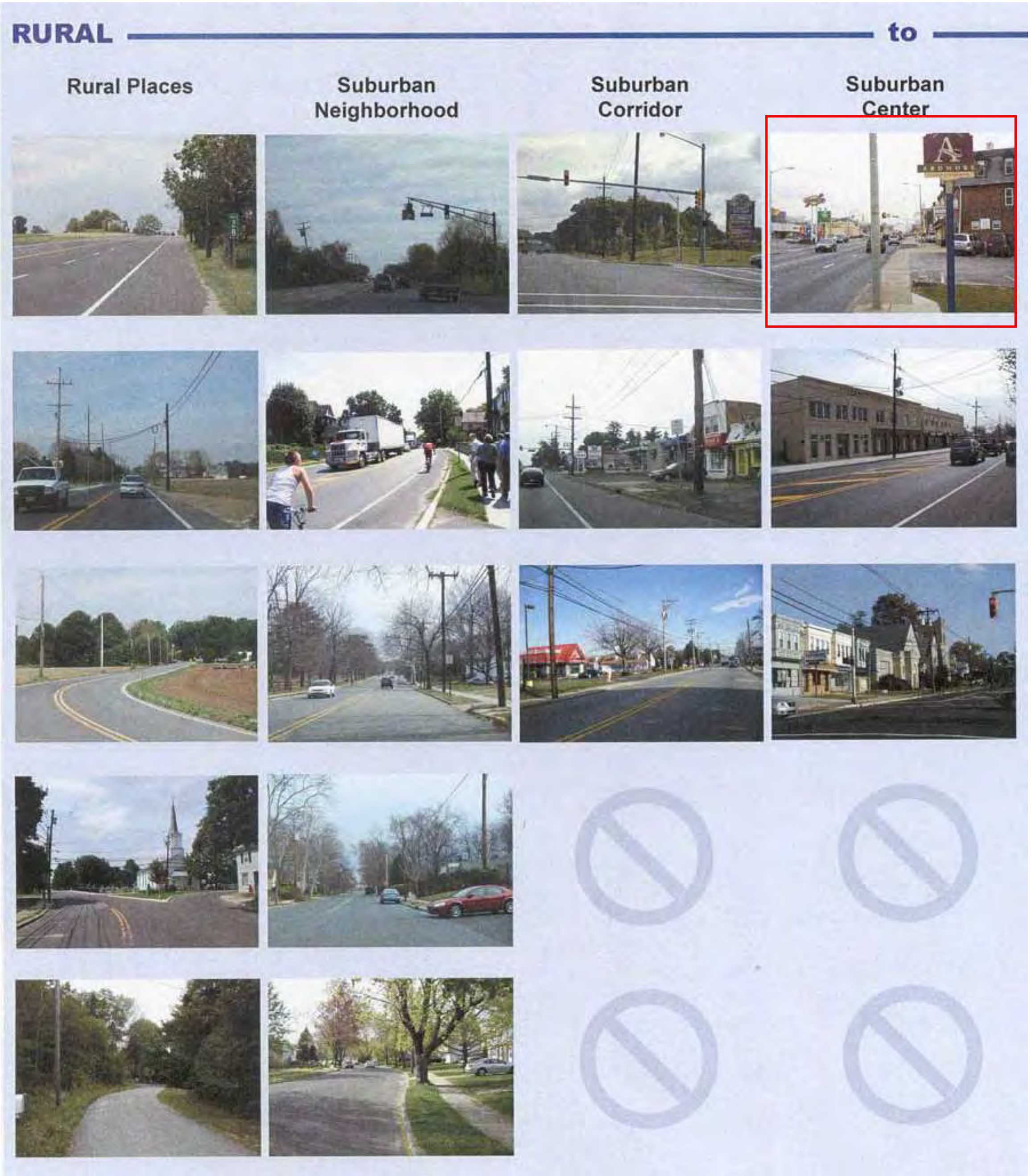
6 Any pedestrian and bicycle concerns/needs? Explain. Sidewalks, multimodal
Any ADA compliance issues? Explain. ADA ramps on corners through town
Any transit issues? Explain.
Any additional design issues? Explain.

## TABLE 1.2
## ROADWAY TYPOLOGIES

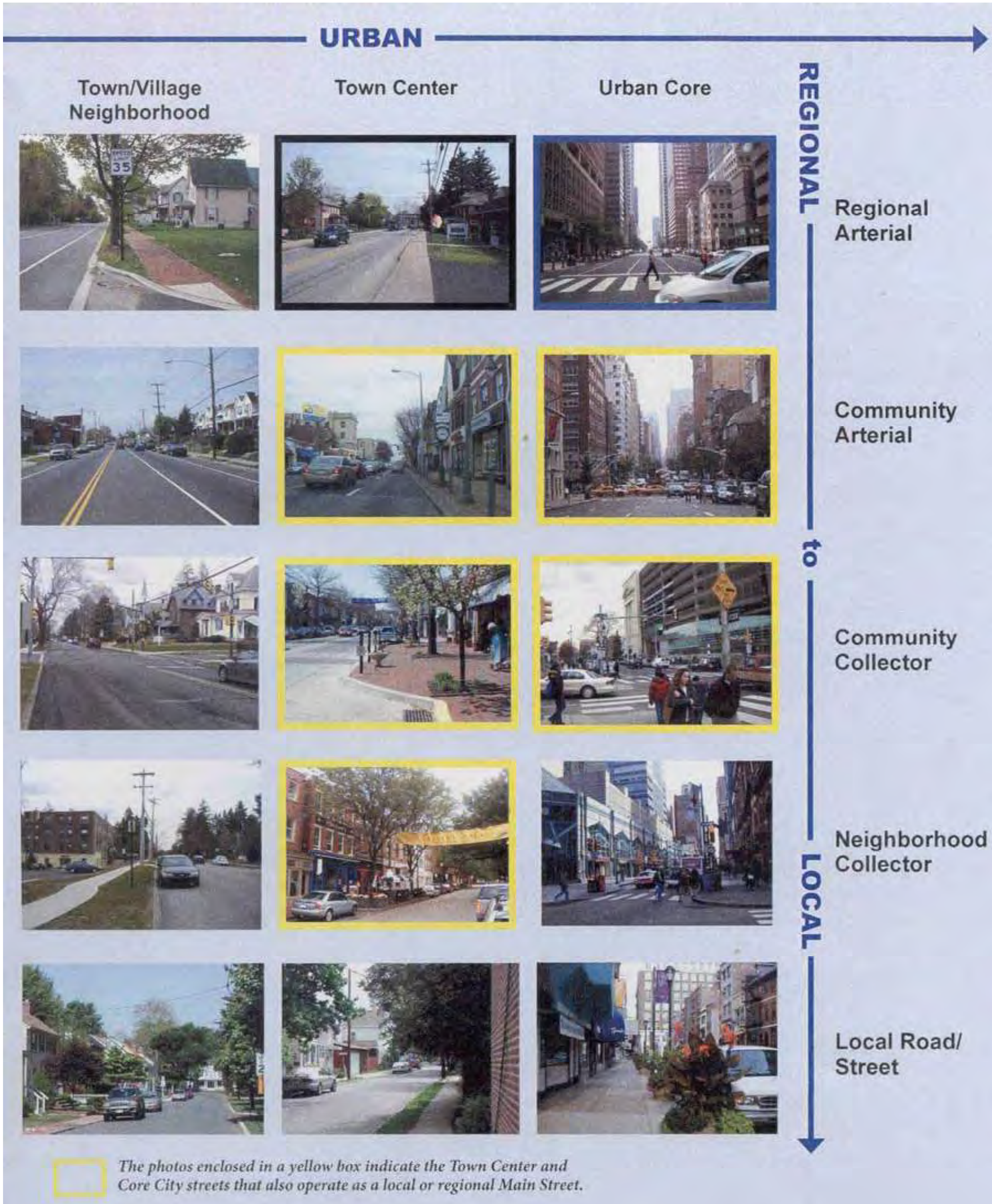
| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

# FIGURE 1.2
# ILLUSTRATED ROADWAY TYPOLOGIES



## FIGURE 1.2 (CONTINUED)
## ILLUSTRATED ROADWAY TYPOLOGIES



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-9. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 6%**

| Metric | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 20 km/h | $V_d$ = 30 km/h | $V_d$ = 40 km/h | $V_d$ = 50 km/h | $V_d$ = 60 km/h | $V_d$ = 70 km/h | $V_d$ = 80 km/h | $V_d$ = 90 km/h | $V_d$ = 100 km/h | $V_d$ = 110 km/h | $V_d$ = 120 km/h | $V_d$ = 130 km/h |
| *e* (%) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) | *R* (m) |
| NC | 194 | 421 | 738 | 1050 | 1440 | 1910 | 2360 | 2880 | 3510 | 4060 | 4770 | 5240 |
| RC | 138 | 299 | 525 | 750 | 1030 | 1380 | 1710 | 2090 | 2560 | 2970 | 3510 | 3880 |
| 2.2 | 122 | 265 | 465 | 668 | 919 | 1230 | 1530 | 1880 | 2300 | 2670 | 3160 | 3500 |
| 2.4 | 109 | 236 | 415 | 599 | 825 | 1110 | 1380 | 1700 | 2080 | 2420 | 2870 | 3190 |
| 2.6 | 97 | 212 | 372 | 540 | 746 | 1000 | 1260 | 1540 | 1890 | 2210 | 2630 | 2930 |
| 2.8 | 87 | 190 | 334 | 488 | 676 | 910 | 1150 | 1410 | 1730 | 2020 | 2420 | 2700 |
| 3.0 | 78 | 170 | 300 | 443 | 615 | 831 | 1050 | 1290 | 1590 | 1870 | 2240 | 2510 |
| 3.2 | 70 | 152 | 269 | 402 | 561 | 761 | 959 | 1190 | 1470 | 1730 | 2080 | 2330 |
| 3.4 | 61 | 133 | 239 | 364 | 511 | 697 | 882 | 1100 | 1360 | 1600 | 1940 | 2180 |
| 3.6 | 51 | 113 | 206 | 329 | 465 | 640 | 813 | 1020 | 1260 | 1490 | 1810 | 2050 |
| 3.8 | 42 | 96 | 177 | 294 | 422 | 586 | 749 | 939 | 1170 | 1390 | 1700 | 1930 |
| 4.0 | 36 | 82 | 155 | 261 | 380 | 535 | 690 | 870 | 1090 | 1300 | 1590 | 1820 |
| 4.2 | 31 | 72 | 136 | 234 | 343 | 488 | 635 | 806 | 1010 | 1220 | 1500 | 1720 |
| 4.4 | 27 | 63 | 121 | 210 | 311 | 446 | 584 | 746 | 938 | 1140 | 1410 | 1630 |
| 4.6 | 24 | 56 | 108 | 190 | 283 | 408 | 538 | 692 | 873 | 1070 | 1330 | 1540 |
| 4.8 | 21 | 50 | 97 | 172 | 258 | 374 | 496 | 641 | 812 | 997 | 1260 | 1470 |
| 5.0 | 19 | 45 | 88 | 156 | 235 | 343 | 457 | 594 | 755 | 933 | 1190 | 1400 |
| 5.2 | 17 | 40 | 79 | 142 | 214 | 315 | 421 | 549 | 701 | 871 | 1120 | 1330 |
| 5.4 | 15 | 36 | 71 | 128 | 195 | 287 | 386 | 506 | 648 | 810 | 1060 | 1260 |
| 5.6 | 13 | 32 | 63 | 115 | 176 | 260 | 351 | 463 | 594 | 747 | 980 | 1190 |
| 5.8 | 11 | 28 | 56 | 102 | 156 | 232 | 315 | 416 | 537 | 679 | 900 | 1110 |
| 6.0 | 8 | 21 | 43 | 79 | 123 | 184 | 252 | 336 | 437 | 560 | 756 | 951 |

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| *e* (%) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) |
| NC | 868 | 1580 | 2290 | 3130 | 4100 | 5230 | 6480 | 7870 | 9410 | 11100 | 12600 | 14100 | 15700 | 17400 |
| RC | 614 | 1120 | 1630 | 2240 | 2950 | 3770 | 4680 | 5700 | 6820 | 8060 | 9130 | 10300 | 11500 | 12900 |
| 2.2 | 543 | 991 | 1450 | 2000 | 2630 | 3370 | 4190 | 5100 | 6110 | 7230 | 8200 | 9240 | 10400 | 11600 |
| 2.4 | 482 | 884 | 1300 | 1790 | 2360 | 3030 | 3770 | 4600 | 5520 | 6540 | 7430 | 8380 | 9420 | 10600 |
| 2.6 | 430 | 791 | 1170 | 1610 | 2130 | 2740 | 3420 | 4170 | 5020 | 5950 | 6770 | 7660 | 8620 | 9670 |
| 2.8 | 384 | 709 | 1050 | 1460 | 1930 | 2490 | 3110 | 3800 | 4580 | 5440 | 6200 | 7030 | 7930 | 8910 |
| 3.0 | 341 | 635 | 944 | 1320 | 1760 | 2270 | 2840 | 3480 | 4200 | 4990 | 5710 | 6490 | 7330 | 8260 |
| 3.2 | 300 | 566 | 850 | 1200 | 1600 | 2080 | 2600 | 3200 | 3860 | 4600 | 5280 | 6010 | 6810 | 7680 |
| 3.4 | 256 | 498 | 761 | 1080 | 1460 | 1900 | 2390 | 2940 | 3560 | 4250 | 4890 | 5580 | 6340 | 7180 |
| 3.6 | 209 | 422 | 673 | 972 | 1320 | 1740 | 2190 | 2710 | 3290 | 3940 | 4540 | 5210 | 5930 | 6720 |
| 3.8 | 176 | 358 | 583 | 864 | 1190 | 1590 | 2010 | 2490 | 3040 | 3650 | 4230 | 4860 | 5560 | 6320 |
| 4.0 | 151 | 309 | 511 | 766 | 1070 | 1440 | 1840 | 2300 | 2810 | 3390 | 3950 | 4550 | 5220 | 5950 |
| 4.2 | 131 | 270 | 452 | 684 | 960 | 1310 | 1680 | 2110 | 2590 | 3140 | 3680 | 4270 | 4910 | 5620 |
| 4.4 | 116 | 238 | 402 | 615 | 868 | 1190 | 1540 | 1940 | 2400 | 2920 | 3440 | 4010 | 4630 | 5320 |
| 4.6 | 102 | 212 | 360 | 555 | 788 | 1090 | 1410 | 1780 | 2210 | 2710 | 3220 | 3770 | 4380 | 5040 |
| 4.8 | 91 | 189 | 324 | 502 | 718 | 995 | 1300 | 1640 | 2050 | 2510 | 3000 | 3550 | 4140 | 4790 |
| 5.0 | 82 | 169 | 292 | 456 | 654 | 911 | 1190 | 1510 | 1890 | 2330 | 2800 | 3330 | 3910 | 4550 |
| 5.2 | 73 | 152 | 264 | 413 | 595 | 833 | 1090 | 1390 | 1750 | 2160 | 2610 | 3120 | 3690 | 4320 |
| 5.4 | 65 | 136 | 237 | 373 | 540 | 759 | 995 | 1280 | 1610 | 1990 | 2420 | 2910 | 3460 | 4090 |
| 5.6 | 58 | 121 | 212 | 335 | 487 | 687 | 903 | 1160 | 1470 | 1830 | 2230 | 2700 | 3230 | 3840 |
| 5.8 | 51 | 106 | 186 | 296 | 431 | 611 | 806 | 1040 | 1320 | 1650 | 2020 | 2460 | 2970 | 3560 |
| 6.0 | 39 | 81 | 144 | 231 | 340 | 485 | 643 | 833 | 1060 | 1330 | 1660 | 2040 | 2500 | 3050 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | U.S. Customary Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

#### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

#### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

### 7.2.3 Cross-Sectional Elements

#### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars: Calculated (m) | Intersection Sight Distance for Passenger Cars: Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars: Calculated (ft) | Intersection Sight Distance for Passenger Cars: Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 35 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

(1) **DESIGN CRITERIA MATRIX**
MPMS NO. N/A Armstrong COUNTY
SR 28 SEC N/A , Clarion COUNTY
Jefferson COUNTY

(2) **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

(3) **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Suburban Center
TOPOGRAPHY Rolling
REMARKS South Bethlehem, Hawthorn, Summerville

(4) **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 8996 (2017)
DESIGN YEAR ADT (Average Daily Traffic) 10344
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 828
D (Directional Distribution) 55
T (Truck Percentage) 5

| (5) Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 35 MPH | 30-35 MPH | 35 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 10'-12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 2'-8' | 4'-6' | 6' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | 44' | 28'-36' | 44' | Yes | DM-2, Table 1.2G | |
| Minimum Horizontal Radius | | | 75' | 231' to 340' | 340' | Yes | AASHTO, Table 3-9 | |
| Maximum Superelevation Rate | | | Varies | 6.0% | 6.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.40% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 110 |
| | Maximum | | 1.90% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 117 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 200' to 250' | 250' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 335' to 390' | 390' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | N/A | Yes | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

(6)
Any pedestrian and bicycle concerns/needs? Explain. Sidewalks, multimodal
Any ADA compliance issues? Explain. ADA ramps on corners through town
Any transit issues? Explain.
Any additional design issues? Explain. 15 mph curve entering New Bethleham

## TABLE 1.2
## ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

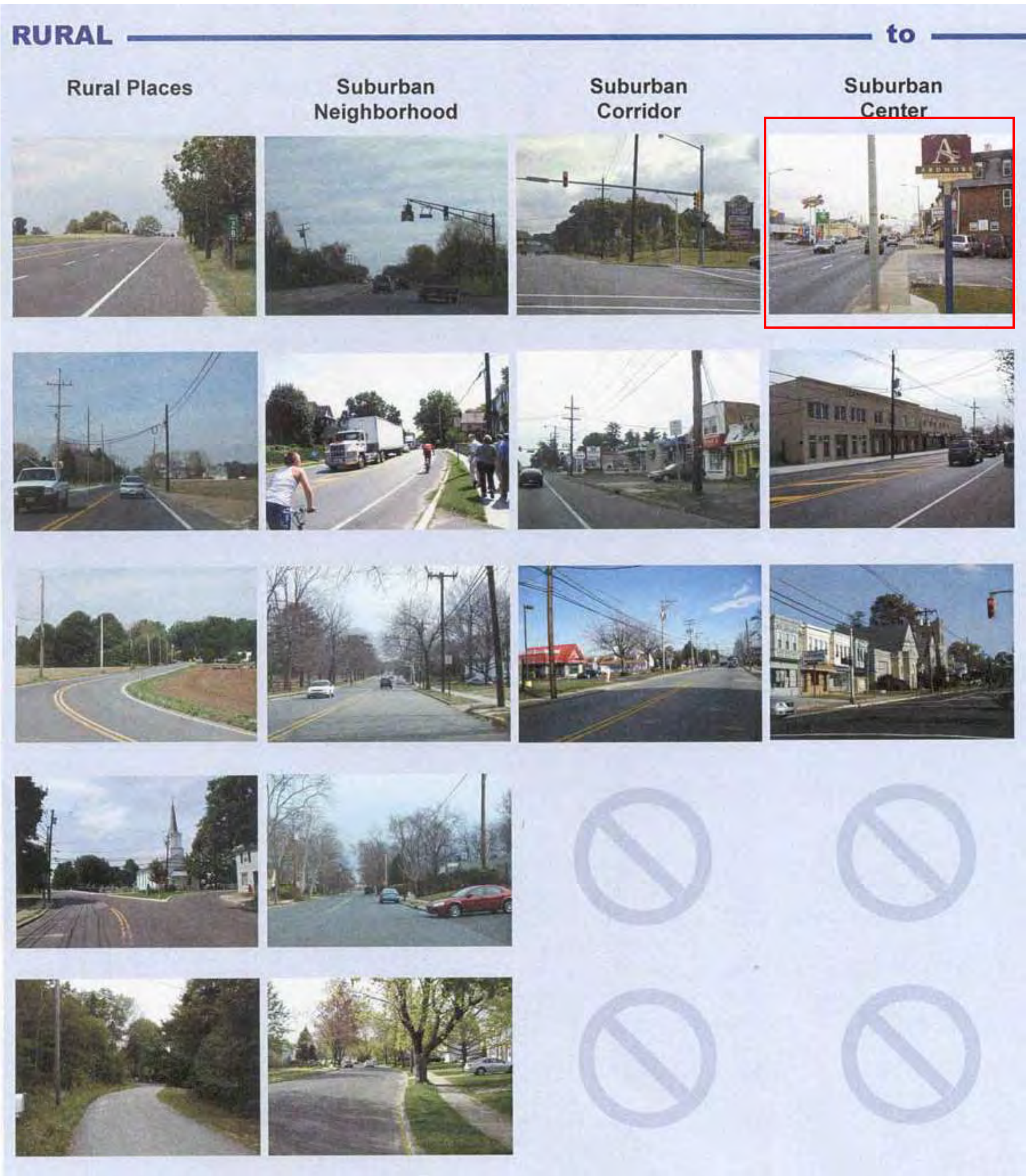
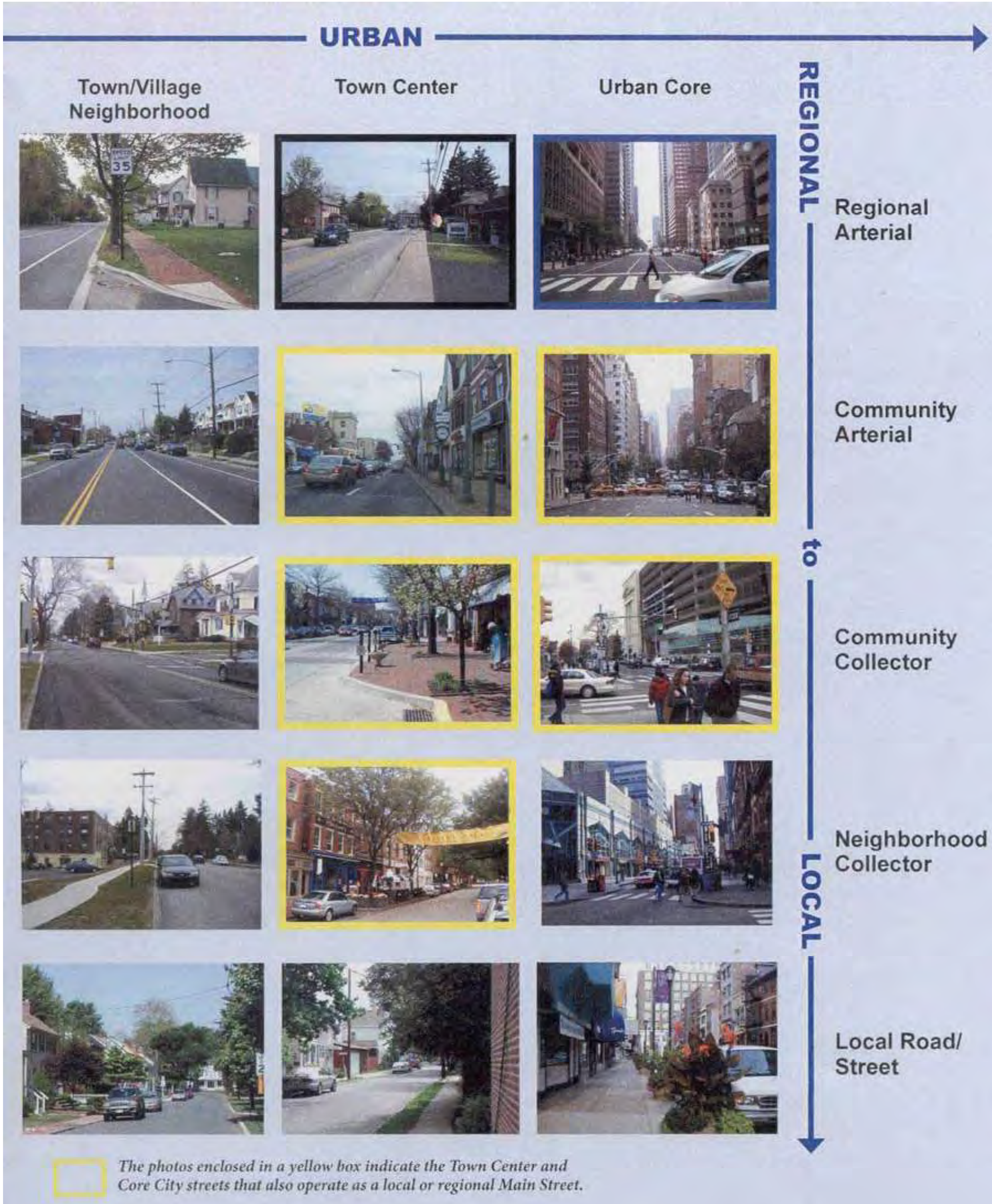


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-9. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 6%**

| Metric | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 20 km/h | $V_d$ = 30 km/h | $V_d$ = 40 km/h | $V_d$ = 50 km/h | $V_d$ = 60 km/h | $V_d$ = 70 km/h | $V_d$ = 80 km/h | $V_d$ = 90 km/h | $V_d$ = 100 km/h | $V_d$ = 110 km/h | $V_d$ = 120 km/h | $V_d$ = 130 km/h |
| $e$ (%) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) |
| NC | 194 | 421 | 738 | 1050 | 1440 | 1910 | 2360 | 2880 | 3510 | 4060 | 4770 | 5240 |
| RC | 138 | 299 | 525 | 750 | 1030 | 1380 | 1710 | 2090 | 2560 | 2970 | 3510 | 3880 |
| 2.2 | 122 | 265 | 465 | 668 | 919 | 1230 | 1530 | 1880 | 2300 | 2670 | 3160 | 3500 |
| 2.4 | 109 | 236 | 415 | 599 | 825 | 1110 | 1380 | 1700 | 2080 | 2420 | 2870 | 3190 |
| 2.6 | 97 | 212 | 372 | 540 | 746 | 1000 | 1260 | 1540 | 1890 | 2210 | 2630 | 2930 |
| 2.8 | 87 | 190 | 334 | 488 | 676 | 910 | 1150 | 1410 | 1730 | 2020 | 2420 | 2700 |
| 3.0 | 78 | 170 | 300 | 443 | 615 | 831 | 1050 | 1290 | 1590 | 1870 | 2240 | 2510 |
| 3.2 | 70 | 152 | 269 | 402 | 561 | 761 | 959 | 1190 | 1470 | 1730 | 2080 | 2330 |
| 3.4 | 61 | 133 | 239 | 364 | 511 | 697 | 882 | 1100 | 1360 | 1600 | 1940 | 2180 |
| 3.6 | 51 | 113 | 206 | 329 | 465 | 640 | 813 | 1020 | 1260 | 1490 | 1810 | 2050 |
| 3.8 | 42 | 96 | 177 | 294 | 422 | 586 | 749 | 939 | 1170 | 1390 | 1700 | 1930 |
| 4.0 | 36 | 82 | 155 | 261 | 380 | 535 | 690 | 870 | 1090 | 1300 | 1590 | 1820 |
| 4.2 | 31 | 72 | 136 | 234 | 343 | 488 | 635 | 806 | 1010 | 1220 | 1500 | 1720 |
| 4.4 | 27 | 63 | 121 | 210 | 311 | 446 | 584 | 746 | 938 | 1140 | 1410 | 1630 |
| 4.6 | 24 | 56 | 108 | 190 | 283 | 408 | 538 | 692 | 873 | 1070 | 1330 | 1540 |
| 4.8 | 21 | 50 | 97 | 172 | 258 | 374 | 496 | 641 | 812 | 997 | 1260 | 1470 |
| 5.0 | 19 | 45 | 88 | 156 | 235 | 343 | 457 | 594 | 755 | 933 | 1190 | 1400 |
| 5.2 | 17 | 40 | 79 | 142 | 214 | 315 | 421 | 549 | 701 | 871 | 1120 | 1330 |
| 5.4 | 15 | 36 | 71 | 128 | 195 | 287 | 386 | 506 | 648 | 810 | 1060 | 1260 |
| 5.6 | 13 | 32 | 63 | 115 | 176 | 260 | 351 | 463 | 594 | 747 | 980 | 1190 |
| 5.8 | 11 | 28 | 56 | 102 | 156 | 232 | 315 | 416 | 537 | 679 | 900 | 1110 |
| 6.0 | 8 | 21 | 43 | 79 | 123 | 184 | 252 | 336 | 437 | 560 | 756 | 951 |

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| $e$ (%) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) |
| NC | 868 | 1580 | 2290 | 3130 | 4100 | 5230 | 6480 | 7870 | 9410 | 11100 | 12600 | 14100 | 15700 | 17400 |
| RC | 614 | 1120 | 1630 | 2240 | 2950 | 3770 | 4680 | 5700 | 6820 | 8060 | 9130 | 10300 | 11500 | 12900 |
| 2.2 | 543 | 991 | 1450 | 2000 | 2630 | 3370 | 4190 | 5100 | 6110 | 7230 | 8200 | 9240 | 10400 | 11600 |
| 2.4 | 482 | 884 | 1300 | 1790 | 2360 | 3030 | 3770 | 4600 | 5520 | 6540 | 7430 | 8380 | 9420 | 10600 |
| 2.6 | 430 | 791 | 1170 | 1610 | 2130 | 2740 | 3420 | 4170 | 5020 | 5950 | 6770 | 7660 | 8620 | 9670 |
| 2.8 | 384 | 709 | 1050 | 1460 | 1930 | 2490 | 3110 | 3800 | 4580 | 5440 | 6200 | 7030 | 7930 | 8910 |
| 3.0 | 341 | 635 | 944 | 1320 | 1760 | 2270 | 2840 | 3480 | 4200 | 4990 | 5710 | 6490 | 7330 | 8260 |
| 3.2 | 300 | 566 | 850 | 1200 | 1600 | 2080 | 2600 | 3200 | 3860 | 4600 | 5280 | 6010 | 6810 | 7680 |
| 3.4 | 256 | 498 | 761 | 1080 | 1460 | 1900 | 2390 | 2940 | 3560 | 4250 | 4890 | 5580 | 6340 | 7180 |
| 3.6 | 209 | 422 | 673 | 972 | 1320 | 1740 | 2190 | 2710 | 3290 | 3940 | 4540 | 5210 | 5930 | 6720 |
| 3.8 | 176 | 358 | 583 | 864 | 1190 | 1590 | 2010 | 2490 | 3040 | 3650 | 4230 | 4860 | 5560 | 6320 |
| 4.0 | 151 | 309 | 511 | 766 | 1070 | 1440 | 1840 | 2300 | 2810 | 3390 | 3950 | 4550 | 5220 | 5950 |
| 4.2 | 131 | 270 | 452 | 684 | 960 | 1310 | 1680 | 2110 | 2590 | 3140 | 3680 | 4270 | 4910 | 5620 |
| 4.4 | 116 | 238 | 402 | 615 | 868 | 1190 | 1540 | 1940 | 2400 | 2920 | 3440 | 4010 | 4630 | 5320 |
| 4.6 | 102 | 212 | 360 | 555 | 788 | 1090 | 1410 | 1780 | 2210 | 2710 | 3220 | 3770 | 4380 | 5040 |
| 4.8 | 91 | 189 | 324 | 502 | 718 | 995 | 1300 | 1640 | 2050 | 2510 | 3000 | 3550 | 4140 | 4790 |
| 5.0 | 82 | 169 | 292 | 456 | 654 | 911 | 1190 | 1510 | 1890 | 2330 | 2800 | 3330 | 3910 | 4550 |
| 5.2 | 73 | 152 | 264 | 413 | 595 | 833 | 1090 | 1390 | 1750 | 2160 | 2610 | 3120 | 3690 | 4320 |
| 5.4 | 65 | 136 | 237 | 373 | 540 | 759 | 995 | 1280 | 1610 | 1990 | 2420 | 2910 | 3460 | 4090 |
| 5.6 | 58 | 121 | 212 | 335 | 487 | 687 | 903 | 1160 | 1470 | 1830 | 2230 | 2700 | 3230 | 3840 |
| 5.8 | 51 | 106 | 186 | 296 | 431 | 611 | 806 | 1040 | 1320 | 1650 | 2020 | 2460 | 2970 | 3560 |
| 6.0 | 39 | 81 | 144 | 231 | 340 | 485 | 643 | 833 | 1060 | 1330 | 1660 | 2040 | 2500 | 3050 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| **Type of Terrain** | **60** | **70** | **80** | **90** | **100** | **110** | **120** | **130** | **40** | **45** | **50** | **55** | **60** | **65** | **70** | **75** | **80** |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars: Calculated (m) | Intersection Sight Distance for Passenger Cars: Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars: Calculated (ft) | Intersection Sight Distance for Passenger Cars: Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 40 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

1 **DESIGN CRITERIA MATRIX**
MPMS NO. N/A Jefferson COUNTY
SR 28 SEC N/A , Clarion COUNTY

2 **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

3 **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Suburban Neighborhood
TOPOGRAPHY Rolling
REMARKS Distant, PA
North from New Bethlehem

4 **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 7196 (2019)
DESIGN YEAR ADT (Average Daily Traffic) 8274
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 745
D (Directional Distribution) 52
T (Truck Percentage) 8

| 5 Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 40 MPH | 35-40 MPH | 40 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 11'-12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 3'-8' | 8'-10' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | N/A | 38'-44' | N/A | N/A | DM-2, Sec 1.2C | |
| Minimum Horizontal Radius | | | 600' | 340'-485' | 600' | Yes | AASHTO, Table 3-9 | Entering Distant, PA |
| Maximum Superelevation Rate | | | Varies | 6.0% | 6.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 1.50% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 83 |
| | Maximum | | 6.90% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 81 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 250'-305' | 305' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 390'-445' | 445' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | N/A | N/A | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

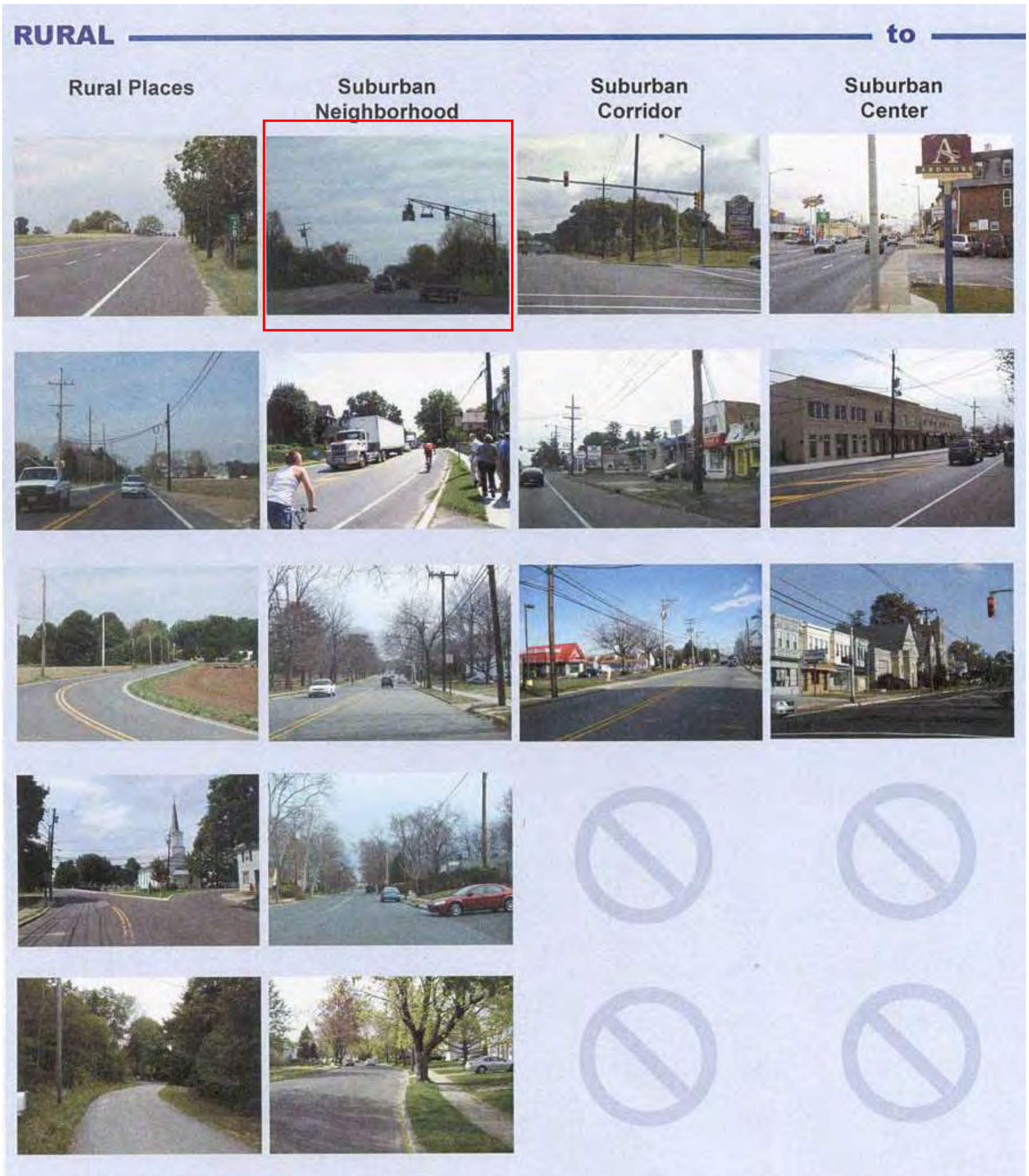
6 Any pedestrian and bicycle concerns/needs? Explain.
Any ADA compliance issues? Explain.
Any transit issues? Explain.
Any additional design issues? Explain.

## TABLE 1.2
## ROADWAY TYPOLOGIES

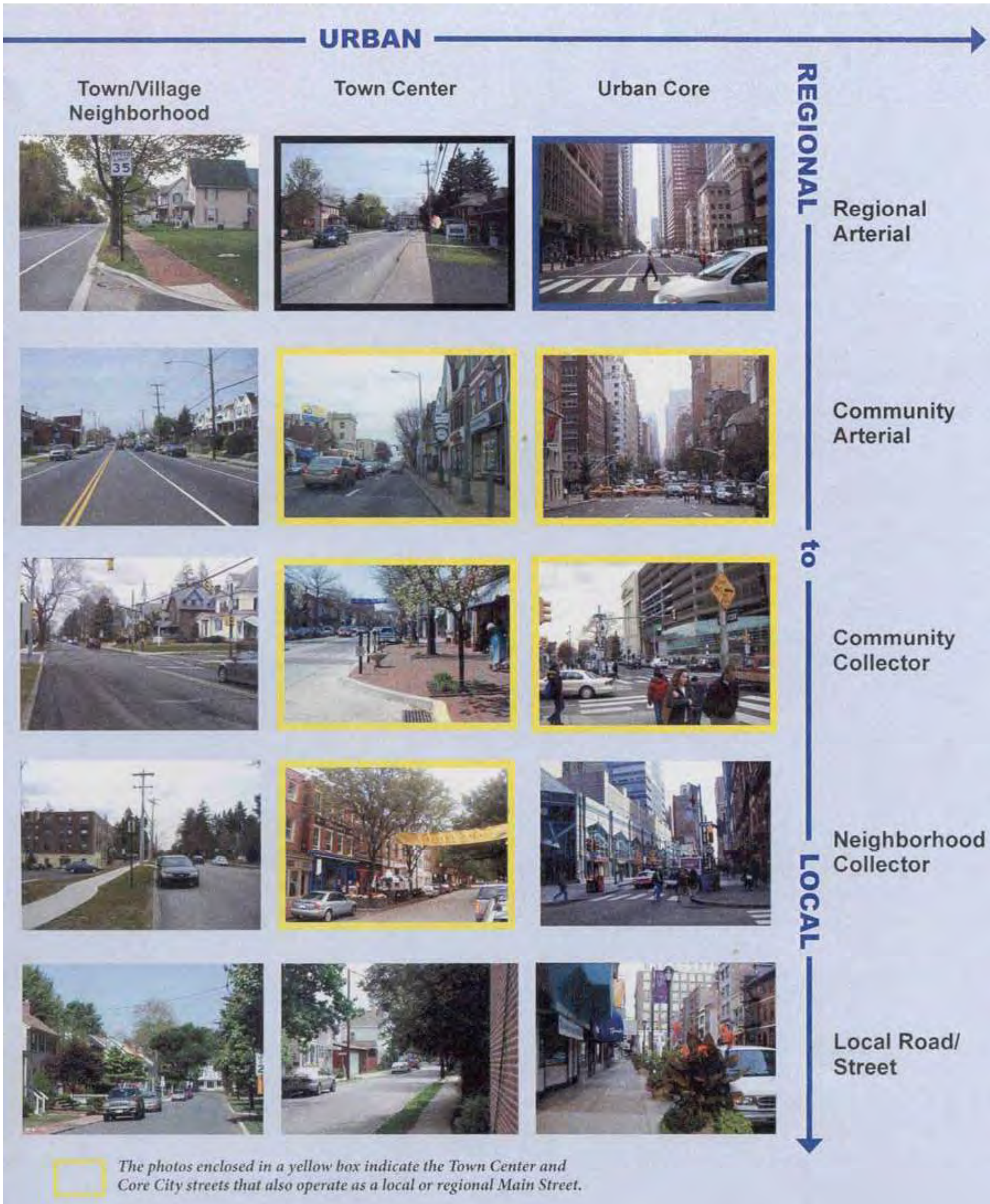
| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## FIGURE 1.2 (CONTINUED)
## ILLUSTRATED ROADWAY TYPOLOGIES



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-9. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 6%**

| Metric | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 20 km/h | $V_d$ = 30 km/h | $V_d$ = 40 km/h | $V_d$ = 50 km/h | $V_d$ = 60 km/h | $V_d$ = 70 km/h | $V_d$ = 80 km/h | $V_d$ = 90 km/h | $V_d$ = 100 km/h | $V_d$ = 110 km/h | $V_d$ = 120 km/h | $V_d$ = 130 km/h |
| $e$ (%) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) | $R$ (m) |
| NC | 194 | 421 | 738 | 1050 | 1440 | 1910 | 2360 | 2880 | 3510 | 4060 | 4770 | 5240 |
| RC | 138 | 299 | 525 | 750 | 1030 | 1380 | 1710 | 2090 | 2560 | 2970 | 3510 | 3880 |
| 2.2 | 122 | 265 | 465 | 668 | 919 | 1230 | 1530 | 1880 | 2300 | 2670 | 3160 | 3500 |
| 2.4 | 109 | 236 | 415 | 599 | 825 | 1110 | 1380 | 1700 | 2080 | 2420 | 2870 | 3190 |
| 2.6 | 97 | 212 | 372 | 540 | 746 | 1000 | 1260 | 1540 | 1890 | 2210 | 2630 | 2930 |
| 2.8 | 87 | 190 | 334 | 488 | 676 | 910 | 1150 | 1410 | 1730 | 2020 | 2420 | 2700 |
| 3.0 | 78 | 170 | 300 | 443 | 615 | 831 | 1050 | 1290 | 1590 | 1870 | 2240 | 2510 |
| 3.2 | 70 | 152 | 269 | 402 | 561 | 761 | 959 | 1190 | 1470 | 1730 | 2080 | 2330 |
| 3.4 | 61 | 133 | 239 | 364 | 511 | 697 | 882 | 1100 | 1360 | 1600 | 1940 | 2180 |
| 3.6 | 51 | 113 | 206 | 329 | 465 | 640 | 813 | 1020 | 1260 | 1490 | 1810 | 2050 |
| 3.8 | 42 | 96 | 177 | 294 | 422 | 586 | 749 | 939 | 1170 | 1390 | 1700 | 1930 |
| 4.0 | 36 | 82 | 155 | 261 | 380 | 535 | 690 | 870 | 1090 | 1300 | 1590 | 1820 |
| 4.2 | 31 | 72 | 136 | 234 | 343 | 488 | 635 | 806 | 1010 | 1220 | 1500 | 1720 |
| 4.4 | 27 | 63 | 121 | 210 | 311 | 446 | 584 | 746 | 938 | 1140 | 1410 | 1630 |
| 4.6 | 24 | 56 | 108 | 190 | 283 | 408 | 538 | 692 | 873 | 1070 | 1330 | 1540 |
| 4.8 | 21 | 50 | 97 | 172 | 258 | 374 | 496 | 641 | 812 | 997 | 1260 | 1470 |
| 5.0 | 19 | 45 | 88 | 156 | 235 | 343 | 457 | 594 | 755 | 933 | 1190 | 1400 |
| 5.2 | 17 | 40 | 79 | 142 | 214 | 315 | 421 | 549 | 701 | 871 | 1120 | 1330 |
| 5.4 | 15 | 36 | 71 | 128 | 195 | 287 | 386 | 506 | 648 | 810 | 1060 | 1260 |
| 5.6 | 13 | 32 | 63 | 115 | 176 | 260 | 351 | 463 | 594 | 747 | 980 | 1190 |
| 5.8 | 11 | 28 | 56 | 102 | 156 | 232 | 315 | 416 | 537 | 679 | 900 | 1110 |
| 6.0 | 8 | 21 | 43 | 79 | 123 | 184 | 252 | 336 | 437 | 560 | 756 | 951 |

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| $e$ (%) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) | $R$ (ft) |
| NC | 868 | 1580 | 2290 | 3130 | 4100 | 5230 | 6480 | 7870 | 9410 | 11100 | 12600 | 14100 | 15700 | 17400 |
| RC | 614 | 1120 | 1630 | 2240 | 2950 | 3770 | 4680 | 5700 | 6820 | 8060 | 9130 | 10300 | 11500 | 12900 |
| 2.2 | 543 | 991 | 1450 | 2000 | 2630 | 3370 | 4190 | 5100 | 6110 | 7230 | 8200 | 9240 | 10400 | 11600 |
| 2.4 | 482 | 884 | 1300 | 1790 | 2360 | 3030 | 3770 | 4600 | 5520 | 6540 | 7430 | 8380 | 9420 | 10600 |
| 2.6 | 430 | 791 | 1170 | 1610 | 2130 | 2740 | 3420 | 4170 | 5020 | 5950 | 6770 | 7660 | 8620 | 9670 |
| 2.8 | 384 | 709 | 1050 | 1460 | 1930 | 2490 | 3110 | 3800 | 4580 | 5440 | 6200 | 7030 | 7930 | 8910 |
| 3.0 | 341 | 635 | 944 | 1320 | 1760 | 2270 | 2840 | 3480 | 4200 | 4990 | 5710 | 6490 | 7330 | 8260 |
| 3.2 | 300 | 566 | 850 | 1200 | 1600 | 2080 | 2600 | 3200 | 3860 | 4600 | 5280 | 6010 | 6810 | 7680 |
| 3.4 | 256 | 498 | 761 | 1080 | 1460 | 1900 | 2390 | 2940 | 3560 | 4250 | 4890 | 5580 | 6340 | 7180 |
| 3.6 | 209 | 422 | 673 | 972 | 1320 | 1740 | 2190 | 2710 | 3290 | 3940 | 4540 | 5210 | 5930 | 6720 |
| 3.8 | 176 | 358 | 583 | 864 | 1190 | 1590 | 2010 | 2490 | 3040 | 3650 | 4230 | 4860 | 5560 | 6320 |
| 4.0 | 151 | 309 | 511 | 766 | 1070 | 1440 | 1840 | 2300 | 2810 | 3390 | 3950 | 4550 | 5220 | 5950 |
| 4.2 | 131 | 270 | 452 | 684 | 960 | 1310 | 1680 | 2110 | 2590 | 3140 | 3680 | 4270 | 4910 | 5620 |
| 4.4 | 116 | 238 | 402 | 615 | 868 | 1190 | 1540 | 1940 | 2400 | 2920 | 3440 | 4010 | 4630 | 5320 |
| 4.6 | 102 | 212 | 360 | 555 | 788 | 1090 | 1410 | 1780 | 2210 | 2710 | 3220 | 3770 | 4380 | 5040 |
| 4.8 | 91 | 189 | 324 | 502 | 718 | 995 | 1300 | 1640 | 2050 | 2510 | 3000 | 3550 | 4140 | 4790 |
| 5.0 | 82 | 169 | 292 | 456 | 654 | 911 | 1190 | 1510 | 1890 | 2330 | 2800 | 3330 | 3910 | 4550 |
| 5.2 | 73 | 152 | 264 | 413 | 595 | 833 | 1090 | 1390 | 1750 | 2160 | 2610 | 3120 | 3690 | 4320 |
| 5.4 | 65 | 136 | 237 | 373 | 540 | 759 | 995 | 1280 | 1610 | 1990 | 2420 | 2910 | 3460 | 4090 |
| 5.6 | 58 | 121 | 212 | 335 | 487 | 687 | 903 | 1160 | 1470 | 1830 | 2230 | 2700 | 3230 | 3840 |
| 5.8 | 51 | 106 | 186 | 296 | 431 | 611 | 806 | 1040 | 1320 | 1650 | 2020 | 2460 | 2970 | 3560 |
| 6.0 | 39 | 81 | 144 | 231 | 340 | 485 | 643 | 833 | 1060 | 1330 | 1660 | 2040 | 2500 | 3050 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

#### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

#### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

### 7.2.3 Cross-Sectional Elements

#### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars | | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars | |
| | | Calculated (m) | Design (m) | | | Calculated (ft) | Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 45 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

1 **DESIGN CRITERIA MATRIX**
MPMS NO. N/A
SR 28 SEC N/A , Armstrong / Clarion / Jefferson COUNTY

2 **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

3 **DESIGN DESIGNATION**

RT 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Rural
TOPOGRAPHY Rolling
REMARKS North of SR85, between New Bethlehem and Hawthrone, North of Summerville

4 **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 7349 (2019)
DESIGN YEAR ADT (Average Daily Traffic) 8450
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 761
D (Directional Distribution) 59
T (Truck Percentage) 13

| 5 Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 45 MPH | 45 -55 MPH | 45 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 11' to 12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 4' | 8' to 10' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | N/A | 38' to 44' | N/A | N/A | DM-2, Sec 1.2C | |
| Minimum Horizontal Radius | | | 470' | 587' to 960' | 587' | Yes | AASHTO, Table 3-10b | |
| Maximum Superelevation Rate | | | varies | 8.0% | 8.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.10% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 103 |
| | Maximum | | 7.10% | 6.00% | 6.00% | Yes | AASHTO, Table 7-2 | line segment 182 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | varies | 360' to 495' | 360' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | varies | 500' to 610' | 500' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | 16'-6" | Yes | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

6 Any pedestrian and bicycle concerns/needs? Explain. 25 mph curve speed reduction at trail crossing north of New Bethleham
Any ADA compliance issues? Explain.
Any transit issues? Explain.
Any additional design issues? Explain.

## TABLE 1.2
## ROADWAY TYPOLOGIES

| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**

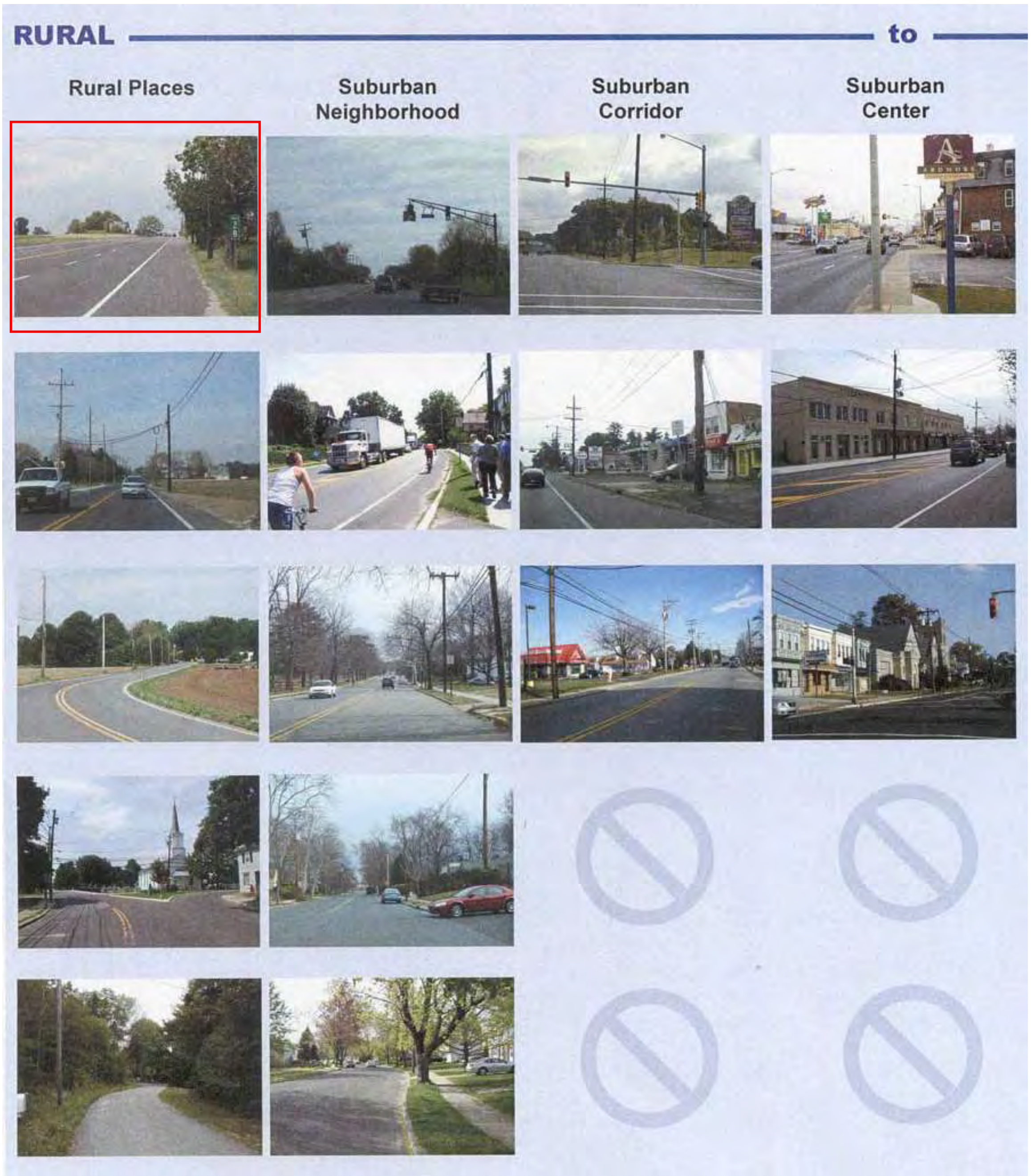
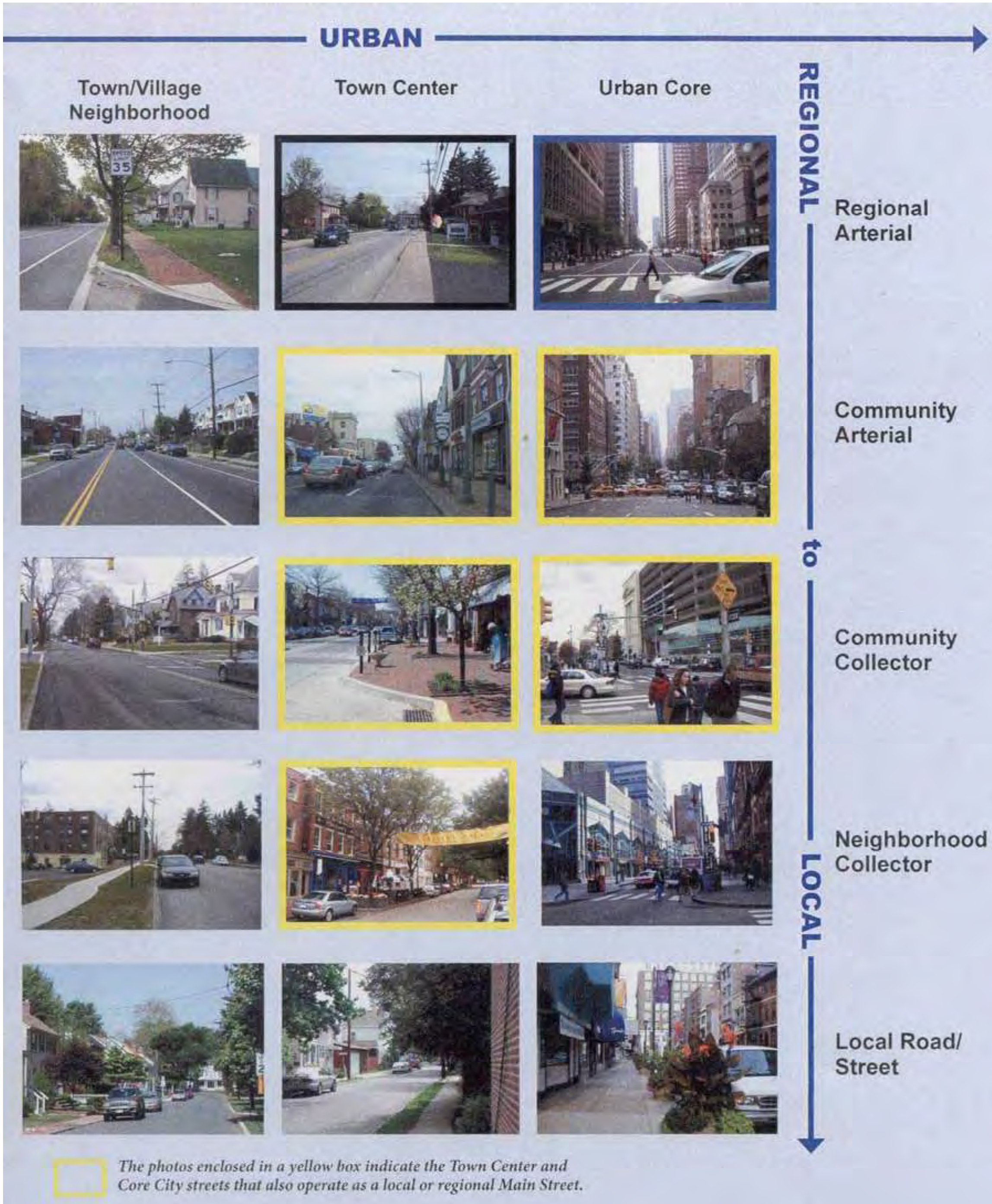


**FIGURE 1.2 (CONTINUED)**
**ILLUSTRATED ROADWAY TYPOLOGIES**



## TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-10b. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 8%**

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| *e* (%) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) |
| NC | 932 | 1640 | 2370 | 3240 | 4260 | 5410 | 6710 | 8150 | 9720 | 11500 | 12900 | 14500 | 16100 | 17800 |
| RC | 676 | 1190 | 1720 | 2370 | 3120 | 3970 | 4930 | 5990 | 7150 | 8440 | 9510 | 10700 | 12000 | 13300 |
| 2.2 | 605 | 1070 | 1550 | 2130 | 2800 | 3570 | 4440 | 5400 | 6450 | 7620 | 8600 | 9660 | 10800 | 12000 |
| 2.4 | 546 | 959 | 1400 | 1930 | 2540 | 3240 | 4030 | 4910 | 5870 | 6930 | 7830 | 8810 | 9850 | 11000 |
| 2.6 | 496 | 872 | 1280 | 1760 | 2320 | 2960 | 3690 | 4490 | 5370 | 6350 | 7180 | 8090 | 9050 | 10100 |
| 2.8 | 453 | 796 | 1170 | 1610 | 2130 | 2720 | 3390 | 4130 | 4950 | 5850 | 6630 | 7470 | 8370 | 9340 |
| 3.0 | 415 | 730 | 1070 | 1480 | 1960 | 2510 | 3130 | 3820 | 4580 | 5420 | 6140 | 6930 | 7780 | 8700 |
| 3.2 | 382 | 672 | 985 | 1370 | 1820 | 2330 | 2900 | 3550 | 4250 | 5040 | 5720 | 6460 | 7260 | 8130 |
| 3.4 | 352 | 620 | 911 | 1270 | 1690 | 2170 | 2700 | 3300 | 3970 | 4700 | 5350 | 6050 | 6800 | 7620 |
| 3.6 | 324 | 572 | 845 | 1180 | 1570 | 2020 | 2520 | 3090 | 3710 | 4400 | 5010 | 5680 | 6400 | 7180 |
| 3.8 | 300 | 530 | 784 | 1100 | 1470 | 1890 | 2360 | 2890 | 3480 | 4140 | 4710 | 5350 | 6030 | 6780 |
| 4.0 | 277 | 490 | 729 | 1030 | 1370 | 1770 | 2220 | 2720 | 3270 | 3890 | 4450 | 5050 | 5710 | 6420 |
| 4.2 | 255 | 453 | 678 | 955 | 1280 | 1660 | 2080 | 2560 | 3080 | 3670 | 4200 | 4780 | 5410 | 6090 |
| 4.4 | 235 | 418 | 630 | 893 | 1200 | 1560 | 1960 | 2410 | 2910 | 3470 | 3980 | 4540 | 5140 | 5800 |
| 4.6 | 215 | 384 | 585 | 834 | 1130 | 1470 | 1850 | 2280 | 2750 | 3290 | 3770 | 4310 | 4890 | 5530 |
| 4.8 | 193 | 349 | 542 | 779 | 1060 | 1390 | 1750 | 2160 | 2610 | 3120 | 3590 | 4100 | 4670 | 5280 |
| 5.0 | 172 | 314 | 499 | 727 | 991 | 1310 | 1650 | 2040 | 2470 | 2960 | 3410 | 3910 | 4460 | 5050 |
| 5.2 | 154 | 284 | 457 | 676 | 929 | 1230 | 1560 | 1930 | 2350 | 2820 | 3250 | 3740 | 4260 | 4840 |
| 5.4 | 139 | 258 | 420 | 627 | 870 | 1160 | 1480 | 1830 | 2230 | 2680 | 3110 | 3570 | 4090 | 4640 |
| 5.6 | 126 | 236 | 387 | 582 | 813 | 1090 | 1390 | 1740 | 2120 | 2550 | 2970 | 3420 | 3920 | 4460 |
| 5.8 | 115 | 216 | 358 | 542 | 761 | 1030 | 1320 | 1650 | 2010 | 2430 | 2840 | 3280 | 3760 | 4290 |
| 6.0 | 105 | 199 | 332 | 506 | 713 | 965 | 1250 | 1560 | 1920 | 2320 | 2710 | 3150 | 3620 | 4140 |
| 6.2 | 97 | 184 | 308 | 472 | 669 | 909 | 1180 | 1480 | 1820 | 2210 | 2600 | 3020 | 3480 | 3990 |
| 6.4 | 89 | 170 | 287 | 442 | 628 | 857 | 1110 | 1400 | 1730 | 2110 | 2490 | 2910 | 3360 | 3850 |
| 6.6 | 82 | 157 | 267 | 413 | 590 | 808 | 1050 | 1330 | 1650 | 2010 | 2380 | 2790 | 3240 | 3720 |
| 6.8 | 76 | 146 | 248 | 386 | 553 | 761 | 990 | 1260 | 1560 | 1910 | 2280 | 2690 | 3120 | 3600 |
| 7.0 | 70 | 135 | 231 | 360 | 518 | 716 | 933 | 1190 | 1480 | 1820 | 2180 | 2580 | 3010 | 3480 |
| 7.2 | 64 | 125 | 214 | 336 | 485 | 672 | 878 | 1120 | 1400 | 1720 | 2070 | 2470 | 2900 | 3370 |
| 7.4 | 59 | 115 | 198 | 312 | 451 | 628 | 822 | 1060 | 1320 | 1630 | 1970 | 2350 | 2780 | 3250 |
| 7.6 | 54 | 105 | 182 | 287 | 417 | 583 | 765 | 980 | 1230 | 1530 | 1850 | 2230 | 2650 | 3120 |
| 7.8 | 48 | 94 | 164 | 261 | 380 | 533 | 701 | 901 | 1140 | 1410 | 1720 | 2090 | 2500 | 2970 |
| 8.0 | 38 | 76 | 134 | 214 | 314 | 444 | 587 | 758 | 960 | 1200 | 1480 | 1810 | 2210 | 2670 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars Calculated (m) | Intersection Sight Distance for Passenger Cars Design (m) | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars Calculated (ft) | Intersection Sight Distance for Passenger Cars Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# 55 MPH DESIGN CRITERIA

BY: NVA DATE: 3/18/2020
CHK'D BY: JDW DATE: 4/1/2020

(1) **DESIGN CRITERIA MATRIX**
MPMS NO. N/A
SR 28 SEC N/A , Armstrong, Clarion, Jefferson COUNTY

(2) **PROJECT DESCRIPTION:** RT 28 Corridor Study from Kittanning to I-80. This corridor plan will assist in the future planning and programming of potential transportation projects with in the study area.

**NHS? (Y/N)** N **STRAHNET? (Y/N)** N

(3) **DESIGN DESIGNATION**

SR 28
DESIGN CRITERIA Reconstruction
AREA SYSTEM (Urban/Rural) Rural
FUNCTIONAL CLASSIFICATION Regional Arterial
ROADWAY TYPOLOGY Rural
TOPOGRAPHY Rolling
REMARKS Most locations along corridor except where other criteria is used

(4) **TRAFFIC DATA**

OPENING YEAR ADT (Average Daily Traffic) 7349 (2019)
DESIGN YEAR ADT (Average Daily Traffic) 8450
DESIGN YEAR (for Design Year ADT) 2045
DHV (Design Hourly Volume) 761
D (Directional Distribution) 59
T (Truck Percentage) 13

(5)

| Criteria* | | Location (ENTIRE PROJECT OR BY STATION) | EXISTING VALUE | REQUIRED VALUE | PROPOSED VALUE | CRITERIA MET? | SOURCE OF DESIGN CRITERIA (AASHTO OR DM-2 Reference) | REMARKS (NOTE ANY DESIGN EXCEPTIONS) |
|---|---|---|---|---|---|---|---|---|
| Design Speed | | | 55 MPH | 45-55 MPH | 55 MPH | Yes | DM-2, Table 1.3 | |
| Lane Width | | | 11' | 11' to 12' | 11' | Yes | DM-2, Table 1.3 | |
| Shoulder Width | | | 6' | 8' to 10' | 8' | Yes | DM-2, Table 1.3 | |
| Minimum Bridge Width | | | N/A | 38' to 44' | N/A | N/A | DM-2, Sec 1.2C | |
| Minimum Horizontal Radius | | | 850' | 587' to 960' | 960' | Yes | AASHTO, Table 3-10b | North of Summerville |
| Maximum Superelevation Rate | | | Varies | 8.0% | 8.0% | Yes | DM-2, Table 1.3 | |
| Vertical Grade | Minimum | | 0.20% | 0.50% | 0.50% | Yes | DM-2, Table 1.3 | line segment 132 |
| | Maximum | | 7.10% | 5.00% | 5.00% | Yes | AASHTO, Table 7-2 | line segment 157 |
| Minimum Stopping Sight Distance (SSD/HLSD) (vertical and horizontal) | | | Varies | 360' to 495' | 495' | Yes | AASHTO, Table 7-1 | |
| Minimum Intersection Sight Distance (ISD) | | | Varies | 500' to 610' | 610' | Yes | AASHTO, Table 9-6 | |
| Minimum Cross Slope | | | Varies | 2.0% | 2.0% | Yes | DM-2, Table 1.3 | |
| Minimum Vertical Clearance | | | N/A | 16'-6" | 16'-6" | Yes | DM-2, Table 2.2 | |

*Refer to Publication 10X, Design Manual 1X, Appendix P for more information on controlling criteria and design exceptions.

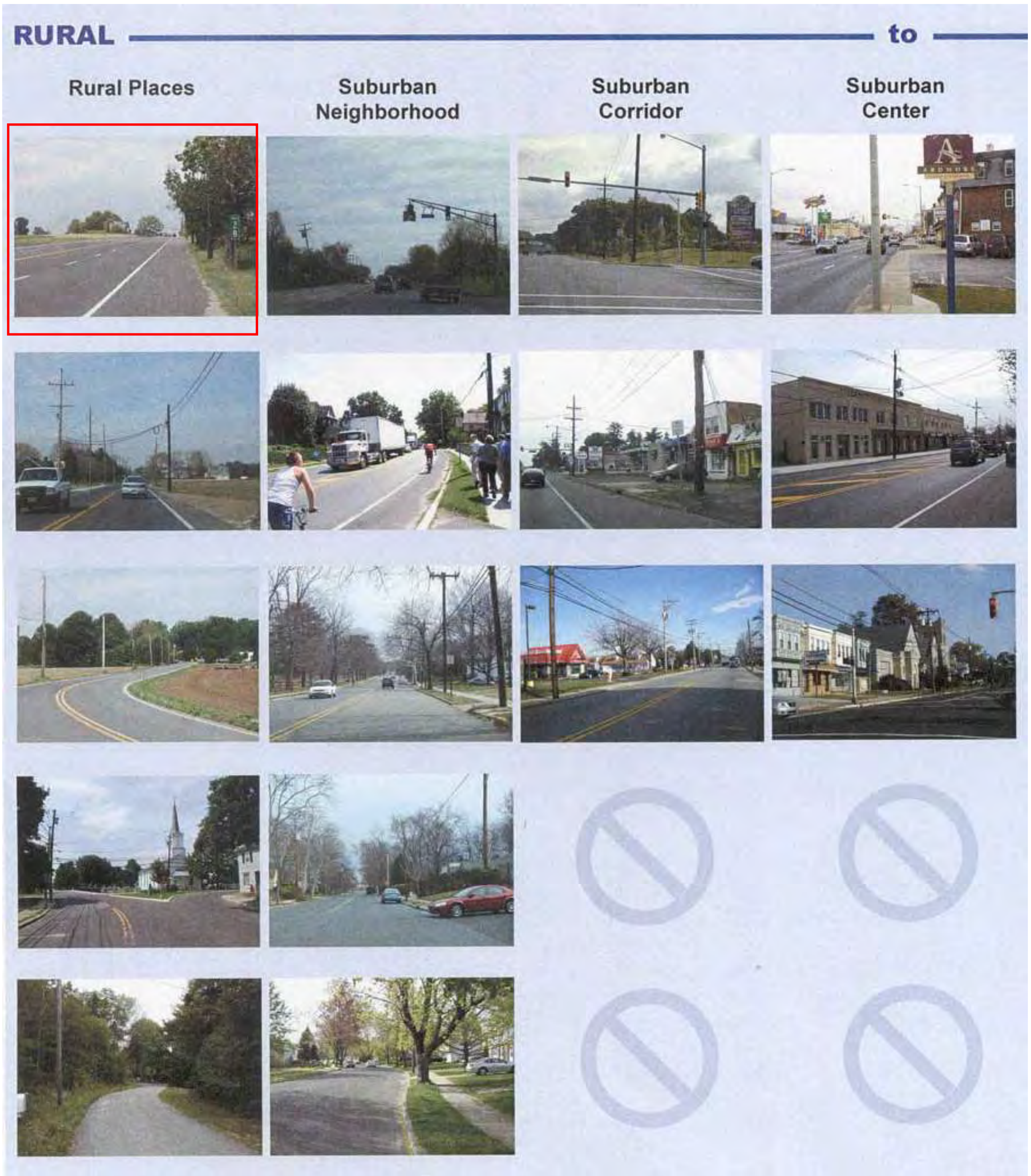
(6)
Any pedestrian and bicycle concerns/needs? Explain.
Any ADA compliance issues? Explain.
Any transit issues? Explain.
Any additional design issues? Explain.

## TABLE 1.2
## ROADWAY TYPOLOGIES

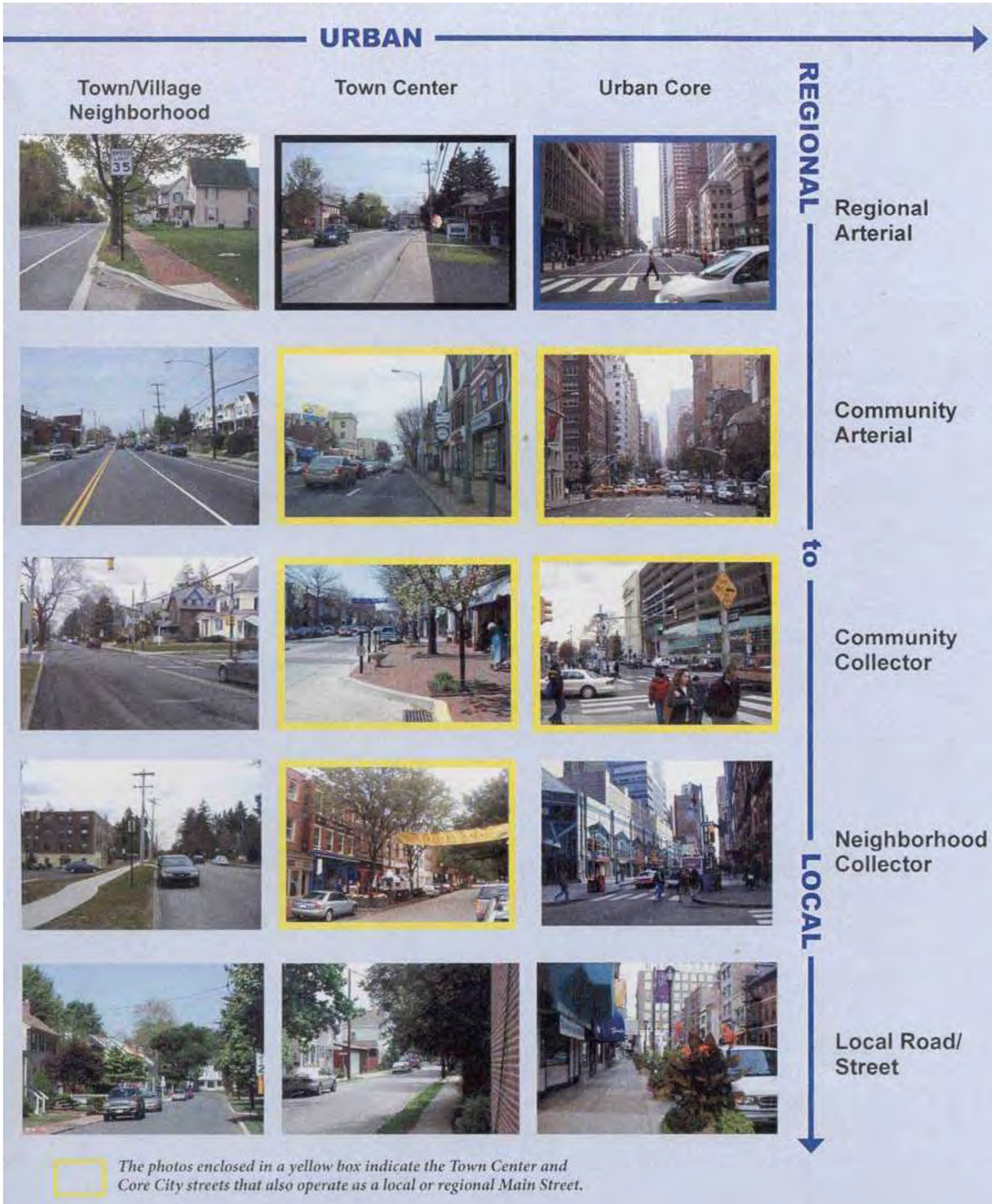
| ROADWAY CLASS | ROADWAY TYPE | DESIRED OPERATING SPEED | AVERAGE TRIP LENGTH | VOLUME | INTERSECTION SPACING | COMMENTS |
|---|---|---|---|---|---|---|
| Arterial | Regional | 50-90 km/h (30-55 mph) | 24-56 km (15-35 mi) | 10,000-40,000 veh/day | 200-400 m (660-1,320 ft) | Roadways in this category would be considered "Principal Arterial" in traditional functional classification. |
| Arterial | Community | 40-90 km/h (25-55 mph) | 11-40 km (7-25 mi) | 5,000-25,000 veh/day | 90-400 m (300-1,320 ft) | Often classified as "Minor Arterial" in traditional classification but may include road segments classified as "Principal Arterial". |
| Collector | Community | 40-90 km/h (25-55 mph) | 8-16 km (5-10 mi) | 5,000-15,000 veh/day | 90-200 m (300-660 ft) | Often similar in appearance to a community arterial. Typically classified as "Major Collector". |
| Collector | Neighborhood | 40-60 km/h (25-35 mph) | < 11 km (< 7 mi) | < 6,000 veh/day | 90-200 m (300-660 ft) | Similar in appearance to local roadways. Typically classified as "Minor Collector". |
| Local | Local | 30-50 km/h (20-30 mph) | < 8 km (< 5 mi) | < 3,000 veh/day | 60-200 m (200-660 ft) | |

**INTENTIONALLY BLANK**

**FIGURE 1.2**
**ILLUSTRATED ROADWAY TYPOLOGIES**



# FIGURE 1.2 (CONTINUED)
# ILLUSTRATED ROADWAY TYPOLOGIES



# TABLE 1.3 (ENGLISH)
## MATRIX OF DESIGN VALUES – REGIONAL ARTERIAL

| | Regional Arterial | Rural | Suburban Neighborhood | Suburban Corridor | Suburban Center | Town/Village Neighborhood | Town/Village Center | Urban Core |
|---|---|---|---|---|---|---|---|---|
| Roadway | Lane Width [1] | 11' to 12' | 11' to 12' | 11' to 12' | 11' to 12' | 10' to 12' | 10' to 12' | 10' to 12' |
| Roadway | Shoulder Width [2, 3] | 8' to 10' | 8' to 10' | 8' to 12' | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) | 4' to 6' (if No Parking or Bike Lane) |
| Roadway | Parking Lane | NA | NA | NA | 8' Parallel | 8' Parallel | 8' Parallel | 8' Parallel |
| Roadway | Bike Lane [4] | NA | 5' to 6' (if No Shoulder) | 6' (if No Shoulder) | 5' to 6' | 5' to 6' | 5' to 6' | 5' to 6' |
| Roadway | Median (if needed) | 4' to 6' | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only | 16' to 18' for Left Turn; 6' to 8' for Pedestrians Only |
| Roadway | Curb Return [5] | 30' to 50' | 25' to 35' | 30' to 50' | 25' to 50' | 15' to 40' | 15' to 40' | 15' to 40' |
| Roadway | Travel Lanes | 2 to 6 | 2 to 6 | 4 to 6 | 4 to 6 | 2 to 4 | 2 to 4 | 2 to 6 |
| Roadway | Cross Slopes (Minimum) [6, 7] | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% | 2.0% |
| Roadway | Cross Slopes (Maximum) [8] | 8.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| Roadway | Bridge Widths (Two-Lane Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| Roadway | Bridge Widths (Four-Lane or More Facilities) [9, 10, 16] | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side | Lane Widths Plus Shoulders Each Side |
| Roadway | Vertical Grades (Minimum) [11] | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% | 0.5% |
| Roadway | Vertical Clearance (Minimum) | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 | 16'-6", See Chapter 2 |
| Roadside [12] | Clear Sidewalk Width | NA | 5' | 5' to 6' | 5' to 6' | 6' to 8' | 6' to 10' | 6' to 12' |
| Roadside [12] | Buffer [13] | NA | 6'+ | 6' to 10' | 4' to 6' | 4' to 6' | 4' to 6' | 4' to 6' |
| Roadside [12] | Shy Distance | NA | NA | NA | 0' to 2' | 0' to 2' | 2' | 2' |
| Roadside [12] | Total Sidewalk Width | NA | 5' | 5' to 6' | 9' to 14' | 10' to 16' | 12' to 18' | 12' to 20' |
| Roadside [12] | Clear Zone Widths [14] | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 | See Chapter 12 |
| Roadside [12] | Right-of-Way Widths [15] | Varies | Varies | Varies | Varies | Varies | Varies | Varies |
| Speed | Desired Operating Speed (Design Speed) | 45-55 mph | 35-40 mph | 35-55 mph | 30-35 mph | 30-35 mph | 30-35 mph | 30-35 mph |
| Speed | Stopping and Passing Sight Distances (Minimum) | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 | 2004 AASHTO Green Book, Exhibit 7-1 |
| Speed | Vertical Grades (Maximum) | 2004 AASHTO Green Book, Exhibit 7-2 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 | 2004 AASHTO Green Book, Exhibit 7-10 |

**Table 3-10b. Minimum Radii for Design Superelevation Rates, Design Speeds, and $e_{max}$ = 8%**

| U.S. Customary | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $V_d$ = 15 mph | $V_d$ = 20 mph | $V_d$ = 25 mph | $V_d$ = 30 mph | $V_d$ = 35 mph | $V_d$ = 40 mph | $V_d$ = 45 mph | $V_d$ = 50 mph | $V_d$ = 55 mph | $V_d$ = 60 mph | $V_d$ = 65 mph | $V_d$ = 70 mph | $V_d$ = 75 mph | $V_d$ = 80 mph |
| *e* (%) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) | *R* (ft) |
| NC | 932 | 1640 | 2370 | 3240 | 4260 | 5410 | 6710 | 8150 | 9720 | 11500 | 12900 | 14500 | 16100 | 17800 |
| RC | 676 | 1190 | 1720 | 2370 | 3120 | 3970 | 4930 | 5990 | 7150 | 8440 | 9510 | 10700 | 12000 | 13300 |
| 2.2 | 605 | 1070 | 1550 | 2130 | 2800 | 3570 | 4440 | 5400 | 6450 | 7620 | 8600 | 9660 | 10800 | 12000 |
| 2.4 | 546 | 959 | 1400 | 1930 | 2540 | 3240 | 4030 | 4910 | 5870 | 6930 | 7830 | 8810 | 9850 | 11000 |
| 2.6 | 496 | 872 | 1280 | 1760 | 2320 | 2960 | 3690 | 4490 | 5370 | 6350 | 7180 | 8090 | 9050 | 10100 |
| 2.8 | 453 | 796 | 1170 | 1610 | 2130 | 2720 | 3390 | 4130 | 4950 | 5850 | 6630 | 7470 | 8370 | 9340 |
| 3.0 | 415 | 730 | 1070 | 1480 | 1960 | 2510 | 3130 | 3820 | 4580 | 5420 | 6140 | 6930 | 7780 | 8700 |
| 3.2 | 382 | 672 | 985 | 1370 | 1820 | 2330 | 2900 | 3550 | 4250 | 5040 | 5720 | 6460 | 7260 | 8130 |
| 3.4 | 352 | 620 | 911 | 1270 | 1690 | 2170 | 2700 | 3300 | 3970 | 4700 | 5350 | 6050 | 6800 | 7620 |
| 3.6 | 324 | 572 | 845 | 1180 | 1570 | 2020 | 2520 | 3090 | 3710 | 4400 | 5010 | 5680 | 6400 | 7180 |
| 3.8 | 300 | 530 | 784 | 1100 | 1470 | 1890 | 2360 | 2890 | 3480 | 4140 | 4710 | 5350 | 6030 | 6780 |
| 4.0 | 277 | 490 | 729 | 1030 | 1370 | 1770 | 2220 | 2720 | 3270 | 3890 | 4450 | 5050 | 5710 | 6420 |
| 4.2 | 255 | 453 | 678 | 955 | 1280 | 1660 | 2080 | 2560 | 3080 | 3670 | 4200 | 4780 | 5410 | 6090 |
| 4.4 | 235 | 418 | 630 | 893 | 1200 | 1560 | 1960 | 2410 | 2910 | 3470 | 3980 | 4540 | 5140 | 5800 |
| 4.6 | 215 | 384 | 585 | 834 | 1130 | 1470 | 1850 | 2280 | 2750 | 3290 | 3770 | 4310 | 4890 | 5530 |
| 4.8 | 193 | 349 | 542 | 779 | 1060 | 1390 | 1750 | 2160 | 2610 | 3120 | 3590 | 4100 | 4670 | 5280 |
| 5.0 | 172 | 314 | 499 | 727 | 991 | 1310 | 1650 | 2040 | 2470 | 2960 | 3410 | 3910 | 4460 | 5050 |
| 5.2 | 154 | 284 | 457 | 676 | 929 | 1230 | 1560 | 1930 | 2350 | 2820 | 3250 | 3740 | 4260 | 4840 |
| 5.4 | 139 | 258 | 420 | 627 | 870 | 1160 | 1480 | 1830 | 2230 | 2680 | 3110 | 3570 | 4090 | 4640 |
| 5.6 | 126 | 236 | 387 | 582 | 813 | 1090 | 1390 | 1740 | 2120 | 2550 | 2970 | 3420 | 3920 | 4460 |
| 5.8 | 115 | 216 | 358 | 542 | 761 | 1030 | 1320 | 1650 | 2010 | 2430 | 2840 | 3280 | 3760 | 4290 |
| 6.0 | 105 | 199 | 332 | 506 | 713 | 965 | 1250 | 1560 | 1920 | 2320 | 2710 | 3150 | 3620 | 4140 |
| 6.2 | 97 | 184 | 308 | 472 | 669 | 909 | 1180 | 1480 | 1820 | 2210 | 2600 | 3020 | 3480 | 3990 |
| 6.4 | 89 | 170 | 287 | 442 | 628 | 857 | 1110 | 1400 | 1730 | 2110 | 2490 | 2910 | 3360 | 3850 |
| 6.6 | 82 | 157 | 267 | 413 | 590 | 808 | 1050 | 1330 | 1650 | 2010 | 2380 | 2790 | 3240 | 3720 |
| 6.8 | 76 | 146 | 248 | 386 | 553 | 761 | 990 | 1260 | 1560 | 1910 | 2280 | 2690 | 3120 | 3600 |
| 7.0 | 70 | 135 | 231 | 360 | 518 | 716 | 933 | 1190 | 1480 | 1820 | 2180 | 2580 | 3010 | 3480 |
| 7.2 | 64 | 125 | 214 | 336 | 485 | 672 | 878 | 1120 | 1400 | 1720 | 2070 | 2470 | 2900 | 3370 |
| 7.4 | 59 | 115 | 198 | 312 | 451 | 628 | 822 | 1060 | 1320 | 1630 | 1970 | 2350 | 2780 | 3250 |
| 7.6 | 54 | 105 | 182 | 287 | 417 | 583 | 765 | 980 | 1230 | 1530 | 1850 | 2230 | 2650 | 3120 |
| 7.8 | 48 | 94 | 164 | 261 | 380 | 533 | 701 | 901 | 1140 | 1410 | 1720 | 2090 | 2500 | 2970 |
| 8.0 | 38 | 76 | 134 | 214 | 314 | 444 | 587 | 758 | 960 | 1200 | 1480 | 1810 | 2210 | 2670 |

tance are considered, there are seldom advantages to using the maximum grade values except when grades are long.

**Table 7-2. Maximum Grades for Rural Arterials**

| | Metric | | | | | | | | U.S. Customary | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Maximum Grade (%) for Specified Design Speed (km/h) | | | | | | | | Maximum Grade (%) for Specified Design Speed (mph) | | | | | | | | |
| Type of Terrain | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| Level | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 5 | 5 | 4 | 4 | 3 | 3 | 3 | 3 | 3 |
| Rolling | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 6 | 6 | 5 | 5 | 4 | 4 | 4 | 4 | 4 |
| Mountainous | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 8 | 7 | 7 | 6 | 6 | 5 | 5 | 5 | 5 |

### Cross Slope

Cross slope is provided to enhance roadway drainage. Two-lane rural roadways are normally designed with a centerline crown and traveled-way cross slopes ranging from 1.5 to 2 percent with the higher values being most prevalent.

### Superelevation

Where curves are used on a rural arterial alignment, a superelevation rate based on the design speed should be used. Superelevation rates should not exceed 12 percent; however, where ice and snow conditions are a factor, the maximum superelevation rate should not exceed 8 percent. Superelevation runoff denotes the length of roadway needed to accomplish the change in cross slope from a section with adverse crown removed to a fully superelevated section and vice versa. Adjustments in design runoff lengths may be needed for smooth riding, drainage, and appearance. Section 3.3 provides a detailed discussion of superelevation and tables of appropriate superelevation rates and runoff lengths for various design speeds.

## 7.2.3 Cross-Sectional Elements

### Widths of Roadway

The logical approach to determining appropriate lane and shoulder widths is to provide a width related to the traffic demands. Table 7-3 provides values for the width of traveled way and usable shoulder that should be considered for the volumes indicated. Regardless of weather conditions, shoulders should be usable at all times. On high-volume highways, shoulders should preferably be paved, but paved shoulders may not always be practical. As a minimum, 0.6 m [2 ft] of the shoulder width should be paved to provide for pavement support, wide vehicles, and collision avoidance. Where bicycles are to be accommodated on the shoulder, a minimum paved width of 1.2 m [4 ft] should be used. The shoulder should be constructed to a uniform width for relatively long stretches of roadway. For additional information concerning shoulders, refer to Section 4.4.

### Sight Distance

Sight distance is directly related to and varies appreciably with design speed. Stopping sight distance should be provided throughout the length of the roadway. Passing and decision sight distances influence roadway operations and should be provided wherever practical. Providing decision sight distance at locations where complex decisions are made greatly enhances the capability for drivers to safely accomplish maneuvers. Examples of locations where complex decisions are needed include interchanges, high-volume intersections, transitions in roadway width, and transitions in the number of lanes. Providing adequate sight distance on rural arterials, which may combine both high speeds and high traffic volumes, can be complex. Table 7-1 presents the recommended minimum values of stopping and passing sight distance. Refer to Section 3.2 for a comprehensive discussion of sight distance and for tabulated values for decision sight distance.

**Table 7-1. Minimum Sight Distances for Arterials**

| Metric | | | U.S. Customary | | |
|---|---|---|---|---|---|
| Design Speed (km/h) | Minimum Stopping Sight Distance (m) | Minimum Passing Sight Distance (m) | Design Speed (mph) | Minimum Stopping Sight Distance (ft) | Minimum Passing Sight Distance (ft) |
| 50 | 65 | 160 | 30 | 200 | 500 |
| 60 | 85 | 180 | 35 | 250 | 550 |
| 70 | 105 | 210 | 40 | 305 | 600 |
| 80 | 130 | 245 | 45 | 360 | 700 |
| 90 | 160 | 280 | 50 | 425 | 800 |
| 100 | 185 | 320 | 55 | 495 | 900 |
| 110 | 220 | 355 | 60 | 570 | 1000 |
| 120 | 250 | 395 | 65 | 645 | 1100 |
| 130 | 285 | 440 | 70 | 730 | 1200 |
| | | | 75 | 820 | 1300 |
| | | | 80 | 910 | 1400 |

Ideally, intersections and railroad crossings should be grade separated or provided with adequate sight distance. Intersections should be placed in sag or tangent locations, or both, where practical, to provide maximum visibility of the roadway and pavement markings.

### Alignment

A smooth flowing alignment is desirable on a rural arterial. Changes in alignment, both horizontal and vertical, should be sufficiently gradual to avoid surprising the driver. Minimum radii should be used sparingly; short horizontal curves—particularly at the end of long tangents—should be avoided. Roads with well-designed and consistent alignment usually function more efficiently and with lower crash rates than roads with poor alignment, even where enhanced signing and pavement marking are provided.

### Grades

The length and steepness of grades directly affect the operational characteristics of an arterial. Table 7-2 presents recommended maximum grades for rural arterials. When vertical curves for stopping sight dis-

intersection is located on a 4 percent upgrade, then the time gap selected for intersection sight distance design for left turns should be increased from 8.0 to 8.8 s, equivalent to an increase of 0.2 s for each percent grade.

The design values for intersection sight distance for passenger cars are shown in Table 9-6. Figure 9-17 includes design values, based on the time gaps for the design vehicles included in Table 9-5.

No adjustment of the recommended sight distance values for the major-road grade is generally needed because both the major- and minor-road vehicle will be on the same grade when departing from the intersection. However, if the minor-road design vehicle is a heavy truck and the intersection is located near a sag vertical curve with grades over 3 percent, then an adjustment to extend the recommended sight distance based on the major-road grade should be considered.

**Table 9-6. Design Intersection Sight Distance—Case B1, Left Turn from Stop**

| Metric | | | | U.S. Customary | | | |
|---|---|---|---|---|---|---|---|
| Design Speed (km/h) | Stopping Sight Distance (m) | Intersection Sight Distance for Passenger Cars | | Design Speed (mph) | Stopping Sight Distance (ft) | Intersection Sight Distance for Passenger Cars | |
| | | Calculated (m) | Design (m) | | | Calculated (ft) | Design (ft) |
| 20 | 20 | 41.7 | 45 | 15 | 80 | 165.4 | 170 |
| 30 | 35 | 62.6 | 65 | 20 | 115 | 220.5 | 225 |
| 40 | 50 | 83.4 | 85 | 25 | 155 | 275.6 | 280 |
| 50 | 65 | 104.3 | 105 | 30 | 200 | 330.8 | 335 |
| 60 | 85 | 125.1 | 130 | 35 | 250 | 385.9 | 390 |
| 70 | 105 | 146.0 | 150 | 40 | 305 | 441.0 | 445 |
| 80 | 130 | 166.8 | 170 | 45 | 360 | 496.1 | 500 |
| 90 | 160 | 187.7 | 190 | 50 | 425 | 551.3 | 555 |
| 100 | 185 | 208.5 | 210 | 55 | 495 | 606.4 | 610 |
| 110 | 220 | 229.4 | 230 | 60 | 570 | 661.5 | 665 |
| 120 | 250 | 250.2 | 255 | 65 | 645 | 716.6 | 720 |
| 130 | 285 | 271.1 | 275 | 70 | 730 | 771.8 | 775 |
| — | — | — | — | 75 | 820 | 826.9 | 830 |
| — | — | — | — | 80 | 910 | 882.0 | 885 |

Note: Intersection sight distance shown is for a stopped passenger car to turn left onto a two-lane highway with no median and grades 3 percent or less. For other conditions, the time gap should be adjusted and the sight distance recalculated.

Sight distance design for left turns at divided-highway intersections should consider multiple design vehicles and median width. If the design vehicle used to determine sight distance for a divided-highway intersection is larger than a passenger car, then sight distance for left turns will need to be checked for that selected design vehicle and for smaller design vehicles as well. If the divided-highway median is wide enough to store the design vehicle with a clearance to the through lanes of approximately 1 m [3 ft] at both ends of the vehicle, no separate analysis for the departure sight triangle for left turns is needed on the minor-road approach for the near roadway to the left. In most cases, the departure sight triangle for right

# APPENDIX I
## SPC Funding Program

WINTER 2020
*Two Chatham Center*
*Suite 500, 112 Washington Place*
*Pittsburgh, PA 15219*
*(412) 391-5590 (P)*
*(412) 391-9160 (F)*
*comments@spcregion.org*
*www.spcregion.org*

# TRANSPORTATION & COMMUNITY
# FUNDING PROGRAMS

## Grant and Reimbursement Programs to Advance and Guide Effective Investment of Public Funds

The Southwestern Pennsylvania Commission (SPC) serves the 10-county Pittsburgh region as the official Metropolitan Planning Organization, Local Development District, and Economic Development District. SPC's Transportation Department meets federal mandates with the publication of a long-range (20-year) transportation plan and the establishment of a short-range (4-year) Transportation Improvement Program (TIP). Planning activities range from data systems and modeling to special transportation studies and air quality analysis.

SPC is committed to assisting our local governments and agencies in the preparation, planning, and execution of their community's priority projects and investments. The information within this document will provide local project sponsors a guide to available resources that can assist with the implementation of a community's shared goals.


**Inside this Issue:**

Act 13 Programs (Marcellus Legacy Fund): 2, 3
Multimodal, Road, Bridge, Safety, Signal, Congestion Mitigation, and Loan Programs: 4, 5
DCNR C2P2: 5
DEP Grants, Loans, and Rebates: 6
Calendar of Programs: 7

# Act 13 Programs (Marcellus Legacy Fund)

The Marcellus Legacy Fund was created by Act 13 of 2012 to provide for the distribution of unconventional gas well impact fees to counties, municipalities, and commonwealth agencies. Pursuant to Section 2315 (a) (6) (i) of the Act, a portion of the fee revenue will be transferred to the Commonwealth Financing Authority for the statewide initiatives listed on pages 2 & 3:

## Abandoned Mine Drainage (AMD) Abatement and Treatment Program

**Purpose:** Funding for projects that involve the reclamation of Abandoned Mine Well(s); construction of a new AMD site; remediation and repair of existing AMD project sites; operation and maintenance maintaining current AMD remediation sites; establishment of trust fund to ensure ongoing maintenance is achieved; and, monitoring of water quality to track or continue to trace non-point source load reductions resulting from AMD remediation projects.

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 and May 31, 2019

**Match/Funding:** 15% match of the total project cost; grants do not exceed $1,000,000

**Website:** https://dced.pa.gov/programs/abandoned-mine-drainage-abatement-treatment-program-amdatp/

## Baseline Water Quality Data Program

**Purpose:** Funding for projects that involve practices for water sample collection and analysis to document existing groundwater quality conditions on private water supplies.

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 to May 31, 2019

**Match/Funding:** 15% match of the total project cost; grants do not exceed $250,000

**Website:** https://dced.pa.gov/programs/baseline-water-quality-data-program/

## Flood Mitigation Program

**Purpose:** Funding for flood mitigation projects authorized by a flood protection authority, the Department of Environmental Protection, the U.S. Army Corps of Engineers, the U.S. Department of Agriculture's Natural Resources Conservation Service, or identified by a local government. Grants are awarded to eligible applicants for projects with a total cost of $50,000 or more.

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 and May 31, 2019

**Local Match Requirement:** 15% match of the total project cost; grants do not exceed $500,000

**Website:** https://dced.pa.gov/programs/flood-mitigation-program-fmp/

## Greenways, Trails and Recreation Program

**Purpose:** Funding for planning, acquisition, development, rehabilitation and repair of greenways, recreational trails, open space, parks and beautification projects. Projects can involve development, rehabilitation and improvements to public parks, recreation areas, greenways, and trails, as well as river conservation.

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 and May 31, 2019

**Match/Funding:** 15% match of the total project cost; grants do not exceed $250,000

**Website:** https://dced.pa.gov/programs/greenways-trails-and-recreation-program-gtrp/

## Orphan or Abandoned Well Plugging Program

**Purpose:** Funds for orphaned or abandoned well plugging projects, including the cleaning out and plugging of abandoned and orphan oil and gas wells; stray gas mitigation systems; and well venting projects.

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 and May 31, 2019

**Match/Funding:** No match required; grants do not exceed $250,000

**Website:** https://dced.pa.gov/programs/orphan-abandoned-well-plugging-program-oawp/

## Sewage Facilities Program

**Purpose:** Funding for costs associated with the planning work required under the Pennsylvania Sewage Facilities Act (Act 537).

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 and May 31, 2019

**Match/Funding:** 50% match of the total project cost; grants do not exceed $100,000

**Website:** https://dced.pa.gov/programs/sewage-facilities-program-sfp/

## Watershed Restoration and Protection Program

**Purpose:** Funding for watershed restoration and protection projects that involve the construction, improvement, expansion, repair, maintenance or rehabilitation of new or existing watershed protection BMPs. The overall goal of the program is to restore and maintain restored stream reaches impaired by the uncontrolled discharge of nonpoint source polluted runoff, and ultimately to remove these streams from the DEP's Impaired Waters list.

**Eligibility:** Municipalities; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between February 1, 2019 and May 31, 2019

**Match/Funding:** 15% match of the total project cost; grants do not exceed $300,000

**Website:** https://dced.pa.gov/programs/watershed-restoration-protection-program-wrpp/

# Funding Programs

## SPC and PennDOT Transportation Alternatives Set-Aside Program

**Purpose:** The Transportation Alternatives Set-Aside (TASA) Program provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities; infrastructure projects for improving non-driver access to public transportation and enhanced mobility; environmental mitigation; recreational trail program projects; and, safe routes to school projects. Key criterion in the review of applications will be readiness for implementation and delivery, safety, consistency with local or regional plans; collaboration with stakeholders; and, statewide or regional significance.

**Eligibility:**

- Local governments
- Regional transportation authorities
- Transit agencies
- Natural resource or public land agencies, including federal agencies
- School districts, local education agencies, or schools
- Tribal governments
- A nonprofit entity responsible for the administration of local transportation safety programs
- Any other governmental entity with responsibility for oversight of transportation or recreational trails

**Deadline:** Applications accepted between August 26, 2019 and September 20, 2019

**Local Match Requirement:** There is no match requirement; however, local sponsors pay all costs for pre-construction activities (design, environmental clearance, right of way, utilities, etc.) and PennDOT provides 100% cost reimbursement for the construction phase (including construction inspection).

**Website:** https://spcregion.org/trans_plan_tap.asp

## DCED Multimodal Transportation Fund (MTF)

**Purpose:** Provides grants to encourage economic development and ensure that a safe and reliable system of transportation is available to Pennsylvania residents. The program is intended to provide financial assistance to improve transportation assets that enhance communities, pedestrian safety, and transit revitalization. The program is under the direction of the Commonwealth Financing Authority.

**Eligibility:** Local Governments; Counties; Councils of Governments; Businesses & Non-Profits; Economic Development Organizations; Public Transportation Agencies (including but not limited to an airport authority, public airport, port authority, or similar public entity); and, Rail and Freight Ports

**Deadline:** Applications are accepted between March 1, 2019 and July 31, 2019

**Local Match Requirement:** 30% match of requested amount (state/federal grants do not count as match)

**Website:** http://community.newpa.com/programs/multimodal-transportation-fund/

## PennDOT Pennsylvania Infrastructure Bank (PIB)

**Purpose:** A PennDOT program that provides low-interest loans to accelerate priority transportation projects. Loan emphasis is on construction projects, but other project phases such as design, right-of-way acquisition, and transportation equipment purchases will be considered. Projects financed by the PIB include: aviation, highway/bridge, rail freight, and transit.

**Eligibility:** Local Governments; Counties; Transportation Authorities; Economic Development Agencies; Non-Profit Organizations; and Private Corporations

**Deadline:** Always accepting applications

**Website:** http://www.penndot.gov/ProjectAndPrograms/Planning/Pages/PA-Infrastructure-Bank.aspx

## PennDOT Automated Red Light Enforcement Program (ARLE)

**Purpose:** The program provides opportunities to improve safety and reduce congestion. ARLE intends to reduce violations and crashes, provide additional safety benefits to highway users, and improve pedestrian safety. The types of eligible projects are wide ranging when considering highway safety or mobility. It is the intent of the ARLE Program to fund worthwhile projects that can be completed at a relatively low cost, and award grants to projects that will be fully funded at the execution of the grant agreement date.

**Eligibility:** Local Governments; Counties; Councils of Governments; Authorized Organizations; Institutions of Higher Education; Watershed Organizations; For-Profit Businesses

**Deadline:** Applications accepted between June 1, 2019 and June 30, 2019

**Local Match Requirement:** No matching funds are required for eligibility in the ARLE program

**Website:** http://www.dot.state.pa.us/Portal%20Information/Traffic%20Signal%20Portal/FUNDARLE.html

## SPC Congestion Mitigation Air Quality Improvement Program (CMAQ)

**Purpose:** The CMAQ Program provides funds for transportation projects and programs that will contribute to attainment or maintenance of the national ambient air quality standards for ozone, carbon monoxide, and particulate matter; and supports goals of the U.S. Department of Transportation: improving air quality, and relieving congestion. Project types include: traffic flow and signal improvements, transportation demand management, transit improvements and programs, commuter bicycle and pedestrian improvements, and diesel emission reductions.

**Eligibility:** Any qualified government entity, including local governments, regional transit agencies, port authorities, and state agencies, is eligible to apply for CMAQ funding. Non-profits and private sector entities may partner with an eligible applicant to apply for CMAQ funding.

**Deadline:** CMAQ application period closes September 9, 2019

**Local Match Requirement:** 20% match of total project cost (by phase) from local, state, or other non-federal sources

**Website:** https://www.spcregion.org/trans_tip_cmaq.asp

## DCNR Community Conservation Partnerships Program (C2P2)

**Purpose:** DCNR's Bureau of Recreation and Conservation provides a single point of contact for communities and non-profit conservation agencies seeking state assistance through the C2P2 Program in support of local recreation and conservation initiatives and those that implement Pennsylvania's Comprehensive Outdoor Recreation Plan. This assistance can take the form of grants, technical assistance, information exchange, and training. All of DCNR's funding sources are combined into one annual application cycle and there is a single application format and process with one set of requirements and guidelines.

**Eligibility:** A wide range of grant and technical assistance programs are offered through C2P2 to help communities, land conservancies, and non-profit organizations plan, acquire, and develop:

- Recreation, park and conservation facilities
- Watersheds and rivers corridors
- Greenways and trails
- Heritage areas and facilities
- Critical habitat, natural areas & open space

**Deadline:** Applications accepted between January 15, 2020 and April 22, 2020

**Local Match Requirement:** Generally, a 50% match by either cash or non-cash value is required

**Website:** http://www.dcnr.state.pa.us/brc/grants/

## Department of Environmental Protection (DEP): Loan, Grant, and Rebate Programs

The DEP has grants and loans, as well as rebates to assist individuals, groups, and businesses with a host of environmental issues. Due to the fact that many of DEP's programs are dependant on annual funding from the commonwealth's budget, program availability and application dates can vary widely and are historically inconsistent. Interested program applicants should use DEP's Grant and Loan Programs Center website to view available grants and loans. Some of the most utilized DEP Programs are:

- County and Municipal Recycling Financial Assistance Programs
- Alternative Fuels Incentive Grant Program
- Small Business Ombudsman's Grants and Loans
- Driving PA Forward
- Growing Greener Grants
- Environmental Education Grants

## PennDOT Multimodal Transportation Fund

**Purpose:** Provides grants to ensure that a safe and reliable system of transportation is available to the residents of this commonwealth. The program is intended to provide financial assistance to municipalities, councils of governments, businesses, economic development organizations, public transportation agencies, rail freight, passenger rail, and ports in order to improve transportation assets that enhance communities, pedestrian safety, and transit revitalization.

**Eligibility:** Municipalities; Council of Governments; Business/Non-profit; Economic Development Organization; Public Transportation Agency; Ports or Rail / Freight Entity

**Deadline:** Applications accepted between September 9, 2019 and November 9, 2019

**Local Match Requirement:** 30% match of the amount awarded; grants normally do not exceed $3,000,000

**Website:** https://www.penndot.gov/ProjectAndPrograms/MultimodalProgram/Pages/default.aspx

## Green Light - Go

**Purpose:** The Green Light - Go: Pennsylvania's Municipal Signal Partnership Program is a competitive state grant program designed to improve the efficiency and operation of existing traffic signals located in the Commonwealth of Pennsylvania. Established by Act 89 of 2013 and revised by Act 101 of 2016, the program is administered by the Pennsylvania Department of Transportation and is purposed to improve mobility and safety at signalized intersections.

**Eligibility:** Municipalities and Planning Organizations

**Deadline:** Applications were accepted between October 15, 2018 through January 11, 2019

**Local Match Requirement:** Minimum 20% match/reimbursement

**Website:** http://www.dot.state.pa.us/portal%20information/traffic%20signal%20portal/fundglg.html

## 2020 Calendar of Programs Anticipated Application Opening & Closing Dates*

| Jan. | Feb. | March | April | May | June | July | Aug. | Sep. | Oct. | Nov. | Dec. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Act 13 Programs | Act 13 Programs | Act 13 Programs | Act 13 Programs | | | | | | | |
| | | | | | | | SPC TASA | SPC TASA | | | |
| | | DCED MTF | DCED MTF | DCED MTF | DCED MTF | DCED MTF | | | | | |
| PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB | PennPOT PIB |
| | | | | | PennPOT ARLE | | | | | | |
| | | | | | | | CMAQ | CMAQ | | | |
| DCNR C2P2 | DCNR C2P2 | DCNR C2P2 | DCNR C2P2 | | | | | | | | |
| | | | | | | | | PennPOT MTF | PennPOT MTF | PennPOT MTF | |
| | | | | | GreenLight-Go (Deadline Varies) | | | | | | |

*Funding programs and the agencies that administer them oftentimes will alter anticipated application periods. Contact these agencies or SPC for up-to-date application information.

## SPC Transportation Department Planning and Programming Contact Information:

**Ryan Gordon**
Transportation Program Development Manager
412-391-5590 x333
rgordon@spcregion.org