











APRIL 2022



















PA 581 (Capital Beltway) linking to I-81.



Acronyms

The following is a summary of acronyms that are used within The Playbook.

ВОМО	PennDOT's Bureau of Maintenance and Operations
CCTV	Closed-Circuit Televisions
DDI	Diverging Diamond Interchange
DMS	Dynamic Message Signs
FSP	Freeway Service Patrol
GHASRB	Greater Harrisburg Area Susquehanna River Bridges Study
HATS	Harrisburg Area Transit Study
НОР	Highway Occupancy Permits
HV	Heavy Vehicles
ISC	Interstate Steering Committee
ITS	Intelligent Transportation Systems
MPO	Metropolitan Planning Organization
NB	Northbound
NRHP	National Register of Historic Places
PennDOT	Pennsylvania Department of Transportation
PMC	Project Management Committee
ROP	Regional Operations Plan
RTMC	Regional Traffic Management Center
RWRPM	Recessed Wet Reflective Pavement Markings
SB	Southbound
TCRPC	Tri-County Regional Planning Commission
TIP	Transportation Improvement Plans
TIRe	PennDOT's Traffic Information Repository
TIS	Transportation Impact Study
TSM0	Transportation Systems Management and Operation
UCC	Unified Command and Control
VPD	Vehicles Per Day



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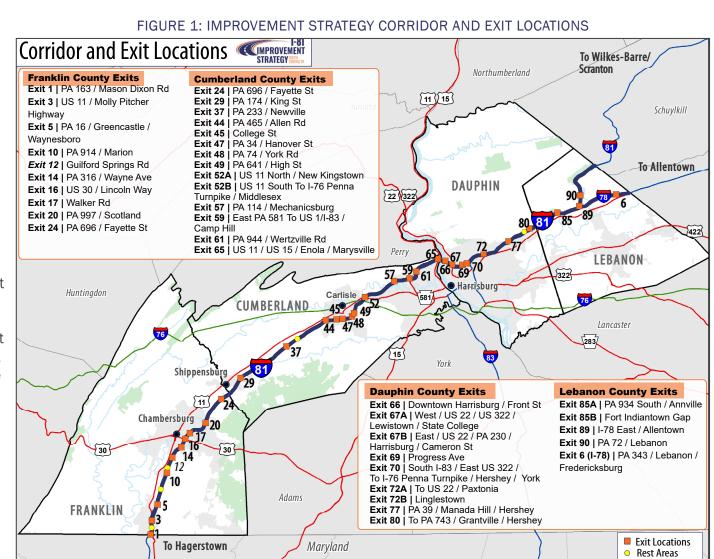
59 Moving Projects from Concept to Construction

The Corridor



The I-81 Improvement Strategy process began in July 2019 to develop a corridor strategy to evaluate existing transportation needs (including highway safety, mobility, land use and access, and highway infrastructure conditions), consolidate needs into focus areas, develop a prioritized list of focus areas and identify improvement options to advance candidate projects onto the Transportation Improvement Program (TIP) and into the project delivery process. Improvement options center on how to optimize the corridor with respect to traffic operations and to target highway safety concerns over the near-term until more extensive future needs can be addressed.

The *I-81 Improvement Strategy* corridor includes I-81 from Maryland to Schuylkill County and includes I-78 from I-81 to Berks County, totaling 104 miles as shown in Figure 1.



The Team



The corridor Metropolitan Planning Organizations (MPOs) and PennDOT District 8-0 collaborated in developing a Project Management Committee (PMC, Figure 2) to meet regularly and provide guidance on the playbook development process. Representation included individuals from:

- Harrisburg Area Transportation Study (HATS) / Tri-County Regional Planning Commission (TCRPC);
- Franklin County MPO;
- · Lebanon County MPO;
- PennDOT District 8-0;
- · PennDOT Central Office; and
- Federal Highway Administration (FHWA).

STRATEGY SOUTH CENTRAL PA **PennDOT** District 8-0/ **FHWA** Central **MANAGEMENT** Office COMMITTEE **MEMBERS** Franklin Co HATS/ **TCRPC** MPO Lebanon Co MPO

FIGURE 2: PROJECT MANAGEMENT COMMITTEE MEMBERS

The Process



The I-81 Improvement Strategy was divided into two overall phases (Figure 3). Phase 1 began with a full needs assessment of the entire corridor followed by identifying and prioritizing Focus Areas for which conceptual improvement candidate projects could developed and prioritized during Phase 2. Environmental screenings of the prioritized focus areas were also completed in Phase 2. Throughout both Phase 1 and 2, an extensive public outreach plan was executed so that all stakeholders had an opportunity to provide input into ways to improve I-81.

FIGURE 3: STRATEGY DEVELOPMENT PHASES



Corridor Needs Analysis and Focus Area Determination

The first phase in developing the *I-81 Improvement Strategy* (Figure 3) was to assess the existing needs along the corridor then determine focus areas by grouping similar needs based on geographic areas. Corridor needs were identified during Phase 1 (Needs Assessment and Prioritization) and documented in the *Needs Assessment Technical Memo*.

To accomplish the needs assessment, the following was completed:



A project website, <u>www.i81southcentralpa.com</u>, was developed and maintained as a primary means of interacting with the public regarding project highlights and progress.



Existing policy documents and other relevant studies that affect future planning for the corridor were reviewed and summarized.



Existing projects that have been planned and programmed for the I-81 corridor were identified and added to a project website map.



A baseline assessment, which included data collection of the quantitative aspects of roadway performance (mobility, safety, infrastructure condition, and land use planning) was completed.



In parallel with the baseline assessment, public engagement activities commenced and included planning roundtables, one-on-one interviews with major freight shipping companies along the corridor and municipal officials, and an online survey to garner public feedback.



Twelve Focus Areas were then identified along the corridor based on the baseline assessment and public feedback.



Finally, need statements were developed for each Focus Area and a virtual public open house was conducted to collect feedback on the 12 Focus Areas and corresponding needs.

The four major categories of needs that were evaluated include:



Mobility



Safet

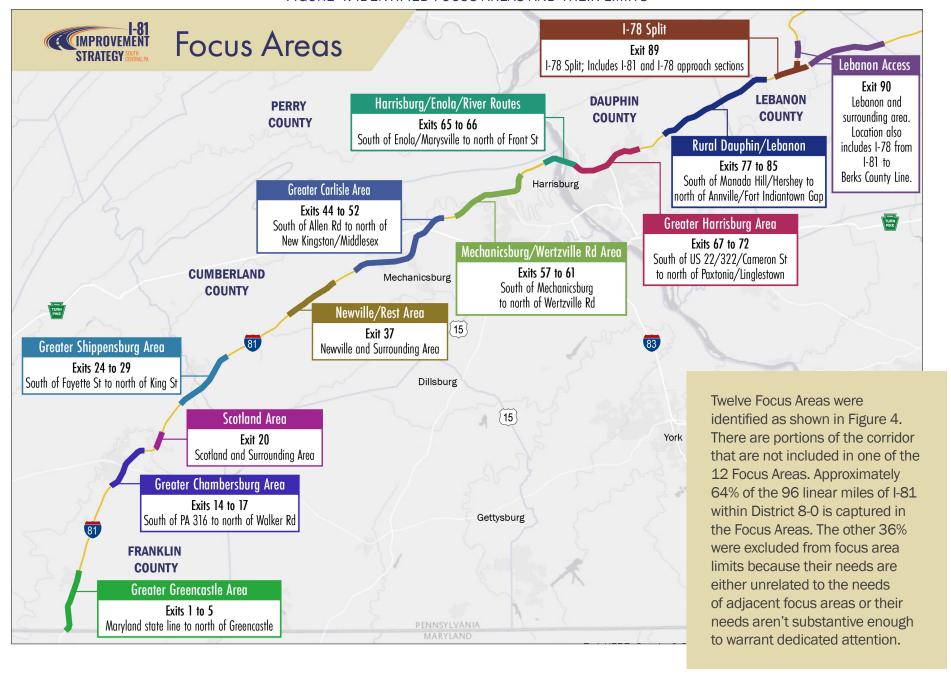


Infrastructure Condition



Land Use Planning

FIGURE 4: IDENTIFIED FOCUS AREAS AND THEIR LIMITS



Focus Area Prioritization



Through a prioritization process, four of the focus areas were advanced for development of design concepts with associated environmental screenings:

- 1. Greater Harrisburg Area,
- 2. Greater Carlisle Area.
- 3. Greater Chambersburg Area, and
- 4. Rural Dauphin/Lebanon.

Figure 5 (on the following page) depicts the rankings per MPO with the top four shown in orange. The top four focus areas were selected for additional evaluation and concept development.

The prioritization process was structured around the four general needs: mobility, highway safety, land use and access, and highway infrastructure condition. In other words, the prioritization process was set-up to ensure that the outcomes would only identify focus areas that have the greatest need, or opportunity for improvement, across the four general needs. Generally, a two-step prioritization process was executed and included the following elements.

Performance Metrics, Normalization and Scoring

STEP

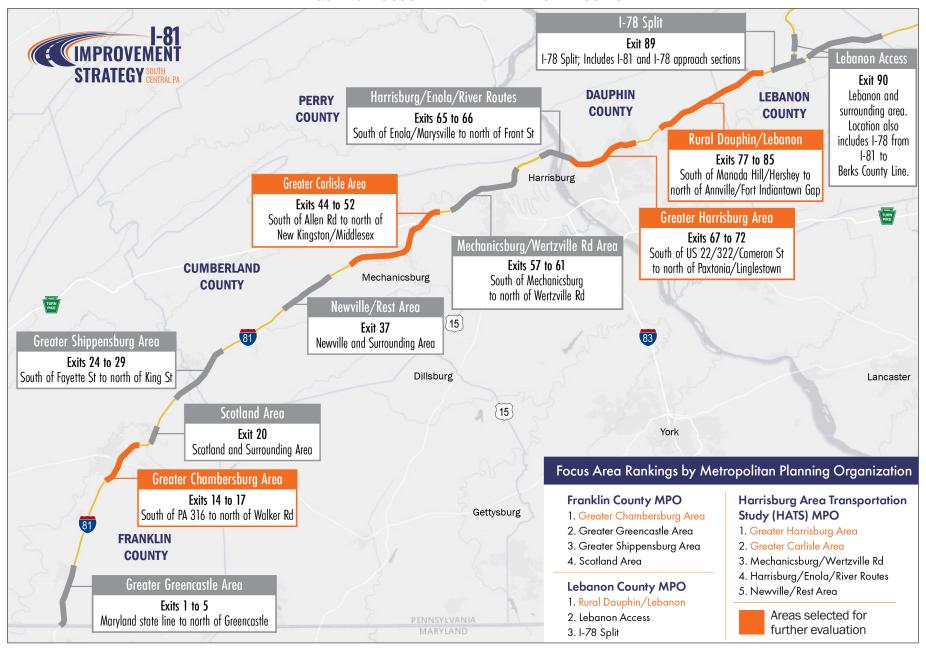
Metrics were chosen for each of the four general need categories. Since each focus area is different, the data was normalized so that all focus areas would be treated fairly. A scoring system was then set for each metric.

Prioritization Weighting and Rating

STEP 2

Each metric was then assigned a weighting (e.g., 20%) to give higher priority to needs such as safety and mobility over condition and land use. Weighted scores were then tallied to produce an overall score for the Focus Area and a ranking of the 12 focus areas was developed.

FIGURE 5: FOCUS AREA PRIORITIZATION RESULTS



In short, the greater the overall rating, the greater the collective needs are within the Focus Area. Table 1 provides the overall ratings per Focus Area.

The findings of the performance metrics analysis, scoring, weighting, and ranking was presented to the PMC in April 2021, and based on subsequent PMC discussion, the following four focus areas were selected to proceed with into Phase 2 (Concept Development). As part of Phase 2, causation factor(s) were further evaluated to

diagnose symptoms shown in the Phase 1 performance analyses and various concepts were prepared that remedy these symptoms.

- 1. Greater Harrisburg Area
- 3. Greater Chambersburg Area
- 2. Greater Carlisle Area
- 4. Rural Dauphin/Lebanon

The focus area prioritization process concluded Phase 1 (Needs Assessment and Prioritization) of the *I-81 Improvement Strategy* and was documented in the *Prioritization Technical Memo*.

TABLE 1: FOCUS AREA RATINGS

Focus Area	Exits	Overall Rating (On a scale from 1-5)	
Greater Greencastle Area	1 to 5	2.33	
Greater Chambersburg Area	14 to 17	2.99	
Scotland Area	20	2.17	
Greater Shippensburg Area	24 to 29	2.25	
Newville/Rest Area	37	1.96	
Greater Carlisle Area	44 to 52	3.65	
Mechanicsburg/Wertzville Rd Area	57 to 61	2.94	
Harrisburg/Enola/River Routes	65 to 66	2.52	
Greater Harrisburg Area	67 to 72	4.26	
Rural Dauphin/Lebanon	77 to 85	2.49	
I-78 Split	89	1.66	
Lebanon Access	90	2.32	

Listing is done in corridor order beginning at the Maryland State line.

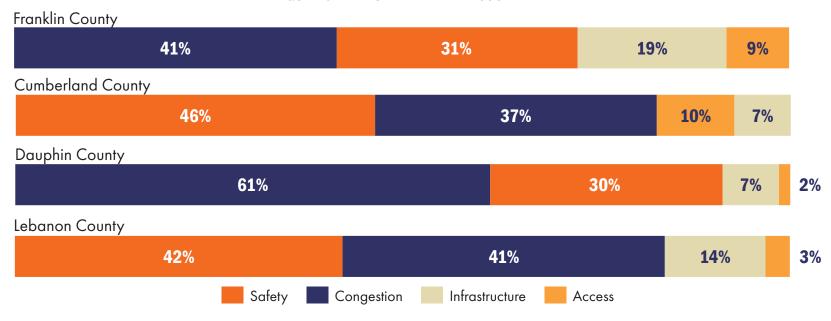
Public Outreach



Public and stakeholder feedback has been gathered at every step of strategy development. In total, more than **3,500** public feedback responses were submitted. This includes feedback from legislative briefings, workshops, online public surveys and feedback forms, and four public meetings. To reach as many community members as possible along the I-81 corridor, a robust stakeholder database was used to promote upcoming events through the I-81 website, email blasts, social media, press releases and letters. We also partnered with HATS, Franklin County MPO and Lebanon County MPO to share all I-81 related news with their local community networks. The feedback gathered for the I-81 Improvement strategy was used to identify the Needs and Priorities (Phase 1) and Conceptual Improvements (Phase 2) and will continue to be reviewed for prioritization and funding for future projects.

In December 2019, an online survey was launched to identify what issues matter most to the motorists who travel along the I-81 corridor. Over 1,100 surveys were submitted along the entire corridor. Safety and congestion consistently ranked as top priorities by survey participants as depicted in Figure 6.

FIGURE 6: NEEDS IDENTIFIED BY COUNTY





In the Fall of 2020, the I-81 Improvement Strategy Team hosted the first Online Public Meeting to provide the general public with the opportunity to review and provide feedback on 12 identified focus areas, associated needs and the criteria that was used during the prioritization of the focus areas. 247 comments were submitted during the comment period. Table 2 is how respondents prioritized the issues in each focus area as it relates to importance.

TABLE 2: FOCUS AREA PUBLIC RESPONSES

Focus Area	Congestion	Safety	Condition	Access
Greater Greencastle Area	23%	31%	38%	8%
Greater Chambersburg Area	44%	17%	39%	0%
Scotland Area	38%	46%	8%	8%
Greater Shippensburg Area	55%	33%	6%	6%
Newville/Rest Area	44%	31%	19%	6%
Greater Carlisle Area	24%	35%	25%	16%
Mechanicsburg/Wertzville Rd. Area	33%	19%	48%	0%
Harrisburg/Enola/River Routes	36%	9%	46%	9%
Great Harrisburg Area	56%	22%	11%	11%
Rural Dauphin/Lebanon Area	22%	31%	22%	25%
I-78 Split	8%	50%	21%	21%
Lebanon Access	25%	0%	50%	25%

Highest ranked concern in each focus area is highlighed.

FIGURE 7: PUBLIC COMMENT PERIOD TIMELINE



In December 2021, a series of virtual public meetings were held to garner feedback on the Phase 2 - Conceptual Improvements that inform the design phase of projects as they get programmed. The meetings were recorded and placed on the project website to continue to solicit feedback from the public through mid-January 2022. For project specific results from the public outreach, please see the Focus Area Conceptual Improvement section. Figure 7 provides a timeline of the last public comment period.





Concept Development

A two-pronged approach was taken for developing conceptual improvements along the corridor and within the top four Focus Areas.

The first type of projects developed were Near Term Systemic projects. These projects are systemic in nature and not confined to one specific Focus Area. *Near Term Systemic projects* were developed to outline project description, location, and programming costs for each Near Term Systemic project. More details on proposed Near Term Systemicprojects can be found in The Projects section beginning on Page 21.

The second type of projects are conceptual projects specific to addressing the needs of the top four Focus Areas. Focus Area Concept Evaluation Memos were developed for each of the top four Focus Areas to consolidate focus area needs, traffic characteristics. general characteristics, conceptual improvements, public feedback, and programming level cost estimates together into one concise document. The concepts proposed in each memo deal directly with the identified needs of that specific Focus Areas and are summarized in The Projects section beginning on Page 21.



Environmental Screenings

Environmental Screening Memos were developed for the Greater Harrisburg, Greater Carlisle, Greater Chambersburg, and Rural Dauphin/Lebanon Focus Areas. A cursory desktop environmental review was conducted to provide a concise summary of key findings as they relate to the potential construction projects in each of the four Focus Areas.

Environmental Screenings evaluated the following items to identify recommendations for further consideration during preliminary engineering phases of future projects.

Resources were mapped for each focus area, and representative mapping is shown as Figures 10 through 12.



FIGURE 8: BOG TURTLE



FIGURE 9: EXAMPLE OF HISTORIC RESOURCE DOCUMENTATION

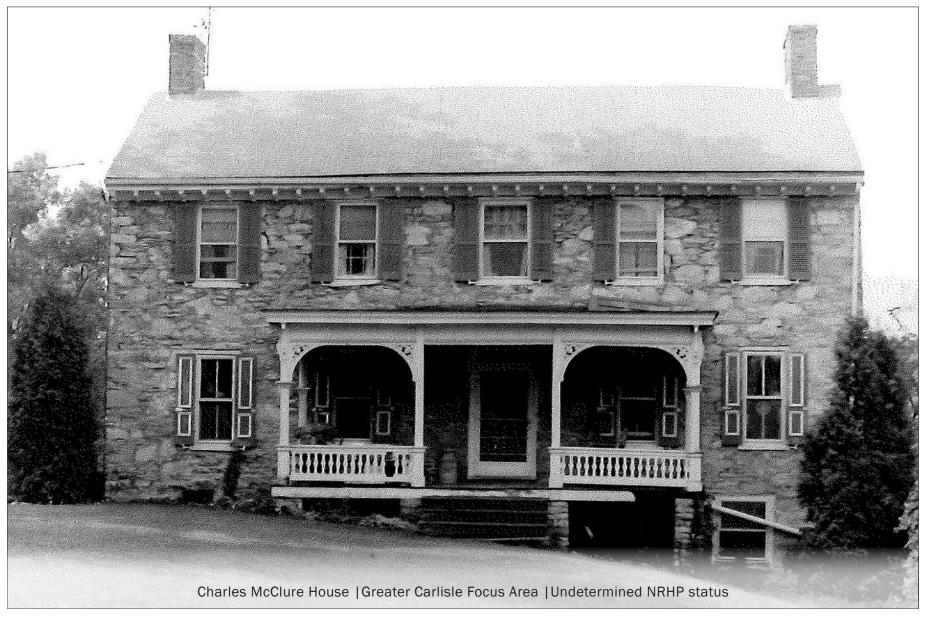


FIGURE 10: EXAMPLE WATER RESOURCES MAPPING I-8\
IMPROVEMENT
STRATEGY CENTRAL PA Project Area 150ft Buffer **Designated Use Streams** I-81 Greater Chambersburg Area Screening Map: Panel 2.1 Water Resources **HQ-CWF** (High Quality-Cold Water Fishes) & Stocked Trout Stream WWF(Warm Water Fishes) Class A Wild Trout & Stocked Trout Stream Flood Hazard Zone A or AE Wetlands Freshwater Emergent Wetland Freshwater Forested/Shrub Wetland Freshwater Pond There are no Scenic Rivers within the map view.

I-81
IMPROVEMENT
STRATEGY CENTRAL PA I-81 Greater Chambersburg Area Screening Map: Panel 2.2 Recreational Resources There are no national parks, state parks, state forests, state game ands, state trails, water trails or LWCF Grants within the map

FIGURE 11: EXAMPLE RECREATIONAL RESOURCES MAPPING

FIGURE 12: EXAMPLE OTHER ENVIRONMENTAL CONSIDERATIONS MAPPING I-81 Greater Chambersburg Area Screening Map: Panel 2.3 Other Environmental Considerations Green Township-Conococheaque Rural Historic District (Not Eligible) Tru by Hilto Poor House (Eligible) Project Area 150ft Buffer Historic Resources

TRI and Brownfields Facilities Environmental Justice Groups Census Blocks





Environmental Screening Concept Evaluation Matrix

A concept evaluation matrix was compiled for each Focus Area based on a 150' buffer distance around the proposed conceptual improvements. The matrices broadly assess how each Concept may potentially impact each environmental resource to provide a color-coded indication of whether a resource is present and seems likely to be impacted, is present but seems less likely to be impacted, or was not identified within the buffer distance. Recommendations for agency coordination and environmental studies are included in each memo. While based on a desktop review, the Environmental Screening Memos may assist project designers to initiate agency coordination and studies earlier in the design process, with the goal of moving the project forward expeditiously while avoiding and minimizing environmental impacts.

The Projects



Near Term Systemic Improvements

Near Term Systemic projects were developed to be systemic in nature across the corridor. These systemic improvements address needs that occur in more than one Focus Area or relate to the adjacent highway network such as:

- Incident Management Strategies
- ITS/TSMO/Traffic Operations (fully consistent with the recently completed Eastern RTMC ROP)
- Signing and Pavement Marking Improvements
- Acceleration and Deceleration Lane Lengthening

These projects originated in the Eastern Regional Traffic Management Center (RTMC) ROP and other studies and planning documents that the MPOs' have been a part of such as Greater Harrisburg Area Susquehanna River Bridges Study (GHASRB).

Meetings were held with PennDOT District 8-0 subject matter experts to refine project descriptions and details. Four Near Term Systemic projects were developed to identify project descriptions, locations, and refined programming level estimates. Each Near Term Systemic project is summarized over the following pages.

PROJECT 1 – PARALLEL CORRIDOR IMPROVEMENTS FOR INCIDENT MANAGEMENT

Parallel Corridor Improvements for Incident Management consists of the following individual projects/initiatives:

1a	1b	1c
I-81 Integrated Corridor	I-81 Freeway Service	Carlisle Area Traffic Signal
Management	Patrol Expansion	Improvements

Each of these individual projects are included in the <u>Eastern RTMC ROP</u> dated September 14, 2020.

PROJECT 1a

I-81 INTEGRATED CORRIDOR MANAGEMENT

Project 1a addresses queue management detection along I-81 and the management of parallel roadways in cases of incidents along I-81. The project will entail upgrading 20 traffic signals on the parallel route to I-81 using Route 72 and Route 22 between Exit 90 (PA 72/Lebanon) south to Exit 72A (To US 22/Paxtonia) to provide access to the Unified Command and Control (UCC) platform, which allows for real-time monitoring and operation of connected traffic signals. The project will also involve developing incident management timing plans that can be implemented through the UCC during an incident detour of I-81, and placement of Closed-Circuit Televisions (CCTV) that are either stand alone or colocated on traffic signal supports to provide situational awareness.



to provide integrated corridor management along the parallel corridors of Route 72 and Route 22 for I-81.

PROJECT 1b

I-81 FREEWAY SERVICE PATROL EXPANSION

Project 1b addresses expanding the existing Freeway Service Patrol (FSP) along I-81 in the area of Harrisburg. The current I-81 FSP coverage area is between Exit 57 (PA 114/Mechanicsburg) and Exit 72 (To US 22/Paxtonia/Linglestown). The expansion includes the addition of FSP as follows:

- Exit 44 (PA 465/Allen Road) to Exit 57 (PA 114/Mechanicsburg)
- Exit 72 (To US 22/Paxtonia/Linglestown) to Exit 89 (Interstate 78)
- Exit 16 (US 30/Lincoln Way) Vicinity to Include Adjacent US 30

\$825,000 WOULD BE REQUIRED

for purchasing capital costs of the vehicles which assumes a total of five vehicles/routes comprised of two vehicles between Exits 44 to 57, two vehicles between Exits 72 to 89.

It should be noted that the operating cost over a three year period, which is a typical contract duration, for all routes identified would be \$2.4 million which would be out of the respective PennDOT County Maintenance Budgets. This maintenance cost is in addition to any current Department maintenance costs for operation of the FSP.

PROJECT 1c

CARLISLE AREA TRAFFIC SIGNAL IMPROVEMENTS

Project 1c addresses upgrading signal controllers and detection at 20 signalized intersections in the Carlisle Adaptive System for connection to UCC. These upgrades will provide for incident management along Route 11 as a parallel route to I-81.

Project is located along Route 465 and Route 11 in the Borough of Carlisle.

\$1.2 MILLION
WOULD BE REQUIRED

for signal upgrades along the parallel corridors of Route 465 and Route 11 to I-81.

PROJECT 2 - ITS DEVICE ENHANCEMENTS

ITS Device Enhancements consists of the following individual projects/initiatives:

2a	2b	2c	2d	2e
DMS on Approaches to I-81 Entrance Ramps	I-81 CCTV Gaps	I-81 DMS Gaps	I-81 CCTV Colocated with DMS Gaps	Systemic Advanced Warning

Each of these individual projects are included in the Eastern RTMC ROP dated September 14, 2020 or identified in the Greater Harrisburg Area Susquehanna River Bridges Master Plan (GHASRB).

PROJECT 2a

DMS ON APPROACHES TO I-81 ENTRANCE RAMPS

Project 2a is proposed to provide improved traveler information to motorists intending to access I-81 from the adjoining surface street system. More specifically, the project involves the installation of post-mounted Type A Dynamic Message Signs (DMS) along key roadways in advance of I-81 entrance ramps. Messages can be posted to these DMS from the Eastern RTMC to advise destined I-81 motorists of pertinent information pertaining to I-81, such as a road closure and weather messages. These Type A DMS signs will serve as pre-entry signs providing drivers information on incidents on I-81 which may result in drivers using alternate routes and not becoming part of an incident queue.

Six locations are proposed at the following three I-81 exits and associated approaches:

- Exit 16 (US 30) Eastbound and Westbound Approaches to I-81
- Exit 44 (PA 465) Northbound and Southbound Approaches to I-81
- Exit 52 (US 11) Northbound and Southbound Approaches to I-81



to provide motorist pre-entry information at all three identified interchanges.

PROJECT 2b

I-81 CCTV GAPS

Project 2b addresses expanding the existing CCTV coverage along I-81 to provide enhanced situational awareness allowing for the shortening of incident detection and response times.

Five locations are proposed at the following approximate mile markers and segment locations:

- Mile Marker 48 (Segment 480/481) in the area of Exit 48
- Mile Marker 56 (Segment 560/561) south of Exit 57
- Mile Marker 66 (Segment 660/661) in area of Exit 66
- Mile Marker 69 (Segment 690/691) in the area of Exit 69
- Mile Marker 76 (Segment 760/761) south of Exit 77



to provide for all five identified CCTV installations.

PROJECT 2c

I-81 DMS GAPS

Project 2c addresses expanding the existing DMS coverage along I-81 to provide enhanced dissemination of information to motorists at key critical locations. This project was submitted as part of PennDOT District 8-0's 2023 TSMO Funding application.

Two locations are proposed at the following mile markers and direction of travel orientations:

- I-81 Southbound in advance of Exit 49 (Segment 491)
- I-81 Southbound in advance of Exit 80 (Segment 801)



to provide for both identified DMS installations.

PROJECT 2d

I-81 CCTV COLOCATED WITH DMS GAPS

Project 2d addresses expanding the existing CCTV coverage along I-81 by installing CCTVs on existing DMS. Expansion of CCTV coverage will provide enhanced situational awareness allowing for shortening of incident detection and response times. Colocating on existing DMS will save capital cost for CCTV structures, communications, and electrical equipment. The ROP identified six CCTV gap locations four of which, noted in bold text below, were included in PennDOT District 8-0's 2023 TSMO Funding application.

APPROXIMATELY \$380,000 WOULD BE REQUIRED

to provide for the six identified CCTVs colocated on existing DMS.

Six locations are proposed at the following existing DMS locations:

• D-81N-55

• D-81S-62

• D-81S-69

D-81N-58

• D-81N-63

• D-81S-71

PROJECT 2e

SYSTEMIC ADVANCED WARNING

Project 2f will leverage updates either made or in planning for the 511PA traveler information system. These updates will allow notifications to be delivered to motorists within a specific geographic location through the 511PA mobile application. Notifications could also be targeted to specific motorists such as commercial vehicles for example. PennDOT currently has the award winning 511PAConnect application that allows emergency responders and PennDOT to engage directly with motorists via their cell phones during emergency situations such as extended duration road closures. 511PAConnect works regardless of whether or not the motorist has the 511PA application on their mobile device. 511PAConnect is not currently for use in the way that this project is proposing - to allow motorists the ability to receive notifications of regional significance who are entering the Greater Harrisburg Area from areas beyond the reach of PennDOT's ITS. This project is an idea or concept that is not implementable as part of the I-81 Improvement Strategy.

As this project relies on leveraging updates to the 511PA and/or 511PAConnect systems, costs are unknown. It should be noted that this project is not a capital expense project that District 8-0 or the MPOs should account for in their project programming.



PROJECT 3 - SIGNING AND PAVEMENT MARKING ENHANCEMENTS

Signing and Pavement Marking Enhancements consists of the following individual projects/initiatives:

3a	3b	3с		
Curve Warning Signage Enhancements	I-81 George Wade Bridge Auxiliary Lanes	I-81 Northbound to North Front Street Southbound Merge at Exit 66		
3d	3e	3f		

Each of these individual projects are included in either the Eastern RTMC ROP dated September 14, 2020, the Greater Harrisburg Area Susquehanna River Bridges Master Plan or been identified as part of the I-81 Improvement Strategy project.

PROJECT 3a

CURVE WARNING SIGNAGE ENHANCEMENTS

Project 3a proposes to use Dynamic Curve Warning systems to provide feedback to vehicles approaching a horizontal curve at unsafe speeds. Vehicle speeds are detected upstream of the curve by radar or other ITS devices and trigger a controller that activates electronic sign elements and/or DMS to warn the speeding driver to slow down prior to the curve. The Dynamic Curve Warning systems will also be supplemented by integrated Dynamic Chevron Sign systems which consist of static chevron signs of which the chevrons are edge-lit by LEDs. Dynamic Curve Warning systems will be installed at I-81 MM 93 in Lebanon County in both the Northbound direction (from Segment 0924, Offset 0311 to Segment 0930, Offset 1288) and Southbound direction (from Segment 0925, Offset 0316 to Segment 0931, Offset 1203).

Per discussion with PennDOT District 8-0, a pilot Dynamic Curve Warning System could be installed at I-81 MM 93 in Lebanon County to evaluate the effectiveness of the system before expanding to other locations or corridors.



PROJECT 3b

I-81 GEORGE WADE BRIDGE AUXILIARY LANES

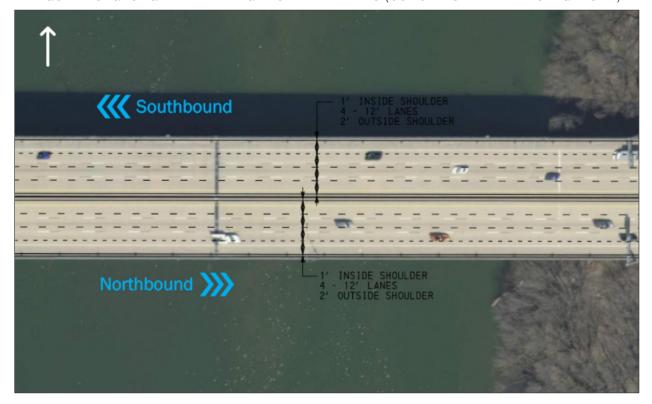
Project 3b addresses restriping the George Wade Bridge in both the Northbound and Southbound directions to convert the outside shoulder into an auxiliary lane as conceptually shown in Figure 13. This will provide a weave lane to manage ramp maneuvers over the length of the bridge and effectively extend the merge/diverge between ramps. This will especially benefit the US 11/15 entrance ramps to I-81 Northbound at Exit 65 (US 11/15 Enola). Drivers approaching from the US 11/15 Southbound loop ramp to I-81 Northbound must merge with traffic from the US 11/15 Northbound direct ramp while then immediately attempting to merge onto I-81 to cross the Susquehanna River. By restriping the George Wade Bridge, the US 11/15 Southbound and Northbound ramp merges are further separated from the Exit 65 and Exit 66 ramp merges and diverges, and the auxiliary lane provides additional length to more safely complete the maneuvers while minimizing the disruption to I-81 through movements. This project is similar to the lane reconfiguration used Northbound across the I-83 John Harris Bridge over the Susquehanna River.



APPROXIMATELY \$230,000 WOULD BE REQUIRED

for pavement marking removal and restriping.

FIGURE 13: GEORGE WADE BRIDGE AUXILIARY LANES (CONCEPTUAL PLAN FROM GHASRB)



PROJECT 3c

I-81 NORTHBOUND TO NORTH FRONT STREET SOUTHBOUND MERGE AT EXIT 66

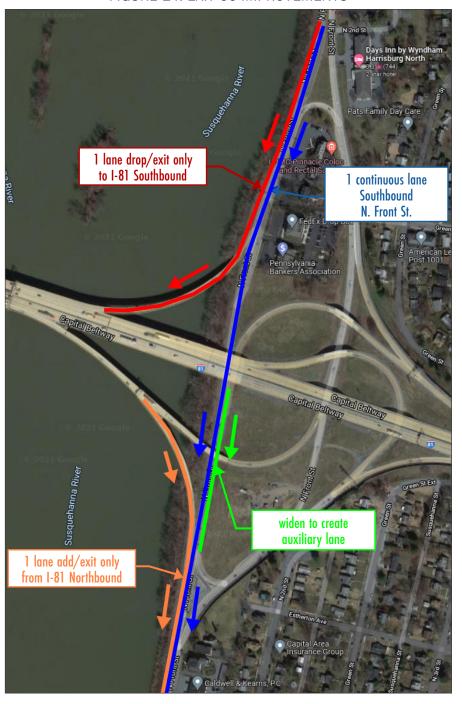
Project 3c addresses concerns expressed by first responders related to the I-81 Northbound exit ramp (Route 8001, Segment 0010) merging onto North Front Street Southbound (Route 3009, Segment 0141) at Exit 66. The project (Figure 14) will consist of widening North Front Street to create an auxiliary lane between the I-81 Southbound exit ramp (Route 8001, Segment 0510) and the channelized left onto North Front Street to I-81 Northbound (shown in green). Southbound North Front Street will then be restriped such that the left through lane on Southbound North Front Street is continuous through the interchange (shown in blue) and the right lane on Southbound North Front Street then becomes a lane drop/exit only onto the I-81 Southbound entrance ramp (Route 8001, Segment 0250) north of the interchange (shown in red), and then becomes a right lane add (shown in orange) from the I-81 Northbound exit ramp (Route 8001, Segment 0010). This will remove the concern of sight distance and merge conditions at the I-81 Northbound exit ramp (Route 8001, Segment 0010).

Note that this project is one idea to address the lane assignments in the Southbound direction along North Front Street through Exit 66. There is a study underway by PennDOT Multimodal Deputate to review the conveyance of shared-use path traffic through this interchange along North Front Street.



for pavement marking removal and restriping and minor roadway widening within the right-of-way (ROW).

FIGURE 14: EXIT 66 IMPROVEMENTS



PROJECT 3d

RECESSED WET REFLECTIVE PAVEMENT MARKINGS

Project 3d proposes a two-pronged manner for installation of Recessed Wet Reflective Pavement Markings (RWRPM) along I-81:

- 1. Interstate Steering Committee (ISC) Funding: PennDOT's ISC, starting in state fiscal year (SFY) 2020-21, began a dedicated RWRPM funding program for the installation of broken-white lane lines on PA's Interstate system. Emphasis for this funding program is to install RWRPM on suitable existing pavement and not new construction. During Year 1 the funding level was \$1M but the funding levels are ramping up to \$2M in SFY 2021-22 (Year 2 Current SFY), \$3M in SFY 2022-23 (Year 3), and \$4M for each year starting in SFY 2023-24 (Year 4+).
- 2. Capital Projects: PennDOT Bureau of Maintenance and Operations (BOMO) will soon be issuing a Strike-Off Letter amending Chapter 3 of PennDOT Publication 46 pertaining to Pavement Markings. This policy will require the installation of RWRPM on interstate broken-white lane lines and eliminate the use of Raised Pavement Markers for the same purpose. The District should consider the new policy on all capital projects requiring new wearing surfaces for I-81 that haven't been Let.



+/- 76 lane miles as indentified.

As new capital projects are identified, RWRPM should be implemented on these projects using capital program funding. The prevailing average cost to design and construct a lane mile of RWRPM using recessed tape material is \$6,023.

PROJECT 3e

SIGNING AND PAVEMENT MARKING ASSESSMENTS AT EXIT 89 (I-78 SPLIT)

Project 3e addresses operations and safety of the I-81 and I-78 interchange. Currently signing and pavement marking improvements are part of the Route 0078-015 Project at this interchange. These improvements should be implemented and evaluated prior to funding additional improvements.

PROJECT 3f

RAMP CURVE SAFETY ASSESSMENT

Project 3f addresses ramp non-collision and run-off-the-road crashes via study and assessment of each ramp, with specific focus on ramps with curvature. Assessments will consist of field views and speed studies for each ramp and will identify low-cost safety improvements including, but not limited to signage and pavement markings. There are 31 numbered exits with a total of 138 diverging and merging ramp alignments along I-81 within the District. Once improvements have been identified and quantified, funding can be sought to implement improvements.

\$250,000 WOULD BE NEEDED

to assess I-81's ramps within the District and determine applicable signing and pavement marking recommendations.

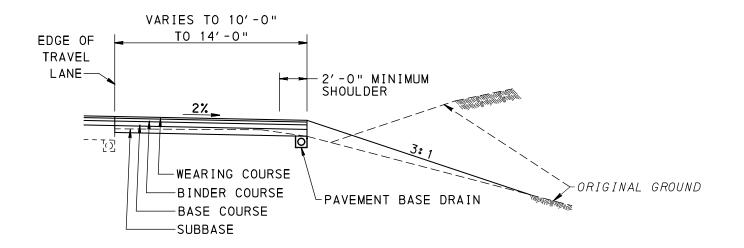
PROJECT 4 ACCELERATION/DECELERATION RAMP EXTENSIONS

Project 4 addresses deficient acceleration and deceleration ramp lengths at specific locations within the corridor. Ramps will be lengthened by widening and reconstructing the existing shoulder to provide a 12' ramp lane and 2' shoulder as shown in Figure 15.

In total 22 ramps not currently within the top four focus areas are identified to be lengthened to meet current standards and is estimated to cost



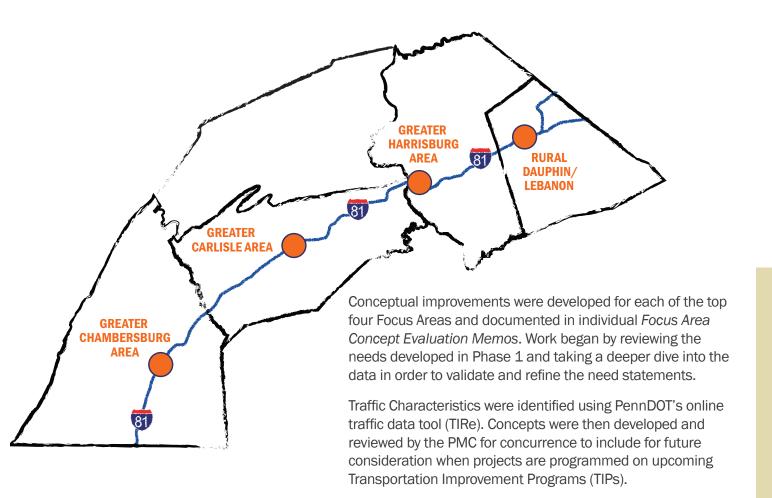
FIGURE 15: SHOULDER RECONSTRUCTION DETAIL



PARTIAL TYPICAL SECTION
ACCELERATION / DECELERATION
LANE EXTENSION
NOT TO SCALE

Focus Area Conceptual Improvements





Evaluation Memos.

Concept specific questions posed during the December 2021/January 2022 public comment period are included throughout the summary along with the number of responses and apparent public preferred option denoted in orange text.



Current Need Statements, Traffic Characteristics, and

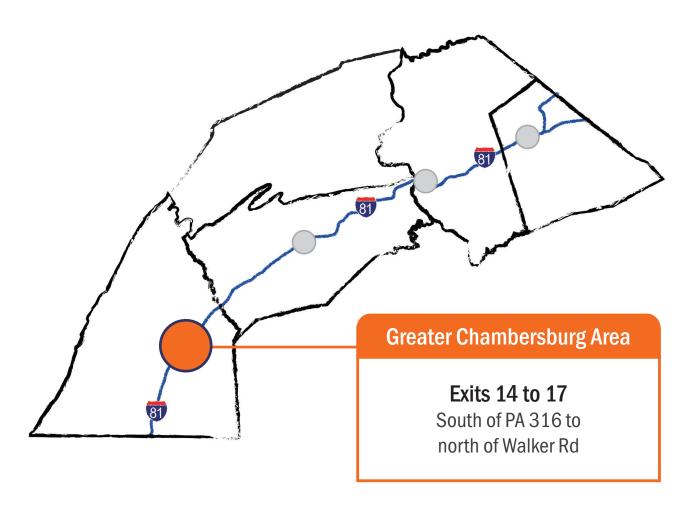
Conceptual Improvements are depicted for the top four Focus Areas. The following summarizes the *Focus Area Concept*



Greater Chambersburg Area

Greater Chambersburg Focus Area includes three full interchanges, Exit 14 (Wayne Ave, PA 316), Exit 16 (Lincoln Way, US 30), and Exit 17 (Walker Rd) and is approximately four miles in length. Safety needs for this Focus Area were isolated to Exit 14 and Exit 16 and not spread out along the mainline. Therefore, multiple concepts were created for those Exits and not the entire corridor. Auxiliary lanes connecting both Northbound and Southbound ramps from Exit 14 to 16 to 17 were constructed in 2010 providing increased mobility along mainline I-81.

Based on early public input, Exit 17 has the greatest potential for future development due in large part to the availability, proximity, and suitability of land. Parcels between Exit 14 and Exit 16 were also identified but to a lesser degree. Exit 17 is a relatively new interchange having been built and opened to traffic in 2005. Since then, parcels near and along Norland Ave have been developed and additional roads that are current dead-end streets (5th Ave and Parkwood Dr) are planned for future extension to create a larger street network. Coordination with local municipalities and PennDOT for all future Transportation Impact Studies (TIS) and Highway Occupancy Permits (HOP) is needed so that developmental impacts to Exit 17 are accounted for in nearby TISs and HOPs.



NEEDS STATEMENTS

Corridor needs were identified during Phase 1 (Needs Assessment and Focus Area Prioritization) of the I-81 Improvement Strategy and documented in the Needs Assessment Technical Memo. Table 3 describes the needs that were identified for the Greater Chambersburg Focus Area as shown on the project website.

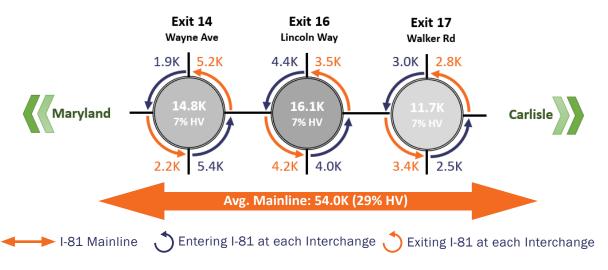
TRAFFIC CHARACTERISTICS

Figure 16 depicts traffic volumes as Annual Average Daily Traffic (vehicles per day (VPD)) from PennDOT's Roadway Management System, obtained December 9, 2021. Total ramp volumes are shown inside the circle along with the percentage of Heavy Vehicles (HV).

TABLE 3: GREATER CHAMBERSBURG FOCUS AREA NEEDS

Greater Chambersburg Area (Exits 14, 16, & 17)					
Highway Safety Exits 14 and 16 are experiencing ramp and ramp terminal (intersection) crashes in excess of similar roadways.					
Mobility	The existing mainline I-81 routinely experiences minor travel delay between Exit 14 and Exit 16, which contributes to operational and safety concerns.				
Land Use and Access	Beyond the existing industrial development in the area, additional commercial and residential development near Exits 14, 16, and 17 will increase traffic volumes at the interchanges.				
Highway Infrastructure	The existing pavement and structures along several segments of existing I-81 corridor were constructed in the 1960s and are approaching the end of their serviceable life span. Gaps in ITS devices (specifically DMS) were identified at Exit 16.				

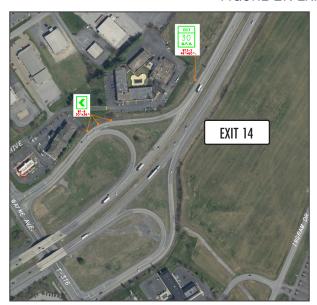
FIGURE 16: GREATER CHAMBERSBURG FOCUS AREA TRAFFIC CHARACTERISTICS



CONCEPTUAL IMPROVEMENTS

Exit 14 improvements were focused on safety along the I-81 Southbound ramps. Concepts vary from additional curve signs to full reconstruction and realignment to meet current critieria as shown in Figure 17.

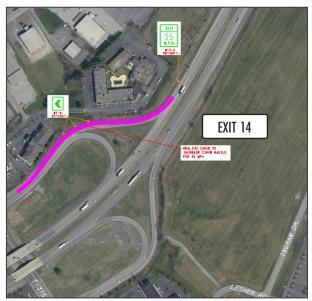
FIGURE 17: EXIT 14 CONCEPTS



Concept 1: Additional Curve Signs



Concept 2: Mill and Overlay with High Friction Wearing Course



Concept 3: Reconstruct and Increase Curve Radius

Exit 16 improvements centered on improving mobility and safety through the ramp signalized intersections (terminal points). Concepts from additional left turn lanes for the off ramps to full interchange reconfigurations are proposed as shown in Figure 18.

FIGURE 18: EXIT 16 CONCEPTS



Concept 1: Additional Left Turn Lanes at Off Ramps



Concept 2: Additional Left Turn Lanes on Ramps and Route 30

Which of the following proposed concepts to reconfigure Exit 16 do you prefer?

Concept 1 – Additional 5 Left Turn Lanes at Off Ramps

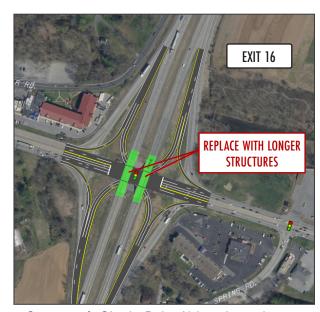
Concept 2 – Additional Left 12 Turn Lanes on Ramps and US 30

Concept 3 – Diverging 21 Diamond Interchange

Concept 4 – Single Point 36 Urban Interchange



Concept 3: Diverging Diamond Interchange



Concept 4: Single Point Urban Interchange

CONCEPT COST ESTIMATES

Programming level cost estimates were developed for the concepts noted above for the Greater Chambersburg Focus Area. Estimates for each candidate project are summarized in Table 4.

TABLE 4: GREATER CHAMBERSBURG FOCUS AREA PROGRAMMING LEVEL COST ESTIMATES

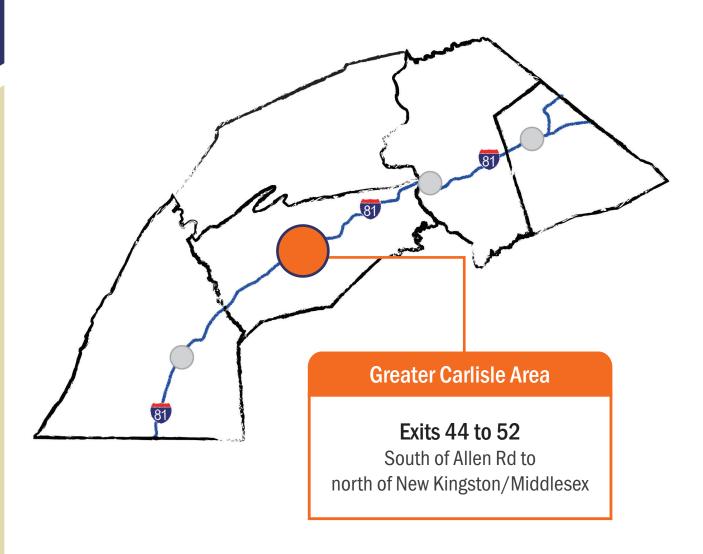
Project Ref	Project Title	Preliminary Engineering	Final Design	Right-Of-Way Acquisition	Utility Relocation	Construction	Pre-Construction Duration (years)
14-1	I-81 Exit 14 SB Exit Ramp Signage Improvements	\$2,000	\$2,000	\$ O	\$ 0	\$14,000	<1 yr - Maintenance Forces
14-2	I-81 Exit 14 SB Exit Ramp High Friction Wearing Course	\$21,000	\$14,000	\$ 0	\$0	\$161,000	<1 yr - Maintenance Forces
14-3	I-81 Exit 14 SB Exit Ramp Realignment	\$81,000	\$54,000	\$ 0	\$ 0	\$619,000	1-2
16-1	I-81 Exit 16 Exit Ramp Lane Addition for Left Turns	\$87,000	\$58,000	\$ 0	\$ 0	\$663,000	1-2
16-2	I-81 Exit 16 Dual Left Turns On US 30 to Entrance Ramps	\$787,000	\$1,101,000	\$ 0	\$ 0	\$17,299,000	2-3
16-3	I-81 Exit 16 Interchange Reconfiguration to Diverging Diamond Interchange	\$654,000	\$436,000	\$ 0	\$ 0	\$4,878,000	3-5
16-4	I-81 Exit 16 Interchange Reconfiguration to Single Point Urban Interchange	\$718,000	\$1,005,000	\$ 0	\$ 0	\$15,778,000	3-5



Greater Carlisle Area

Greater Carlisle Focus Area includes four full interchanges, Exit 44 (Allen Rd, PA 465), Exit 45 (College St), Exit 47 (Hanover St, PA 34), and Exit 52 (Middlesex/New Kingstown, US 11) as well as two half interchanges, Exit 48 (York Rd, PA 74) and Exit 49 (High St, PA 641). The focus area is approximately nine miles in length.

With numerous, closely spaced interchanges with short on and off ramps, improvements focused on the overall corridor between Exit 44 (Allen Rd) and Exit 49 (High St). While within the focus area, Exit 52 is somewhat separated. Improvements at Exit 52 were also developed. This Focus Area also includes the location where the PA Turnpike (I-76) intersects with I-81 but, without a direct interchange, currently vehicles have to use a portion of US 11, locally known as the Miracle Mile, to traverse between interstates.



NEEDS STATEMENTS

Corridor needs were identified during Phase 1 (Needs Assessment and Focus Area Prioritization) of the I-81 Improvement Strategy and documented in the Needs Assessment Technical Memo. Table 5 describes the needs that were identified for the Greater Carlisle Focus Area as shown on the project website.

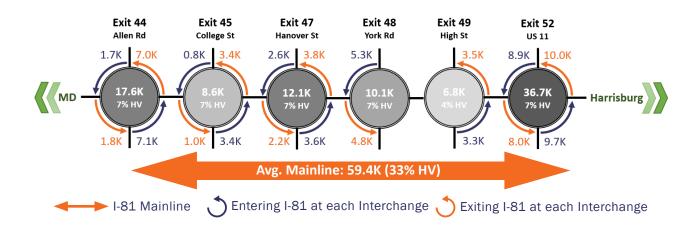
TRAFFIC CHARACTERISTICS

Figure 19 depicts traffic volumes as Annual Average Daily Traffic (vehicles per day (VPD)) from PennDOT's Roadway Management System, obtained December 9, 2021. Total ramp volumes are shown inside the circle along with the percentage of Heavy Vehicles (HV).

TABLE 5: GREATER CARLISLE FOCUS AREA NEEDS

Greater Carlisle Focus Area (Exits 44, 45, 47, 48, 49, & 52)						
Highway Safety	Short ramps and acceleration lanes, inadequate merging sight distance, capacity issues, closely spaced interchanges causing speed differentials, inadequate interchange configuration at Exit 48 / Exit 49, and no direct access between I-81 and the PA Turnpike result in highway safety concerns.					
Mobility	The existing mainline I-81 routinely experiences relatively high speeds in excess of the posted speed limit and travel delay at several sections of roadway which contribute to operational and safety issues.					
Land Use and Access	Industrial, commercial, and residential development will continue in proximity to Exits 44, 45, 47, 48, and 49. With expected growth throughout the area in the future, traffic volumes will increase at the existing interchanges.					
Highway Infrastructure	Portions of the existing pavement and all structures on the existing I-81 corridor were constructed in the 1960s and are approaching the end of their serviceable life span. Gaps in ITS devices (CCTV and DMS) were identified in five locations.					

FIGURE 19: GREATER CARLISLE FOCUS AREA TRAFFIC CHARACTERISTICS



CONCEPTUAL IMPROVEMENTS

Two corridor-wide concepts were developed to address the numerous closely spaced interchanges with short on and off ramps:

- Collector-Distributor
 (C-D) Lanes
- 2. Auxiliary Lanes

C-D Lanes physically separate the exiting and entering traffic from the two mainline lanes by a concrete barrier. The northbound C-D lane (Figure 20) would begin south of Exit 44 and end north of Exit 49. The southbound C-D lane (Figure 21) would mirror the northbound and begin north of Exit 49 and end south of Exit 44. Limits are shown in purple in Figure 22. The purpose of a C-D lane is to ease ramp friction and increase safety by eliminating weaving into and out of the mainline I-81 lanes thus reducing the number of mainline entrance and exit points while still satisfying the demand for access to and from I-81.

Which Carlisle Access Improvements do you prefer?

Auxiliary Lanes

79

Collector-Distributor (C-D) Lanes 41

FIGURE 20: NORTHBOUND C-D LANES



FIGURE 21: SOUTHTHBOUND C-D LANES

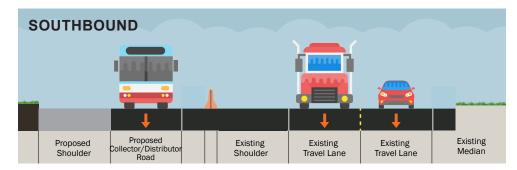
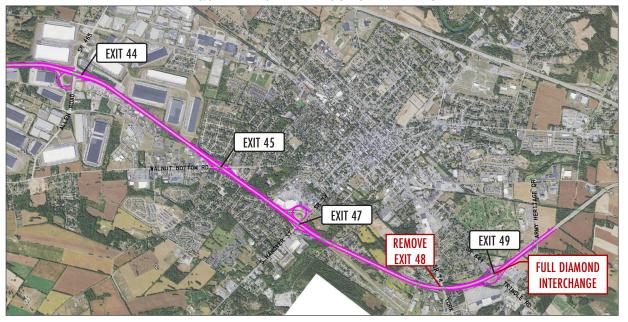


FIGURE 22: C-D LANE CONCEPT LIMITS



Alternatively, Auxiliary lanes would address both safety and mobility through the Focus Area but with a narrower footprint compared to C-D Lanes. Auxiliary Lanes will connect an on ramp to the next off ramp, thereby creating three lanes between interchanges.

AASHTO's A Policy on Geometric Design of Highways and Streets, 6th Edition, 2011 (The Green Book) defines auxiliary lanes as the portion of the roadway adjoining the through lanes for speed change, turning, storage for turning, weaving, truck climbing, and other purposes that supplement through-traffic movement. It is also noted that operational efficiency (mobility) may be improved by using a continuous auxiliary lane between the entrance and exit terminals where (1) interchanges are closely spaced, (2) the distance between the end of the taper on the entrance terminal and the beginning of the taper on the exit terminal is short, and/or (3) local frontage roads do not exist, of which all three conditions are present in the Carlisle Focus Area.

Auxiliary lanes will be constructed for both northbound (NB) and southbound (SB) between Exits 44 and 45, 45 and 47, and 47 and 49 as depicted in Figures 23-25.

FIGURE 23: SOUTHBOUND AUXILIARY LANES



FIGURE 24: NORTHBOUND AUXILIARY LANES

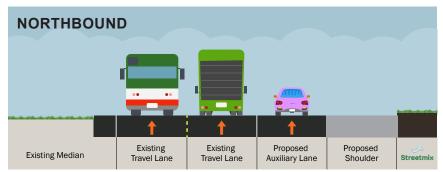
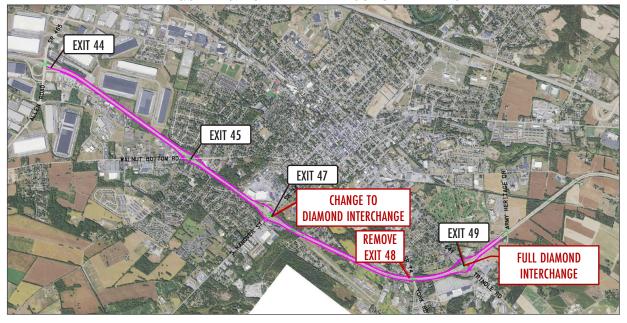


FIGURE 25: AUXILIARY LANE CONCEPT LIMITS

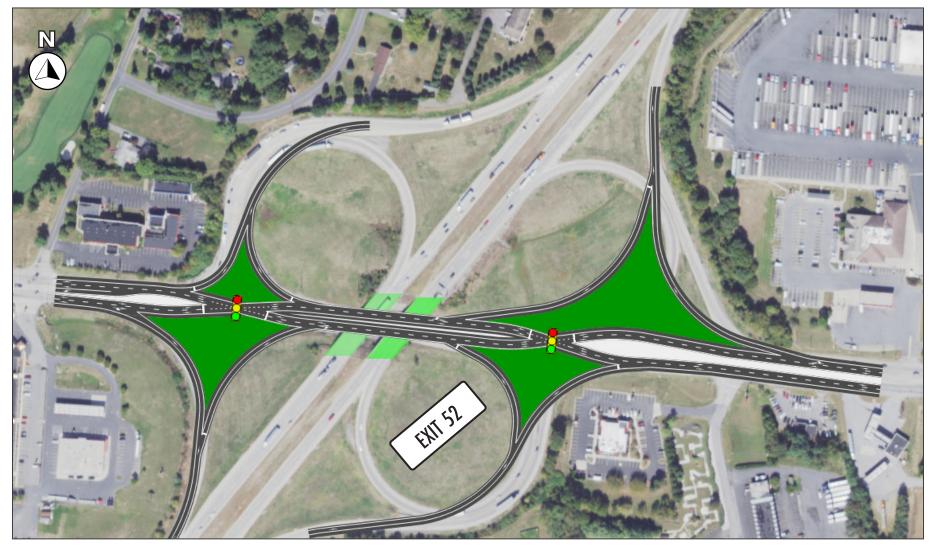


I-81 Improvement Strategy Playbook 40

To address the safety and mobility of Exit 52's ramps, the interchange could be converted to a Diverging Diamond Interchange (DDI) as depicted in Figure 26. This reconfiguration may fit within the existing footprint of the interchange and should improve traffic flow on US 11. PennDOT District 8-0 currently has two DDI interchange reconfigurations; I-83 Exit 4 Shrewsberry and the US 222/US 322 Ephrata interchange.



FIGURE 26: DIVERGING DIAMOND INTERCHANGE AT EXIT 52



Additionally, since there currently is no direct connection between the PA Turnpike (I-76) and I-81, one potential configuration was developed to provide a direct connection as shown in Figure 27. Additional studies will be required before advancing a project to construct a new interchange. Studies should include the two existing interchanges on US 11 otherwise known as the Miracle Mile (PA Turnpike and I-81) and should consider a new PA Turnpike interchange on the west side of Carlisle. There is potential to reduce traffic on I-81 around Carlisle by

adding adding a western interchange as depicted in Figure 28.

If a direct connection (between the **Turnpike and I-81) were constructed,** do you have a preference on where?

Western Connection 47

Eastern Connection 55

FIGURE 27: EASTERN DIRECT CONNECTION TO 1-76

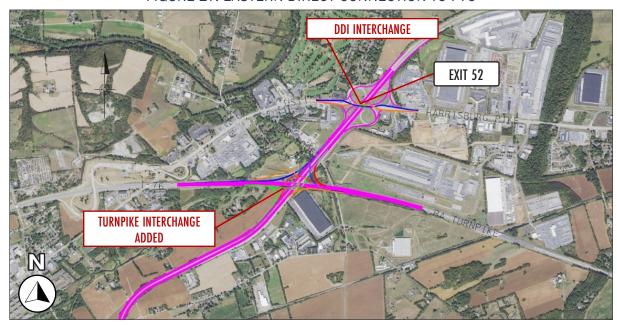


FIGURE 28: POTENTIAL WESTERN INTERCHANGE LOCATION



CONCEPT COST ESTIMATES

Based on public feedback, auxiliary lanes appeared to be the preferred concept and therefore used to develop candidate projects and programming level estimates. Approximate candidate project limits are depicted in Figure 29. Estimates for each candidate project are summarized in Table 6.

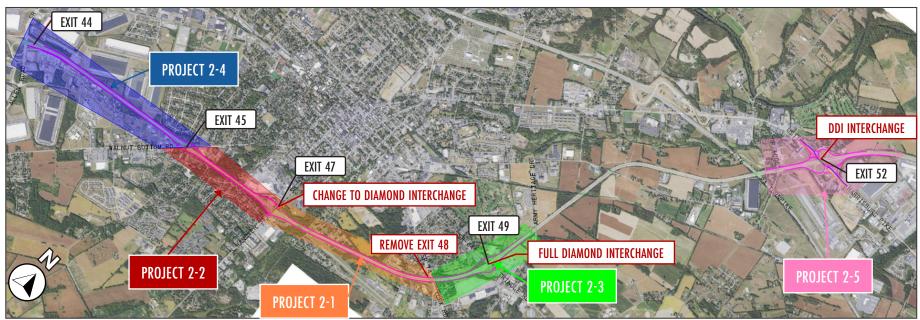


FIGURE 29: AUXILIARY LANES CANDIDATE PROJECT LIMITS

TABLE 6: GREATER CARLISLE FOCUS AREA PROGRAMMING LEVEL COST ESTIMATES

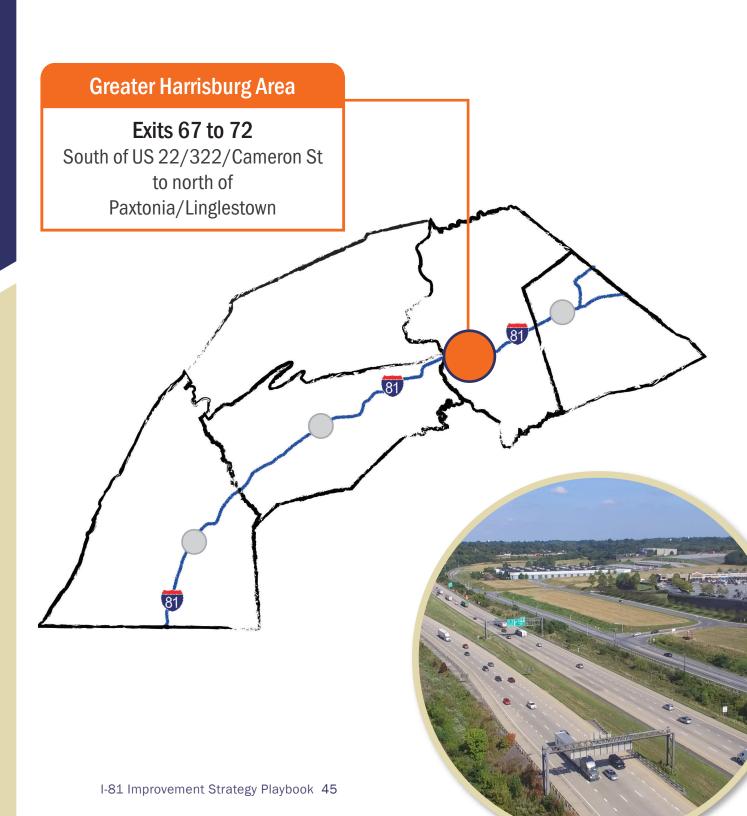
Project Ref	Project Title	Preliminary Engineering	Final Design	Right-Of-Way Acquisition	Utility Relocation	Construction	Pre-Construction Duration (years)
2-1	I-81 Auxiliary Lanes between Exit 47 and Exit 48	\$1,145,000	\$1,603,000	\$500,000	\$ 0	\$25,189,000	3-5
2-2	I-81 Auxiliary Lanes between Exit 45 and Exit 47	\$774,000	\$1,083,000	\$500,000	\$ 0	\$17,012,000	2-4
2-3	I-81 Exit 48 and Exit 49 Interchange Reconfigurations	\$463,000	\$648,000	\$700,000	\$ 0	\$10,168,000	3-5
2-4	I-81 Auxiliary Lanes between Exit 44 and Exit 45	\$517,000	\$724,000	\$200,000	\$ 0	\$11,370,000	2-4
2-5	I-81 Exit 52 Interchange Reconfiguration to Diverging Diamond Interchange	\$1,624,000	\$2,273,000	\$200,000	\$ 0	\$35,715,000**	3-5
2-6	Alternative analysis and Point of Access Study for a new interchange between I-81 and I-76.	\$500,000	\$ 0	\$ 0	\$ 0	\$ 0	1

^{**} Cost includes replacement of the mainline bridges over the PA Turnpike (near southern limit of work) to address asset management concerns.



Greater Harrisburg Area

The Greater Harrisburg Focus Area could be separated into three different locations for improvement projects; Exit 67 (US 22/322), Exit 70 (I-83), and Exit 72 (Linglestown/Paxtonia). The main concern at Exit 67 and Exit 72 is safety while both safety and mobility needs are present through the Exit 70 area.



NEEDS STATEMENT

Corridor needs were identified during Phase 1 (Needs Assessment and Focus Area Prioritization) of the I-81 Improvement Strategy and documented in the Needs Assessment Technical Memo. Table 7 describes the needs that were identified for the Greater Harrisburg Focus Area as shown on the project wesite.

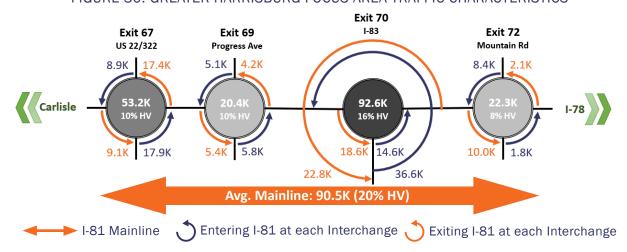
TRAFFIC CHARACTERISTICS

Figure 30 depicts traffic volumes as Annual Average Daily Traffic (vehicles per day (VPD)) from PennDOT's Roadway Management System, obtained December 9, 2021. Total ramp volumes are shown inside the circle along with the percentage of Heavy Vehicles (HV).

TABLE 7: GREATER HARRISBURG FOCUS AREA NEEDS

Greater Harrisburg Area (Exits 67, 69, 70 & 72)							
Highway Safety	Ramp curve issues, confusing lane assignments and ramp orientations / configurations, the inadequate bottleneck configuration at Exit 70 (I-83) with unsafe lane drops and merges, and high congestion along the freeway result in highway safety implications.						
Mobility	The existing mainline I-81 routinely experiences relatively high speeds in excess of the posted speed limit and substantial recurring congestion in both directions of I-81, particularly on weekdays from 3 to 6 PM, which contribute to operational and safety issues.						
Land Use and Access	Commercial development will continue to increase between and south of I-81 Exits 67 and 69, increasing traffic volumes at both interchanges. Both exits provide access into the City of Harrisburg and surrounding communities.						
Highway Infrastructure	The existing structures within the I-81 corridor were constructed in the 1960s and 1970s and are approaching the end of their serviceable life span. The existing pavement was reconstructed in the 1990s and 2000s and ride quality is beginning to degrade. Gaps in ITS devices (Closed Circuit TV) were identified in three locations (mile markers 69 SB, 69 and 71 SB).						

FIGURE 30: GREATER HARRISBURG FOCUS AREA TRAFFIC CHARACTERISTICS



CONCEPTUAL IMPROVEMENTS

The main concern at Exit 67 is safety along the ramp from Eastbound US 22/322 to Northbound I-81. The left turning curve starts on the bridge and existing chevrons and truck roll over warnings signs cannot be seen until drivers are already in the curve and almost off of the bridge. Additional signage is needed, and two options exist as shown in Figure 31.

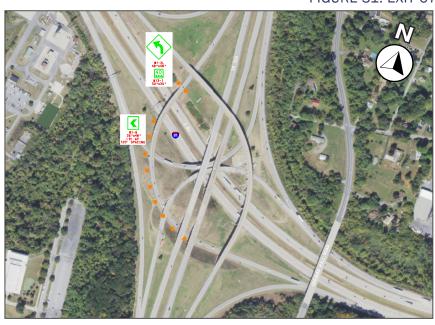
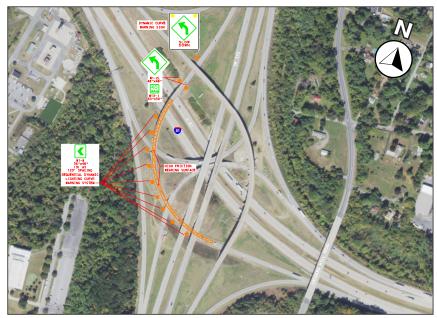


FIGURE 31: EXIT 67 SAFETY IMPROVEMENTS

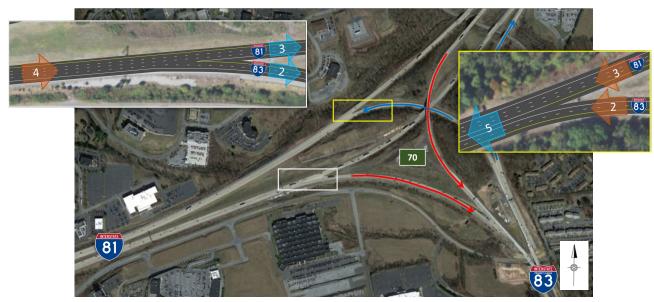




Concept 2: Dynamic Signs and High Friction Wearing Surface

To address both safety and mobility concerns throughout the Exit 70 (I-83) area, a reconfiguration is required to improve the existing weave conditions. Two options exist as shown in Figure 32, the top reconfigures the interchange area to provide three lanes between the off ramp and on ramp in both directions, while the bottom is more involved by relocating I-81 Southbound lanes to be adjacent to the Northbound lanes which transforms the existing left-hand I-83 off and on ramps into more traditional right-hand ramps.

FIGURE 32: EXIT 70 IMPROVEMENTS



Third Lane from Off Ramp to On Ramp



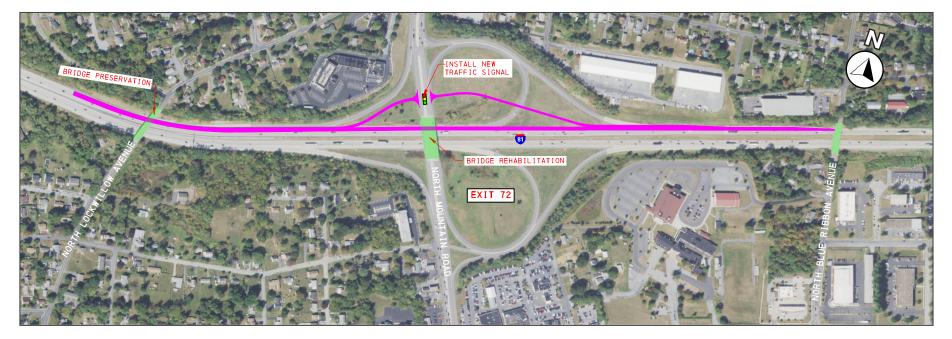


Relocation of Southbound Lanes to create right-hand off and on ramps

Safety is the immediate need to be addressed at Exit 72 (Linglestown/Paxtonia), specifically at the Southbound exit ramp terminal (unsignalized intersection with N. Mountain Road which has two lanes of travel in each direction). Often, traffic queues from the signalized intersection to the north extend along Northbound Mountain Road and through the I-81 Southbound exit ramp intersection. Figure 33 depicts a partial interchange reconfiguration to address this safety need.



FIGURE 33: EXIT 72 SAFETY IMPROVEMENTS



CONCEPT COST ESTIMATES

Programming level cost estimates were developed for the concepts noted above for the Greater Harrisburg Focus Area. Estimates for each candidate project are summarized in Table 8.

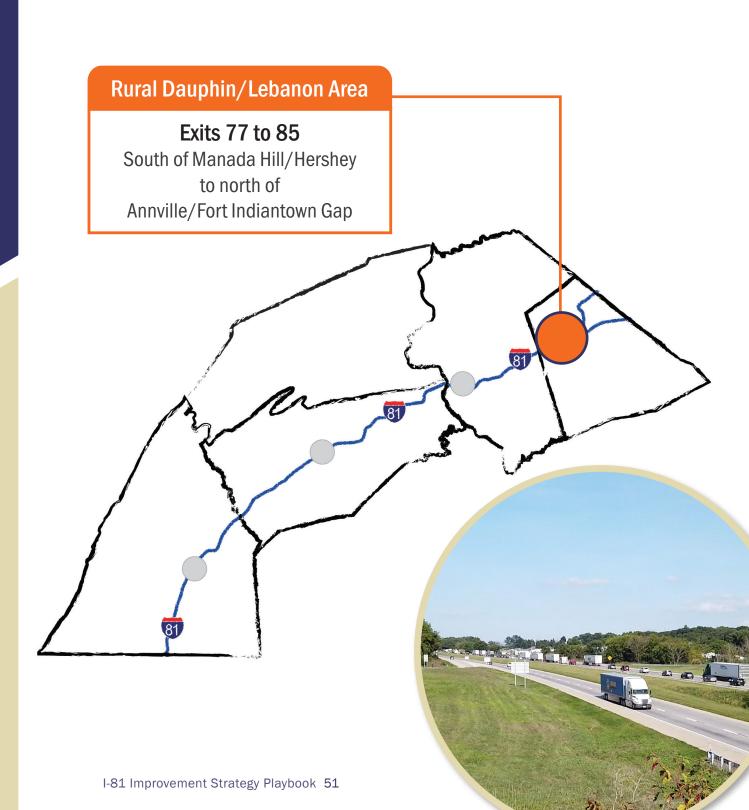
TABLE 8: GREATER HARRISBURG FOCUS AREA PROGRAMMING LEVEL COST ESTIMATES

Project Ref	Project Title	Preliminary Engineering	Final Design	Right-Of-Way Acquisition	Utility Relocation	Construction	Pre-Construction Duration (years)
67-1	I-81 Exit 67 US 22/322 EB to I-81 NB Entrance Ramp Safety Improvements	\$10,000	\$7,000	\$ 0	\$ 0	\$72,000	<1 yr - Maintenance Forces
67-2	I-81 Exit 67 US 22/322 EB to I-81 NB Entrance Ramp Safety Improvements	\$78,000	\$52,000	\$ 0	\$ 0	\$596,000	<1 yr - Maintenance Forces
70-1	I-81 Exit 70 Widening and Merge Mitigation	\$695,000	\$973,000	\$ 0	\$ 0	\$15,286,000	2-4
70-2	I-81 Exit 70 SB Realignment	\$3,269,000	\$4,576,000	\$ 0	\$ 0	\$70,601,000	3-5
72-1	I-81 Exit 72 Reconfiguration of SB Ramps	\$930,000	\$620,000	\$ 0	\$ 0	\$6,813,000	2-4



Rural Dauphin/Lebanon

The Rural Dauphin/Lebanon Focus Area includes approximately 10 miles in both Dauphin and Lebanon Counties between Exits 77 (PA 39) and Exits 85 (PA 934). It also includes Exit 80 (PA 743). Mobility needs along the mainline for this Focus Area are the largest concern and by addressing them will also help to address the other needs. Therefore, the main concepts for this Focus Area primarily address the mobility need.



NEEDS STATEMENT

Corridor needs were identified during Phase 1 (Needs Assessment and Focus Area Prioritization) of the I-81 Improvement Strategy, documented in the Needs Assessment Technical Memo and as shown on the project website. Table 9 describes the needs that were identified in Phase 1 for the Rural Dauphin/ Lebanon Focus Area and refined during Phase 2 to reflect deeper understanding obtained during the Focus Area specific data analyses.

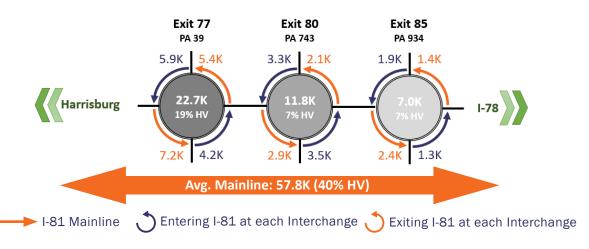
TRAFFIC CHARACTERISTICS

Figure 34 depicts traffic volumes as Annual Average Daily Traffic (vehicles per day (VPD)) from PennDOT's Roadway Management System, obtained December 9, 2021. Total ramp volumes are shown inside the circle along with the percentage of Heavy Vehicles (HV).

TABLE 9: RURAL DAUPHIN/LEBANON FOCUS AREA NEEDS

Rural Dauphin/Lebanon (Exits 77, 80, & 85)							
Highway Safety	High congestion, including high truck volumes, along I-81 particularly in the Southbound direction result in highway safety implications.						
Mobility	The existing mainline I-81 routinely experiences travel delay at several sections of roadway which contribute to operational and safety issues. Southbound delays occur during weekday PM peak periods, especially on Fridays. To a lesser extent, Northbound delays occur during the same peaks, and particularly on Fridays.						
Land Use and Access	Several parcels have been identified for potential development near Exit 85. While the type of development is not known at this time, it is anticipated that warehouse and industrial buildings will be constructed consistent with development patterns over the past 10 years. The increased development pressure will increase traffic volumes near Exits 80 and 85.						
Highway Infrastructure	The existing structures on the I-81 corridor were constructed in the 1960s and are approaching the end of their serviceable life span. The existing pavement was reconstructed in the 1990s and ride quality is beginning to degrade. Gaps in ITS devices (Closed Circuit TV and Dynamic Message Sign) were identified in two locations (mile marker 76 and 80 Southbound).						

FIGURE 34: RURAL DAUPHIN/LEBANON FOCUS AREA TRAFFIC CHARACTERISTICS



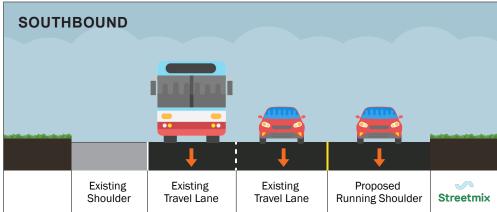
CONCEPTUAL IMPROVEMENTS

Evaluation of mobility data for this Focus Area showed recurring congestion during the PM peak period (3 PM - 6 PM) during weekdays. particularly on Friday, primarily in the Southbound direction throughout the entire focus area and beyond. Some recurring congestion is seen in the Northbound direction but not to the level seen in the Southbound direction. Northbound is generally limited to the PM peak period (3 PM - 6 PM) on Friday. As safety and mobility go hand in hand, plus with the high potential for additional development near two exits within the Focus Area, two concepts were identified to address the mobility needs: hard shoulder running and additional third southbound lane.

Hard Shoulder Running concept (Figure 35) proposes to address mobility and safety needs by widening the inside shoulder (median side) in both the Southbound and Northbound directions to provide an area that could be used as an additional lane during specific periods of the day when mobility is limited by the available capacity of the existing two-lane facility. Hard running shoulders for part-time use have been in use along many different interstates across the country and has been studied by the Federal Highway Administration (FHWA).

FIGURE 35: HARD SHOULDER RUNNING CONCEPT (PICTURE OF US 23 NEAR ANN ARBOR, MI)





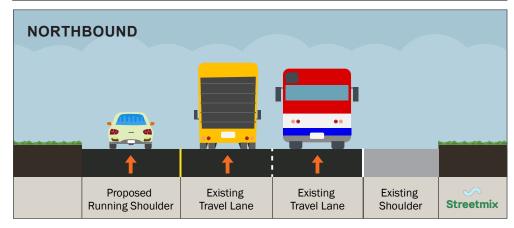


Figure 36 depicts the requirements for widening to provide a third Southbound lane that would be open for around the clock use. This work will require widening to the median to provide a new 12' wide third lane along with a new 12' wide inside shoulder. The outside shoulder should also be considered to be widened to 12'. All mainline bridges will be required to be widened to accept the new lane and widened shoulders.

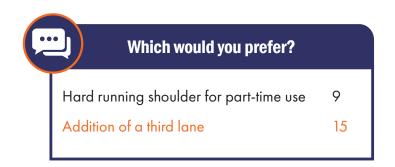
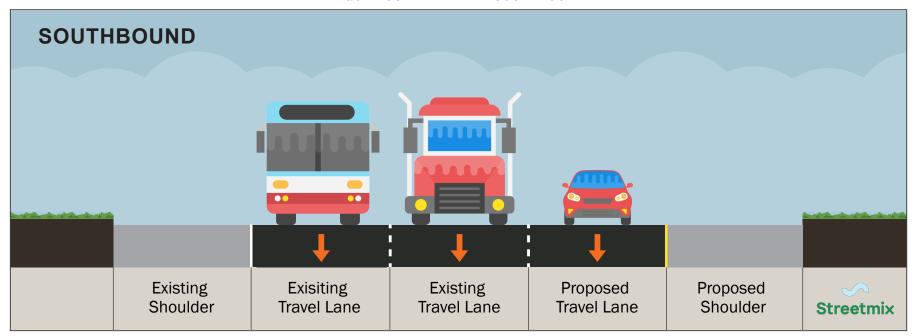


FIGURE 36: THIRD LANE SOUTHBOUND



CONCEPT COST ESTIMATES

Programming level cost estimates were developed for the concepts noted above for the Rural Dauphin/Lebanon Focus Area. Estimates for each candidate project are summarized in Table 10.

TABLE 10: RURAL DAUPHIN/LEBANON FOCUS AREA PROGRAMMING LEVEL COST ESTIMATES

Project Ref	Project Title	Preliminary Engineering	Final Design	Right-Of-Way Acquisition	Utility Relocation	Construction	Pre-Construction Duration (years)
1	I-81 Hard Running Shoulder between Exit 72 and Exit 89	\$3,872,000	\$5,421,000	\$ 0	\$ 0	\$83,633,000	2-4
1A	I-81 SB Hard Running Shoulder between Exit 72 and Exit 89	\$1,936,000	\$2,711,000	\$ 0	\$ 0	\$41,817,000	2-4
2	I-81 SB Lane Addition between Exit 72 and Exit 89	\$8,530,000	\$11,941,000	\$ 0	\$ 0	\$184,232,000	3-5

The Game Plan





Once all the concepts were developed and vetted by the PMC, programming level estimates were developed for all phases of the project (Preliminary Engineering, Final Design, Right-of-Way Acquisition, Utility Relocation, and Construction). The implementation plan (Table 11) was developed by assembling the conceptual improvements together in one list and identifying high, medium, and low priority projects by the PMC.

With the plan defined, as funding becomes available, projects can be programmed, and preliminary engineering and the environmental clearance process can begin. Once Environmental Clearance is issued then Final Design and Right of Way Acquisition can begin with construction following.

TABLE 11: STRATEGY IMPLEMENTATION PLAN

Focus Area	Concept Ref	Project Title	Total (Combined All Phases)	Priority	Design/ROW/UTL Clr Duration (yrs)
Greater Chambersburg	Exit 14 - 1	I-81 Exit 14 SB Exit Ramp Signage Improvements	\$18,000	High	<1 yr - Maintenance Forces
Greater Chambersburg	Exit 14 - 2	I-81 Exit 14 SB Exit Ramp High Friction Wearing Course	\$196,000	Medium	<1 yr - Maintenance Forces
Greater Chambersburg	Exit 14 - 3	I-81 Exit 14 SB Exit Ramp Realignment	\$754,000	Low	1-2
Greater Chambersburg	Exit 16 - 1	I-81 Exit 16 Exit Ramp Lane Addition for Left Turns	\$808,000	High	1-2
Greater Chambersburg	Exit 16 - 2	I-81 Exit 16 Dual Left Turns On US 30 to Entrance Ramps	\$19,187,000	Low	2-3
Greater Chambersburg	Exit 16 - 3	I-81 Exit 16 Interchange Reconfiguration to Diverging Diamond Interchange	\$5,968,000	Low	3-5
Greater Chambersburg	Exit 16 - 4	I-81 Exit 16 Interchange Reconfiguration to Single Point Urban Interchange	\$17,501,000	Low	3-5
Greater Carlisle	2-1	I-81 Auxiliary Lanes between Exit 47 and Exit 48	\$28,437,000	High	3-5
Greater Carlisle	2-2	I-81 Auxiliary Lanes between Exit 45 and Exit 47	\$19,369,000	Medium	2-4
Greater Carlisle	2-3	I-81 Exit 48 and Exit 49 Interchange Reconfigurations	\$11,979,000	Medium	3-5
Greater Carlisle	2-4	I-81 Auxiliary Lanes between Exit 44 and Exit 45	\$12,811,000	Medium	2-4
Greater Carlisle	2-5	I-81 Exit 52 Interchange Reconfiguration to Diverging Diamond Interchange	\$39,812,000	High	3-5
Greater Carlisle	2-6	Alternatives analysis and Point of Access Study for a new interchange between I-81 and I-76.	\$500,000	High	1
Greater Harrisburg	Exit 67 - 1	I-81 Exit 67 US 22/322 EB to I-81 NB Entrance Ramp Safety Improvements	\$89,000	High	<1 yr - Maintenance Forces
Greater Harrisburg	Exit 67 - 2	I-81 Exit 67 US 22/322 EB to I-81 NB Entrance Ramp Safety Improvements	\$726,000	Medium	<1 yr - Maintenance Forces
Greater Harrisburg	Exit 70 - 1	I-81 Exit 70 Widening and Merge Mitigation	\$16,954,000	High	2-4
Greater Harrisburg	Exit 70 - 2	I-81 Exit 70 SB Realignment	\$78,446,000	Medium	3-5
Greater Harrisburg	Exit 72 - 1	I-81 Exit 72 Reconfiguration of SB Ramps	\$8,363,000	Medium	2-4

Focus Area	Concept Ref	Project Title	Total (Combined All Phases)	Priority	Design/ROW/UTL Clr Duration (yrs)
Rural Dauphin/Lebanon	1	I-81 Hard Running Shoulder between Exit 72 and Exit 89	\$92,926,000	Low	2-4
Rural Dauphin/Lebanon	1A	I-81 SB Hard Running Shoulder between Exit 72 and Exit 89	\$46,464,000	Low	2-4
Rural Dauphin/Lebanon	2	I-81 SB Lane Addition between Exit 72 and Exit 89	\$204,703,000	Medium	3-5
Quick Strike	1a	I-81 Integrated Corridor Management	\$3,159,000	TBD	2
Quick Strike	1b	I-81 Freeway Service Patrol Expansion	\$825,000	N/A	2
Quick Strike	1c	Carlisle Area Traffic Signal Improvements	\$1,404,000	TBD	2
Quick Strike	2a	DMS on Approaches to I-81 Entrance Ramps	\$1,287,000	TBD	1
Quick Strike	2b	I-81 CCTV Gaps	\$1,287,000	TBD	1
Quick Strike	2c	I-81 DMS Gaps	\$943,000	N/A	1
Quick Strike	2d	I-81 CCTV Colocated with DMS Gaps	\$464,000	N/A	1
Quick Strike	2e	Systemic Advanced Warning	\$ 0	N/A	N/A
Quick Strike	3a	Curve Warning Signage Enhancements	\$560,000	N/A	1
Quick Strike	3b	I-81 George Wade Bridge Auxiliary Lanes	\$269,000	TBD	1
Quick Strike	3c	I-81 Northbound to North Front Street Southbound Merge at Exit 66	\$318,000	TBD	2
Quick Strike	3d	Recessed Wet Reflective Pavement Markings	\$ 0	N/A	N/A
Quick Strike	3e	Signing & Pavement Marking Assessments at Exit 89 (I-78 Split)	\$ 0	N/A	N/A
Quick Strike	3f	Ramp Curve Safety Assessment	\$250,000	N/A	1
Quick Strike	4	Accel and Decel Lane Lengthening	\$3,885,000	High	1-2

Moving Projects from Concept to Construction

The I-81 Improvement Strategy, designed as an addendum to the Long-Range Transportation Plans for the Harrisburg Area, Franklin County, and Lebanon County Metropolitan Planning Organizations (MPOs), provides a prioritized framework for addressing the safety, congestion, condition, and development needs along the entire length of the interstate in PennDOT's District 8-0.

The MPOs, PennDOT, and FHWA recognize that Pennsylvania's Interstates are critical components of the overall transportation system. Planning and programming functions for Pennsylvania's 1,870 linearmiles and over 2,200 bridges of the Interstate system are administered by PennDOT's Interstate Steering Committee (ISC) through a statewide Interstate TIP (Transportation Improvement Program). PennDOT currently spends approximately \$450 million annually on the Interstate system and will increase that annual investment to \$1 billion by 2028. The November 2021 passage of the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Bill (BIL), was a landmark surface transportation act that will inject \$16.3 billion annually in state formula funds into Pennsylvania's transportation program over the next five Construction years. The new law represents the biggest federal infrastructure funding package in generations, with funding levels not seen since the launch of the Interstate Highway System 65 years ago.

Despite the influx of new infrastructure funding, the ISC must use planning tools to prioritize and program projects, as the Improvement Strategy shows that the cost to address the needs along the corridor clearly exceed the available funds. Therefore, the I-81 Improvement Strategy will be instrumental in coordinating with partners and the ISC to prioritize and program improvement projects for the foreseeable future using the funds that are available. As the first such PennDOT District-wide interstate planning effort, it is hoped that this "playbook" provides a competitive edge for securing and applying infrastructure funds along I-81 in the Chambersburg-Harrisburg-Lebanon region.

Long Range Transportation Plan

Design

and

I-81 Improvement Strategy Priority projects & other MPO/Regional studies

Prepared by



In Association with















