

Camp Hill to Capital Corridor Safety Study

Harrisburg Area Transportation Study
Tri-County Planning Commission



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Background and Study Area

The Camp Hill to Capital Corridor is an approximately 5.4-mile corridor that consists of US 11 & 15 in Camp Hill Borough, East Pennsboro Township and Wormleysburg Borough, crosses the Susquehanna River via the Harvey Taylor Bridge and connects to Forster, N. 7th (SR 3016) and State Streets (SR 3014) in the City of Harrisburg. The corridor exhibits many distinct cross-sections and contexts that change frequently, including residential and commercial uses, the Pennsylvania State Capitol Complex, as well as two major structures (State Street Bridge and Harvey Taylor Bridge). This Project's intention is to evaluate the safety of the corridor and recommend immediate, short, mid, and long term solutions for resolving previously known and identified safety concerns. The area has presented high vehicular travel speeds, pedestrian safety concerns, and a lack of bicycle infrastructure. This corridor is a major route to and from the Pennsylvania State Capitol Complex from points north and south, and in certain segments accommodates over 30,000 vehicles daily. These commuting practices have led to challenging conditions along the corridor for pedestrians and bicyclists crossing it as well as commuters using these modes to commute to and from the complex. The need for this study was exacerbated by several pedestrian and bicyclist fatalities within the Camp Hill and Harrisburg sections of the corridor, including one in Camp Hill in 2016 and five within an 18-month period in 2017/2018 along State Street in Harrisburg.

The corridor is exhibited by many different roadway contexts, including boulevards, urban streets, bridges, and limited-access highways. However, the corridor is identified by the functional classification system by only two roadway classes: Principal Arterial or Freeway & Expressway. This means that this corridor is intended to serve a major population or commercial center with a high degree of mobility by vehicle. Abutting land uses are served directly by arterials but still contain large volumes of through traffic exhibited by vehicle commuter patterns with demand for travel between the central business district and outlying residential areas. The freeways & expressways section (Between US 11 & 15 and the foot of the Harvey Taylor Bridge at Front Street) is short (approximately two miles) but exhibits many characteristics found on an interstate highway. The directional lanes are separated by a physical barrier, and their access and egress points are limited to on- and off-ramp locations. Like interstate highways, these roadways are designed and constructed to maximize motor vehicle mobility, and abutting land uses are not directly served by the highway.

For the purposes of this analysis, the corridor has been divided into 11 different segments, based on the cross-section and/or context of the corridor or surrounding area. They have all been mapped to the same scale and therefore several segments have been placed together based on similarities of context/cross-section.

Ultimately, the purpose of this study is to investigate corridor safety for all modes of travel. The multi-modal approach posed many challenges due to the varying characteristics of the corridor. The study focused on immediate, short, medium and long-term type improvements with the following implementation time-frames, as outlined within the study's implementation matrix, included at the end of this document:

- Immediate – less than 6 months
- Short – 6 months to 2 years
- Medium – 2 to 4 years
- Long – More than 4 years

Additionally, a series of concepts have been identified for consideration for project implementation using current Tri-County Regional Transportation Commission Transportation Improvement Program (TIP) funding (Project 111000). These projects are highlighted within the document and implementation matrix in red text.

It is important to note that many improvements that have been proposed may require a local maintenance agreement, as codified by PennDOT DM-2, Chapter 6, Appendix C.

While performing this study, the team focused on the following questions in formulating alternative improvements for implementation consideration:

- What elements of the road may present a safety concern?
- What opportunities exist to eliminate or mitigate the identified safety concerns?

General Corridor Characteristics

The study corridor, illustrated in Figure 1, exhibits numerous typical roadway characteristics that vary and change, in some cases dramatically, as one travels the corridor in either direction. A summary of these roadway characteristics and general land use contexts is provided below.

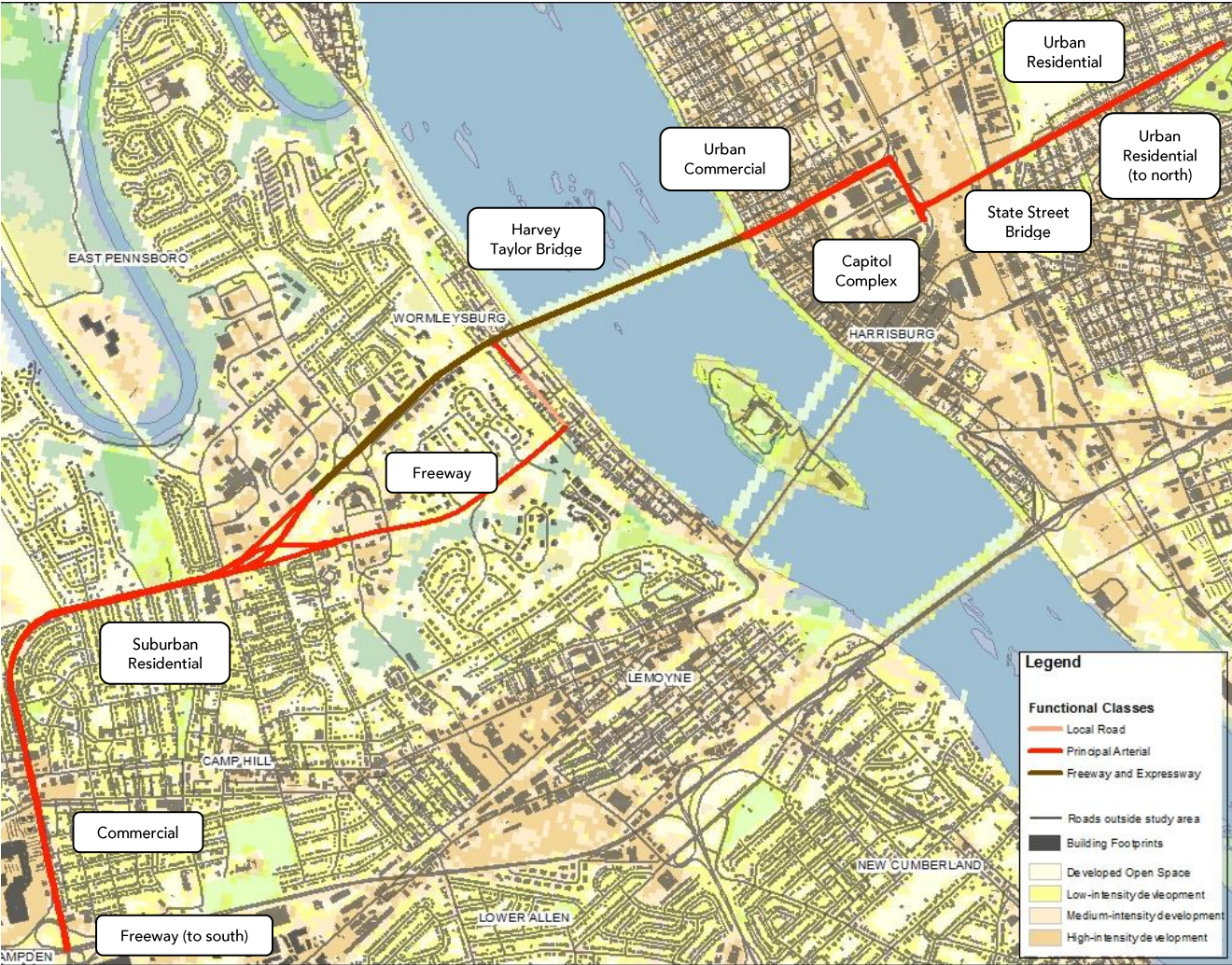


Figure 1 – Camp Hill to Capital Corridor Study Area

Roadway Classification

The study corridor is generally classified as a Principal Arterial Highway, with the exception of the limited access portion (Harvey Taylor Bridge Bypass and Harvey Taylor Bridge).

Roadway Configuration

Traveling south to north, the roadway exhibits several different configurations:

32nd Street (US 11/15), Capital Beltway to 32nd Street (Segments 1 and 2) – 4-6 lane cross-section with no shoulders and raised curb median.

Cumberland Boulevard (US 11/15), 32nd Street to 21st Street (Segment 3) – 4 lane cross section with shoulders and raised curb median. Limited center turn lane.

Harvey Taylor Bridge Bypass (SR 1014), 21st Street to Harvey Taylor Bridge (Segments 4, 5, and 6) – 4-lane cross section with shoulders and jersey barrier median.

Harvey Taylor Bridge (SR 3016), 2nd Street (Wormleysburg) to Front Street (Segments 7 and 8) – 4-lane cross section with no shoulders and jersey barrier median.

Forster Street (SR 3016), Front Street to 7th Street (Segment 9) – 6-lane cross section with no shoulders and curb median. Additional turn lanes are provided at signalized intersections. On-street parking is present.

7th Street (SR 3016), Forster Street to State Street (Segment 10) – 5-lane cross section with no shoulders and curb median. On-street parking is present.

State Street Bridge (SR 3014), 7th Street to 13th Street (Segment 10) – 4-lane cross section with no shoulders and raised curb median.

State Street (SR 3014), 13th Street to 17th Street (Segment 11) – 5-lane cross section with no shoulders and no median. Two-way left-turn lane is provided, and on-street parking is present.

Annual Average Daily Traffic (AADT)

The AADT varies within the corridor from a high of approximately 34,500 vehicles at the southern portion of the study corridor to 15,000 vehicles at the northern portion of the study corridor. The southern portion of the corridor exhibited congested conditions in both directions during peak periods, while the Harvey Taylor Bridge, Forster Street, 7th Street, and State Street are predominantly commuter corridors, with the heaviest morning traffic flows entering Harrisburg, and the heaviest evening traffic flows leaving Harrisburg.

Posted Speed Limit

The posted speed limit within the study corridor is 35 miles per hour (mph) throughout the corridor, with the exception of the limited access portion (Harvey Taylor Bridge Bypass and Harvey Taylor Bridge), where the posted speed limit is 50 mph.

Data Collection Program

An extensive data collection program was conducted as part of the study. Data included in this study was compiled from many sources, including HATS, PennDOT, municipalities, previous and ongoing planning studies (Walk & Bike Camp Hill Study, Harrisburg Vision Zero, etc.), and field reconnaissance data obtained by the study team.

The following data was collected/summarized in preparation of this study:

- Field information/photo log inventory
- Walking field view of the entire corridor
- Crash data
- Targeted pedestrian counts
- Study corridor travel speeds
- Sign inventory
- Existing deficiencies
- Cartway/sidewalk widths
- Pavement condition
- Cross-street and driveway access points
- Presence of ADA-compliant features
- Posted speed limits
- Existing on-street parking

Crash Summary

Crash data was reviewed for the most recent period available: 2007 – 2017, inclusive. This dataset was provided by the PennDOT CDART System and a summary of key elements of this analysis are included within each segment summary. A detailed review of individual crash incidents was not completed but general inferences about the most predominant crash types within each segment have been provided. Crash data provided by PennDOT is included in a supplemental document, per confidentiality guidelines identified in *75 Pa. C.S. 3754* and *23 U.S.C. 40*.

Public Involvement/Stakeholder Outreach

The study team led an in-depth public involvement/stakeholder outreach process. Direct involvement with Borough and City officials, public stakeholders, law enforcement, and state and local transportation officials provided valuable insight and direction for the study and allowed the study team to gather firsthand information on existing conditions and issues. Individual and group interests and desired results were taken into consideration throughout the study. These meetings also served to provide our team with feedback on proposed recommendations and functioned as a means of keeping stakeholders and community members aware of the study and its progress.

The following is a list of the key stakeholders from which input was requested:

- PennDOT officials
- Camp Hill Borough
- City of Harrisburg
- Borough of Wormleysburg
- East Pennsboro Township
- Cumberland Boulevard Improvement Task Force
- Law enforcement agencies
- Large employers within the corridor vicinity
 - Holy Spirit/Geisinger
 - Blue Shield
 - Camp Hill Shopping Center

- Capital Area Transit
- PennDOT Statewide Bicycle/Pedestrian Coordinator
- Camp Hill School District

Two repeated themes were evident within the feedback provided by these groups:

- Speed reduction measures should be implemented along the study corridor
- Additional crosswalks, pedestrian infrastructure improvements, bike lanes, signs, and trails are needed within the corridor based on current pedestrian and bicycle travel patterns.

The full summaries of these meetings/interviews are included in Appendix B.

Segment 1 – 32nd Street, US 11/SR 581 Interchange to Market Street (Camp Hill Borough)



Description

Segment 1 is the southern terminus of the project corridor. It is a 0.5 mile segment of 32nd Street (US 11 & 15) located within Camp Hill Borough between the US 11/PA 581 interchange and Market Street. South of the study corridor, US 15 is a limited-access highway, which, following the interchange with US 11/SR 581, transitions to a lower speed arterial. Within this segment, the context of the roadway transitions to a predominantly commercial corridor with several shopping plazas and low density commercial uses, many of which include varying levels of driveway access. This segment includes three closely spaced (within an approximately 1/3-mile section) signalized intersections with crosswalks across the corridor, at Harvard Avenue/Camp Hill Shopping Center, Chestnut Street/Trindle Road, and Market Street. Each of the three signalized intersections experiences substantial pedestrian traffic, particularly from Camp Hill High School, located on Chestnut Street, approximately 1/4 -mile east of the study corridor. These three intersections were recently upgraded to an adaptive signal system, and each provides countdown pedestrian signal heads and an all-red pedestrian phase. CAT bus service is provided along this corridor via numerous bus routes.

Existing Concerns

There are several challenges within this segment, including access for Camp Hill High School students, as well as connections to the Camp Hill Shopping Center and other commercial properties located west of the study corridor. While pedestrians are provided an all-red phase to cross at each of the three signalized intersections, field observations confirmed that in many cases pedestrians do not wait for this phase. Further, the all-red phase causes substantial queuing, particularly during the PM peak. Finally, worn pavement markings obscure the existing crosswalks, as illustrated in Figure 2.



Figure 2 – 32nd Street at Chestnut Street/Trindle Road, looking south



Figure 3 – Damaged sidewalk at culvert, 32nd Street northbound, south of Chestnut Street, looking north

The sidewalk network within this segment is generally complete, however several areas exhibit poor conditions, particularly in the vicinity of the state-owned culvert located between Chestnut Street and Bramar Road, as shown in Figure 3. While a detailed structural analysis of the culvert was not performed, sidewalk adjacent to the culvert has collapsed due to what appears to be erosion surrounding the culvert.

Additionally, the transition between the higher speed, limited access portion of US 15 into the lower speed, signal-controlled commercial corridor in Camp Hill is abrupt, particularly for drivers that may not be familiar with the corridor. This is magnified by the addition of traffic from SR 581 via a substandard merge point, as this transition area ends, as shown in Figure 4.



Figure 4 – Southern terminus of the study area (US 11/15 at PA 581, looking north)

Crash Data

Between 2007 and 2017 there were 149 reported crashes within this segment, with the most common reported crash type being same-direction rear end and angle crashes. Same-direction rear crashes are indicative of driver inattention within congested conditions, while angle crashes

indicate existing concerns at signalized or unsignalized intersections. This segment exhibited the third most total crashes within the study corridor and was one of only four segments that experienced a fatal crash.

Crash Types from 2007 to 2017								
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Total	Pedestrian Fatal	Fatal Injury
64	2	53	22	7	0	149	0	2

Proposed Alternatives

Optical Speed Bars: Install optical speed bars on US 15 northbound, approaching PA 581 and the Camp Hill commercial corridor. Optical Speed Bars (illustrated in Figure 21) are transverse stripes spaced at gradually decreasing distances. The rationale for using them is to increase a driver’s perception of speed and cause them to reduce speed. The preferred material is thermoplastic because of the exposure to high traffic volumes

Speed transition/reduction on Route 15 NB: Due to the changes in roadway characteristics upon entering Camp Hill Borough in Segment 1 on NB Route 15, it is recommended that additional advance signing/technology measures be installed to warn motorists of the oncoming speed reduction and context change associated with entering the Camp Hill commercial corridor. Additionally, consider increasing size of speed limit signage within this section from conventional size (24” x 30”) to larger size (36” x 48”) detailed in the MUTCD for expressways or “special applications that require increased emphasis, improved recognition, or increased legibility.”



Figure 5 – Example of roadway context transition treatment, US 15 SB, approaching Frederick, Maryland

Lighting: The segment area is poorly lit, including the roadway as well as the access driveways. With the volume of cross traffic and amount of pedestrians utilizing the nearby facilities, the corridor would greatly benefit from increased lighting.

Signal Modifications: Reconfigure existing signal at US 15 and PA 581 (shown in Figure 4) to include PA 581 WB off-ramp movement. Modifying this signal will reduce conflicts between mainline and merging traffic within the current substandard merge area while also metering traffic entering Camp Hill.

Pavement Markings: Re-stripe all crosswalks as continental style with high visibility material, in a similar fashion to those installed within the Harrisburg section of the study area (Figure 6).



Figure 6 – Continental-style crosswalks, State Street at 13th Street, Harrisburg



Figure 7 – Proposed sidewalk repairs at 32nd Street culvert

Sidewalk Repair/Maintenance: Replace damaged sidewalk over culvert along 32nd Street (Figure 7) and perform maintenance on existing sidewalk surfaces (Figure 8). While sidewalk repairs are normally the responsibility of the adjacent property owner, the damaged area appears to be caused by erosion at the state-owned culvert. Therefore this repair should be under the jurisdiction of PennDOT.

Advance Pedestrian Phase versus All-Red Phase: Consider eliminating the All-Red Phase pedestrian phase at the signalized intersections with Trindle Road/Chestnut Street and Market Street. Further, consider implementation of a Leading Pedestrian Interval (LPI) at each of the three signalized intersections within this segment. An LPI provides pedestrians with a “head start” to enter an intersection via a crosswalk. An LPI is particularly effective to increase visibility of pedestrians in crosswalks where conflicts with permissive left or right turns exist.



Figure 8 – Overgrown sidewalk along 32nd Street northbound north of Market Street, looking south

This modification should aid traffic flow and enhance the capabilities of the newly installed traffic adaptive signal system while providing pedestrians with improved crossing opportunities.

School Zones: School zones are designated areas adjacent to schools where speed limits are reduced during morning and afternoon school hours. Special crossing signs (Figure 9), speed signs, and pavement markings can be used to demarcate these zones and give motorists physical cues to treat such areas with special care and attention. Given that bussing is not provided for schoolchildren within Camp Hill, the borough should investigate the implementation of school zones in appropriate locations in the vicinity of schools or locations where school-related pedestrian traffic is highest.



Figure 9 – Proposed school zone signage, Philadelphia, PA

Gateway Treatment: Investigate the feasibility of a gateway treatment for vehicles entering Camp Hill Borough in the vicinity of the PA 581 interchange. This would reinforce the abrupt change in the roadway and surrounding context as drivers enter the Camp Hill Commercial Corridor.

Relocate Camp Hill Mall Access: Perform traffic study to investigate relocating main signalized entrance for Camp Hill Mall from Harvard Avenue intersection to northern driveway to improve pedestrian connections to the east, as well as provide additional separation from higher speed freeway section to the south. This would not result in providing an additional access point to the mall; it would shift the signal to a location where pedestrians were observed to be crossing most frequently.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above. The cost estimates provided within each segment are based on PennDOT ECMS Price History, RS Means, and engineering judgment.

Concept	Description	Design Cost	Construction Cost	Total Cost
1-A	Speed transition/reduction on Route 15 NB	\$5,000	\$15,000	\$20,000
1-B	Optical Speed Bars	\$2,000	\$6,000	\$8,000
1-C	Lighting	\$10,000	\$100,000	\$110,000
1-D	Signal Modifications	\$20,000	\$170,000	\$190,000
1-E	Pavement Markings	\$2,000	\$12,000	\$14,000
1-F	Sidewalk Repair/Maintenance	\$4,000	\$25,000	\$29,000
1-G	Advance Pedestrian Phase versus All-Red Phase	\$5,000	\$10,000	\$15,000
1-H	School Zones	\$10,000	\$25,000	\$35,000
1-I	Gateway Concept Study			\$30,000 (study only)
1-J	Relocate Camp Hill Mall Driveway			\$30,000 (study only)

Segment 2 – 32nd Street, Market Street to Country Club Road (Camp Hill Borough)



Description

Segment 2 is a 0.5 mile section of 32nd Street as it transitions into Cumberland Boulevard within Camp Hill Borough, between Market Street and County Club Road. Portions of this segment are adjacent to East Pennsboro Township as well. This segment transitions out of the commercial corridor (Segment 1) into a predominantly residential corridor comprised primarily of single-family detached homes. Unlike the bulk of the corridor within Camp Hill, this segment includes numerous homes (particularly along 32nd Street/Cumberland Boulevard southbound) that front the study corridor. This segment is bounded by signalized intersections (at Market Street and Country Club Road) and includes a third signalized intersection at Brentwater Road. Unsignalized access is provided at three locations southbound, each of which provides right-in/right-out access only (32nd Street, Logan Street, Walnut Street), and one right-in/right-out location northbound (Lincoln Street). A crosswalk and traditional three-ball signals are provided at the signalized intersection with Brentwater Road, however no sidewalk connections are present to access this intersection. CAT bus service is provided along this corridor via the AB and D routes.

Existing Concerns

Two primary challenges for pedestrians exist within this segment. First, there is a lack of crossing opportunities across 32nd Street/Cumberland Boulevard. The lone crossing of the study corridor within this segment (at the signalized intersection with Brentwater Road) does not provide any circulation opportunities for pedestrians traveling along Cumberland Boulevard northbound, where the existing crosswalk ends in a small concrete pad (Figure 10), and southbound, where the existing crosswalk ends in what currently appears to be a live traffic lane. Second, sidewalks are not consistently provided within this segment. This is particularly evident between 32nd Street and Country Club Road, where sidewalks are not provided northbound and southbound. Further, existing sidewalks along 32nd Street in the vicinity of Lincoln Road are in poor condition or overgrown. Sidewalks which currently exist along 32nd Street southbound south of Cumberland Boulevard are in fair condition, however no buffer is provided to the adjacent travel lanes, making pedestrian circulation particularly uncomfortable, most notably as 32nd Street approaches Walnut Street and Market Street where a de facto right-turn lane is present.



Figure 10 – Existing sidewalk connectivity, 32nd Street northbound at Brentwater Road

Crash Data

Between 2007 and 2017 there were 68 reported crashes within this segment, with the most common type of reported crash same-direction rear end, which is indicative of driver inattention combined with congested conditions.

Crash Types from 2007 to 2017								
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Total	Pedestrian Fatal	Fatal Injury
35	2	10	17	5	0	68	0	0

Proposed Alternatives

32nd Street Closure: Evaluate the closure of North 32nd Street at Cumberland Boulevard to reduce the number of vehicular access points and potential pedestrian conflict areas. As detailed in Figure 11, add curb to create a dead-end street, construct branch type cul-de-sac for vehicle turnaround and remove paved area. This concept would also require appropriate wayfinding signage at the intersections of 32nd Street with Brentwater Road and Country Club Place. Additionally, extend sidewalk connections north to Brentwater Road.



Figure 11 – Proposed reconfiguration of North 32nd Street at Cumberland Boulevard

Lighting: The segment area is poorly lit, including the roadway as well as the access driveways/sidewalk facilities. With the volume of cross traffic and the amount of pedestrians utilizing the nearby facilities, the corridor would greatly benefit from increased lighting.

Pavement Markings: Re-stripe all crosswalks within this segment as continental style layout with high visibility materials.



Figure 12 – Existing poor crosswalk conditions, Brentwater Road at Cumberland Boulevard

Sidewalk Connectivity: As detailed in Figure 13, install sidewalk connection along Cumberland Boulevard between Brentwater Road and Country Club Road.

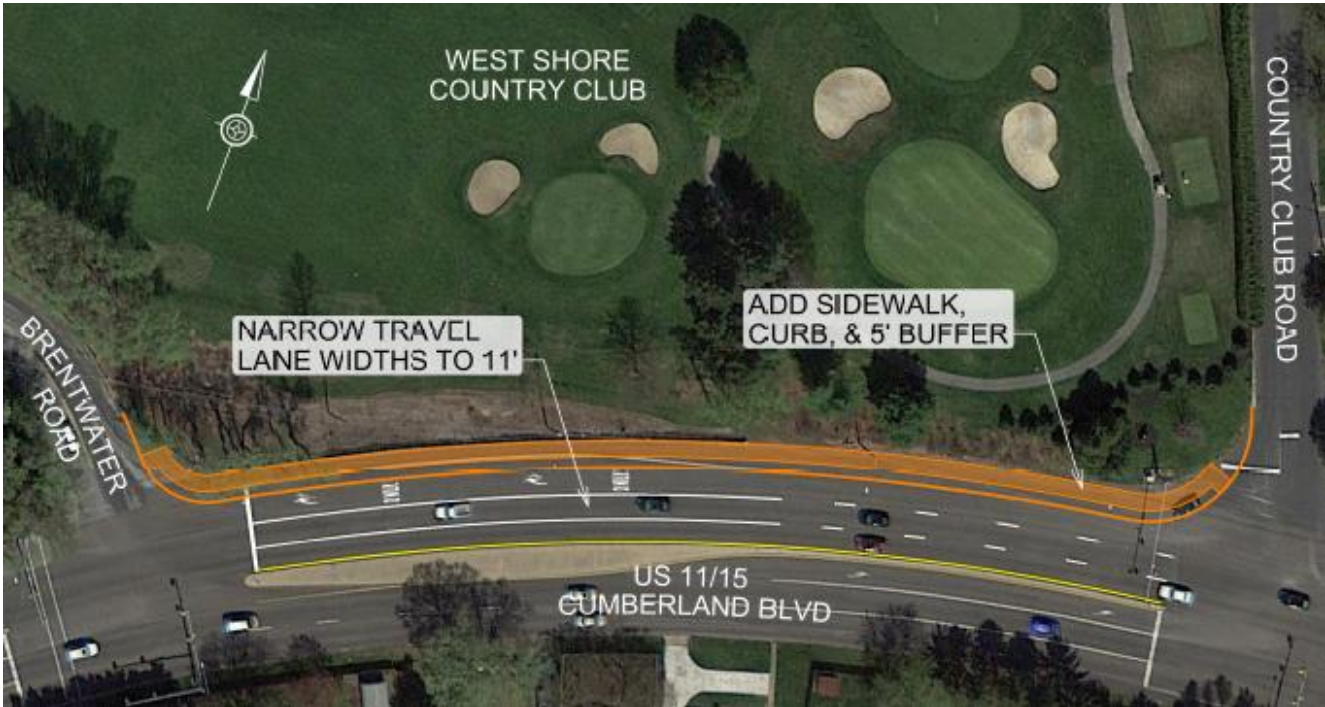


Figure 13 – Proposed sidewalk installation, Cumberland Boulevard southbound between Country Club Road and Brentwater Road

Lane Width Reduction: As detailed in Figure 13, reduce width of existing right turn lane from Cumberland Boulevard to Brentwater Road. This concept would support the sidewalk connection noted above.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
2-A	32nd Street Closure	\$18,000	\$167,000	\$185,000
2-B	Lighting	\$15,000	\$120,000	\$135,000
2-C	Pavement Markings	\$1,000	\$7,000	\$8,000
2-D	Sidewalk Connectivity	\$10,000	\$100,000	\$110,000
2-E	Lane Width Reduction	\$5,000	\$15,000	\$20,000

Segment 3 – Cumberland Boulevard, Country Club Road to 21st Street (Camp Hill Borough)



Description

Segment 3 is a 0.5 mile section of Cumberland Boulevard within Camp Hill Borough, between Country Club Road and 21st Street. This segment is similar in context to Segment 2, as it is surrounded primarily by single-family residential homes. However, within this segment, few homes front the study corridor (seven homes front Cumberland Boulevard southbound between Creston Road and Siebert Park). Two significant bicycle or pedestrian traffic generators are located within this segment: Siebert Park, Camp Hill Borough's largest park that includes a football stadium and borough pool, amongst other activities, as well as Eisenhower Elementary School, a use that is magnified given that bussing is not provided for borough students. This segment is bounded by signalized intersections at Country Club Road and at 21st Street, but within the segment no other signalized intersections are present. Numerous unsignalized intersections are present within this segment including several that have full access (Creston Road, 27th Street, 25th Street), right-in/right-out access (29th Street, 28th Street, 26th Street, Willow Avenue, 24th Street), as well as right and left-in/right-out access at Siebert Park. Pedestrian crossings are provided via two ADA-compliant tunnels, located in the vicinity of 27th Street and Willow Avenue. Sidewalks are provided sporadically within this segment, predominantly as connections to each of the pedestrian tunnels, however they are generally only linked to the most adjacent cross-street.

Existing Concerns

While some pedestrian accommodations are present within this segment, there are concerns associated with access to the pedestrian tunnels as well as circulation and security within each tunnel. While each tunnel is accessible via the most adjacent cross street/streets, connections from other cross streets via Cumberland Boulevard are challenging, as shown in Figure 14. Within the tunnels, while mirrors are provided to reduce blind spots, lighting is generally dim. Overall, the tunnels appear to be experiencing limited use, aside from anecdotal information provided by local stakeholders that indicated substantial use during high school football games. There is also a lack of wayfinding to the tunnels, particularly within Siebert Park, where the tunnel entrance is somewhat obscured due to the main driveway into the park.



Figure 14 – Cumberland Boulevard pedestrian tunnel, looking north, approaching 27th Street

Crash Data

Between 2007 and 2017 there were 167 reported crashes within this segment, with the most common type of reported crashes being angle and same-direction rear end crashes. Angle crashes indicate existing concerns at signalized or unsignalized intersections, while same-direction rear crashes are indicative of driver inattention within congested conditions. This segment exhibited the second most total crashes within the corridor and was one of only four segments that experienced a fatal crash, including the only fatal pedestrian crash within the Camp Hill section of the study corridor.

Crash Types from 2007 to 2017									
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Other	Total	Pedestrian Fatal	Fatal Injury
60	4	66	30	3	1	2	167	1	2

Proposed Alternatives

Sidewalk Connectivity #1: As shown in Figure 15, to provide circulation opportunities for pedestrians that currently must walk within the shoulder of Cumberland Boulevard, install sidewalk connection along Cumberland Boulevard northbound between North 29th Street and Willow Avenue.



Figure 15 – Proposed sidewalk improvements, Cumberland Boulevard northbound

Sidewalk Connectivity #2: As shown in Figure 16, in addition to the sidewalk connections detailed above, install sidewalk connection along Cumberland Boulevard southbound between 27th Street and Willow Avenue.



Figure 16 – Proposed sidewalk improvements, Cumberland Boulevard southbound

This section of sidewalk will provide additional circulation opportunities for pedestrians currently using the shoulder of Cumberland Boulevard.

Cumberland Boulevard Side Street Closures between Country Club Road and 21st Street: Produce a traffic study to investigate reducing side-street access, including the potential for limiting access to right-in/right-out only or full closures. This improvement, when implemented with the sidewalk improvements noted above will reduce the number of vehicular/pedestrian conflicts while reducing the potential for crashes where the likelihood for severe injuries is greatest (left-turn or angle).

Sidewalk Repairs (Tunnel to Elementary School along Cumberland Boulevard): Replace existing broken fence with concrete barrier and repair sidewalk in the same area, as shown in Figure 17. This improvement should be coordinated with the upcoming borough project related to this sidewalk.



Figure 17 – Deficient sidewalk and fencing, Cumberland Boulevard northbound looking south towards 24th Street

Pedestrian Tunnel Upgrades: Several improvements are recommended for each of the pedestrian tunnels. Lighting within the tunnels should be upgraded, while security cameras should be installed within each tunnel and at access points to the current ramps. Snow fencing should be installed along Cumberland Boulevard to reduce winter maintenance at tunnel entrances. Wayfinding signage should be improved to direct pedestrians to each tunnel.

Lighting: The segment area is poorly lit, including the roadway as well as the access driveways. With the volume of cross traffic and number of pedestrians utilizing the nearby facilities, the corridor would greatly benefit from increased lighting.

Pavement Markings: Re-stripe all crosswalks as continental style layout with high visibility materials.

School Zones: School zones are designated areas approaching or adjacent to schools where speed limits are reduced during morning and afternoon school hours. Special crossing signs, speed signs, and pavement markings can be used to demarcate these zones and give motorists physical cues to treat such areas with special care and attention. Given that bussing is not provided for schoolchildren within Camp Hill, the borough should investigate the implementation of school zones on 21st Street and Cumberland Boulevard in the vicinity of the Eisenhower Elementary School, where school-related pedestrian traffic is highest.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
3-A	Sidewalk Connectivity #1	\$35,000	\$255,000	\$290,000
3-B	Sidewalk Connectivity #2	\$28,000	\$202,000	\$230,000
3-C	Side Street Closures (Study Only)			\$30,000
3-D	Sidewalk Repairs	\$6,000	\$50,000	\$56,000
3-E	Pedestrian Tunnel Upgrades	\$11,000	\$95,000	\$106,000
3-F	Lighting	\$20,000	\$125,000	\$145,000
3-G	Pavement Markings	\$5,000	\$10,000	\$15,000
3-H	School Zones	\$10,000	\$75,000	\$30,000

Segment 4, 5, 6 – Harvey Taylor Bridge Bypass, 21st Street to Harvey Taylor Bridge (Camp Hill Borough, Wormleysburg Borough, East Pennsboro Township)





SEGMENT 5 – HARVEY TAYLOR BRIDGE BYPASS
EAST PENNSBORO TOWNSHIP



SEGMENT 6 -- HARVEY TAYLOR BRIDGE BYPASS
EAST PENNSBORO TOWNSHIP/WORMLEYSBURG BOROUGH



Description

Segments 4, 5, and 6 cover an approximately 1.25-mile section of the Harvey Taylor Bridge Bypass (SR 1014) that is effectively the eastern/northernmost portion of the study area within Camp Hill Borough and the only segment of the study corridor within Wormleysburg and East Pennsboro Township. This segment is the only freeway segment within the study area, linking Camp Hill/Wormleysburg with Harrisburg via the Harvey Taylor Bridge. This segment was generally not reviewed for pedestrian and bicycle connectivity, as it is not currently conducive to non-motorized traffic. However, at the intersection at 21st Street, where Cumberland Boulevard transitions into the freeway segment, pedestrian activity was present, despite a lack of crosswalks or sidewalks. This segment is flanked primarily by commercial office complexes as well as the Geisinger Holy Spirit hospital.

Existing Concerns

The primary concern with pedestrian and bicycle circulation within this segment is at the intersection of Cumberland Boulevard and 21st Street. Given the lack of connections to the existing pedestrian tunnel at Willow Avenue, pedestrians or cyclists at this intersection have few circulation opportunities within this area. Various stakeholders expressed concerns about congestion on 21st Street between Cumberland Boulevard and Center Street and they were also concerned about traffic speeds on the freeway travelling to the Harvey Taylor Bridge.

Crash Data

Between 2007 and 2017 there were 131 reported crashes within these segments of the bypass, with the most common type of reported crash same-direction rear end, which is indicative of driver inattention combined with congested conditions.

Crash Types from 2007 to 2017									
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Other	Total	Pedestrian Fatal	Fatal Injury
63	0	21	32	5	2	4	131	0	0

Proposed Alternatives

Restripe 21st Street: As detailed in Figure 18, restripe 21st Street northbound between Cumberland Boulevard to Center Street to provide 2nd through lane.

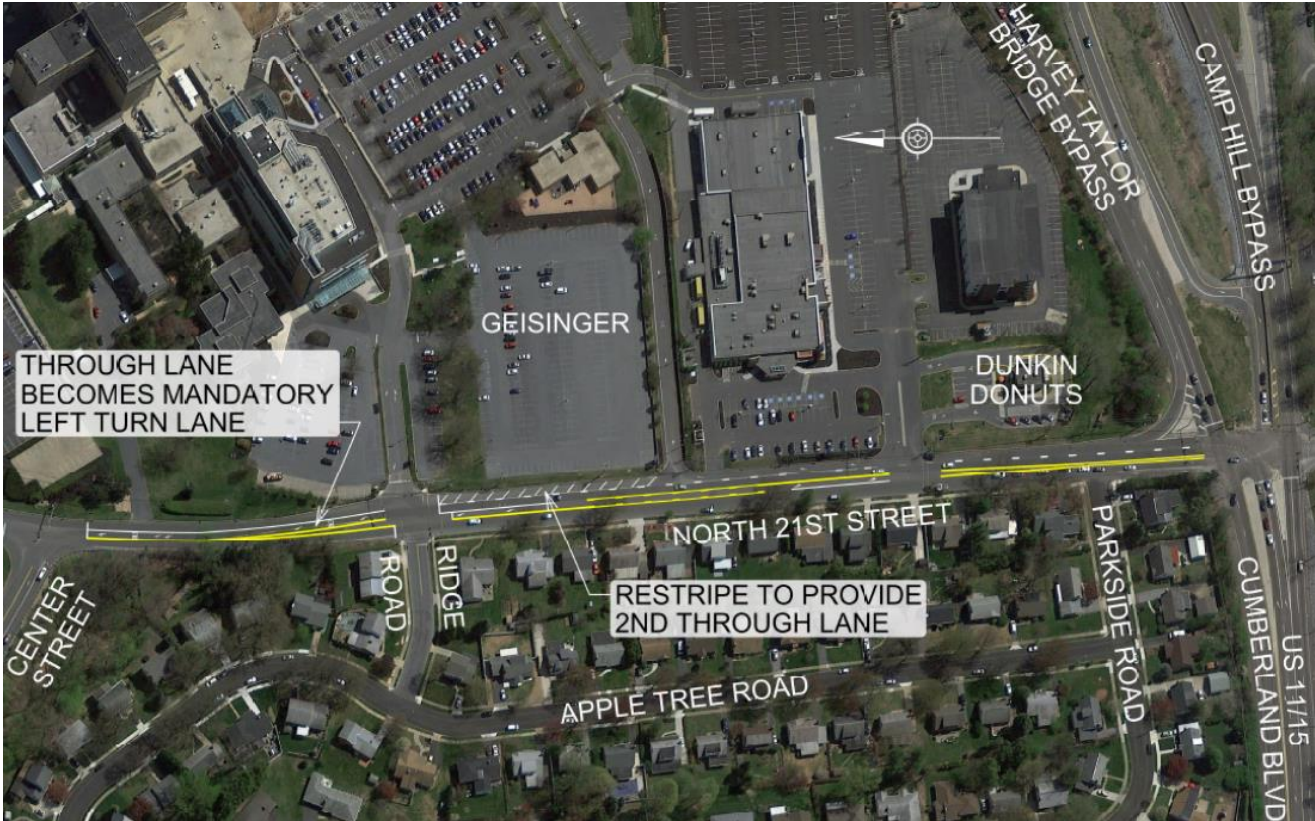


Figure 18 – Proposed improvements on North 21st Street, Cumberland Boulevard to Center Street

Speed Reduction Measures: Speed enforcement should be increased along this section of the corridor. With the completion of the new Erford Road bridge structure, there may be opportunities to employ technology and/or Camp Hill Borough gateway signage attached to the Erford Road structure (similar to the example shown in Figure 19) to encourage lower vehicular travel speeds as they approach the City of Harrisburg or Camp Hill Borough. Additionally, consider increasing size of speed limit signage within this section from conventional size (24" x 30") to larger size (36" x 48") detailed in the MUTCD for expressways or "special applications that require increased emphasis, improved recognition, or increased legibility."



Figure 19 – Gateway Signage Treatment, Agawam, Massachusetts

Optical Speed Bars: Install optical speed bars on the Harvey Taylor Bypass southbound, approaching North 21st Street. Optical Speed Bars (illustrated in Figure 21) are transverse stripes spaced at gradually decreasing distances. The rationale for using them is to increase a driver’s perception of speed and cause them to reduce speed. The preferred material is thermoplastic because of the exposure to high traffic volumes



Figure 20 – Camp Hill Bypass southbound, looking south at 21st Street.

Signing/Pavement Markings: Advance signage for the left exit to 21st Street should be improved to more clearly direct traffic to the channelized left turn lane. Further, signage adjacent to the through travel lanes at the intersection with 21st Street (shown in Figure 20) should be installed to clearly indicate that left turns from the through travel lanes at this location are prohibited. Additional physical measures to prevent vehicles from making this prohibited turn should be considered as well.

Lighting: The segment area is poorly lit and would greatly benefit from increased lighting.

Investigate Bicycle Route: In order to maintain bicycle access parallel to the limited access freeway section of the study corridor, a study should be convened to analyze the feasibility of a bicycle route south of the study area. A potential corridor for this route may include on-road accommodations on Route 11/15 in Camp Hill/Lemoyne/East Pennsboro and North 2nd Street in Wormleysburg.

Pedestrian Justification Study: PennDOT District 8-0 should investigate pedestrian the feasibility or need for pedestrian accommodations at the signalized intersection of Cumberland Boulevard and 21st Street.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
4-A	Restripe 21st Street	\$3,000	\$25,000	\$28,000
4-B	Speed Reduction Measures	\$10,000	\$50,000	\$60,000
4-C	Optical Speed Bars	\$1,000	\$4,000	\$5,000
4-D	Signing/Pavement Markings	\$5,000	\$25,000	\$30,000
4-E	Lighting	\$30,000	\$150,000	\$180,000
4-F	Bicycle Route Study			\$30,000 (study only)
4-G	Pedestrian Justification Study			\$15,000 (study only)

Segments 7 and 8, Harvey Taylor Bridge





Description

Segments 7 and 8 are comprised of the Harvey Taylor Bridge connecting Cumberland County to Harrisburg over the Susquehanna River. The bridge provides barrier-separated multi-use pathways adjacent to the northbound and southbound travel lanes, linking ramps at 2nd Street in Wormleysburg with the sidewalk network at Front Street in Harrisburg.

Existing Concerns

The pathways along the Harvey Taylor Bridge provide the highest level of bicycle and pedestrian accommodation within the corridor. Connections within Wormleysburg are provided via a pedestrian tunnel linking residential neighborhoods north and south of the bridge, however signage directing pedestrians to the tunnel is not present. Vehicular travel speeds entering Harrisburg change abruptly northbound as traffic enters densely developed Harrisburg.

Crash Data

Between 2007 and 2017 there were 17 reported crashes within the bridge segments, with the most common type of reported crash same-direction rear end, which is indicative of driver inattention combined within congested conditions. These segments exhibited the fewest number of crashes within the study corridor.

Crash Types from 2007 to 2017								
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Total	Pedestrian Fatal	Fatal Injury
8	0	1	4	3	0	17	0	0

Proposed Alternatives

Optical Speed Bars: Install optical speed bars (illustrated in Figure 21) on the Harvey Taylor Bridge deck surface northbound, approaching the signalized intersection with Front Street in Harrisburg. Optical Speed Bars are transverse stripes spaced at gradually decreasing distances. The rationale for using them is to increase a driver’s perception of speed and cause them to reduce speed. The preferred material is thermoplastic because of the exposure to high traffic volumes.

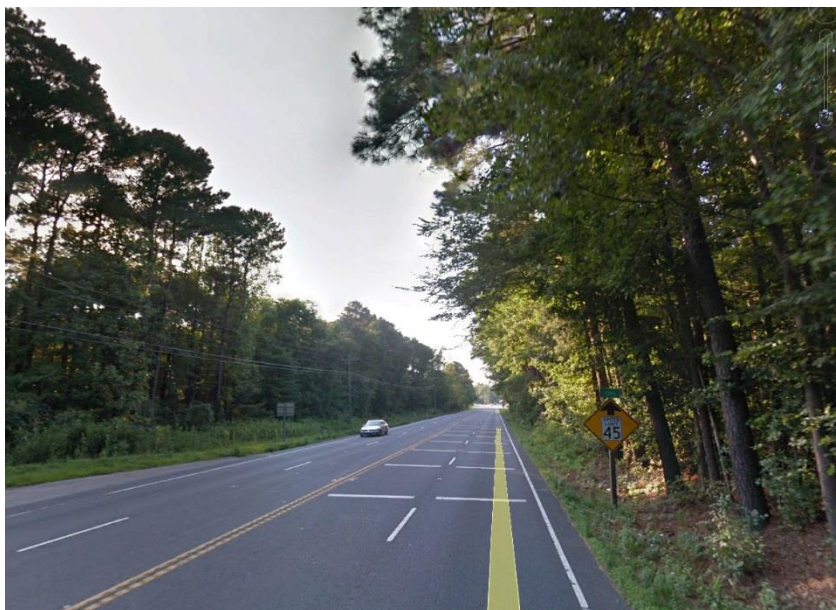


Figure 21 – Optical Speed Bars, US 460 EB, approaching Zuni, Virginia

Speed Reduction Measures: As shown in the example in Figure 22, install advance speed limit ahead pavement markings and reduced speed ahead signage on the bridge deck.



Figure 22 – Reduced Speed Ahead Pavement Markings, NY 198 at NY 33 Interchange, Buffalo, New York

Pavement Markings: As shown in Figure 23, install lane designation pavement markings for the left lane approach of the bridge, northbound, indicating “To 2nd Street”. Install elephant track striping or dotted extension lines for the Forster Street approaches through intersection.

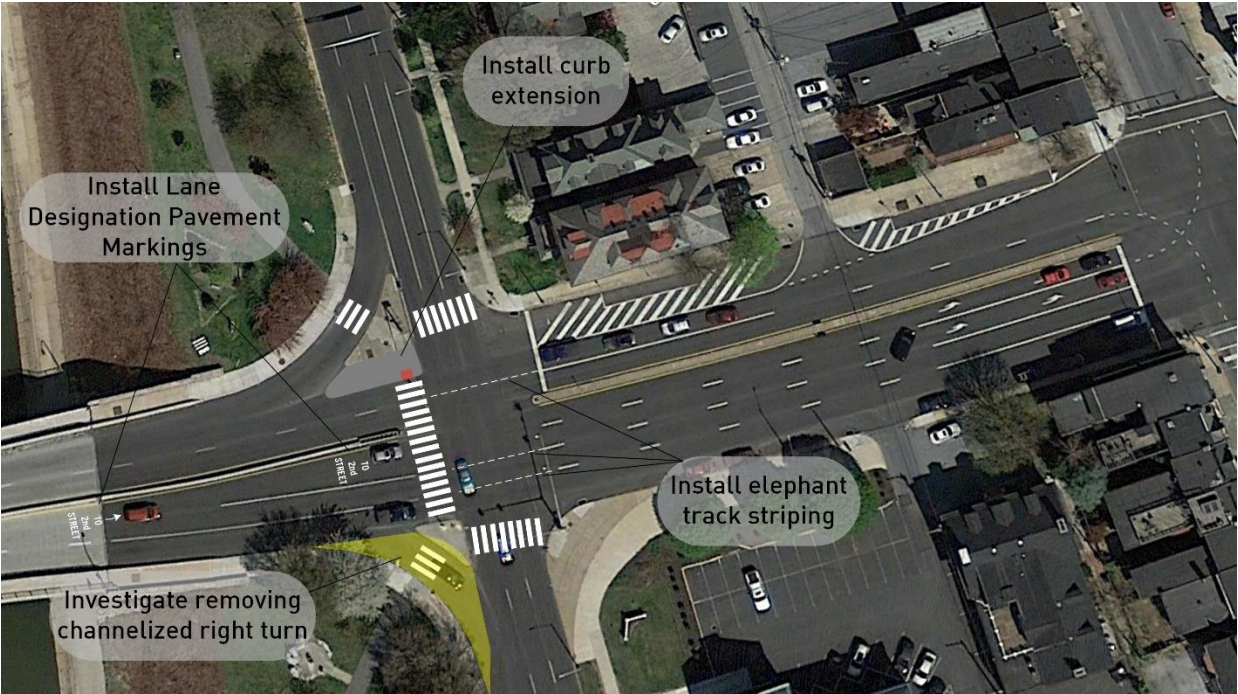


Figure 23 – Proposed striping and pedestrian modifications, Front Street at Forster Street

Curb Extension: As shown in Figure 23, to shorten the crosswalk on the northbound approach of the Harvey Taylor Bridge, a curb extension should be installed on the northwest corner of the intersection. In addition to shorten the crosswalk and improving conditions for pedestrians, this will better align travel lanes from Forster Street approaching the bridge as well and will reinforce the striped gore area adjacent to the southbound approach at this intersection.

Intersection Quadrant Modification: As shown in Figure 23, evaluate eliminating channelized uncontrolled right turn onto Front Street from the Harvey Taylor Bridge. This will reduce the footprint of the intersection and reduce overall crosswalk width while removing conflicts between pedestrians and higher speed vehicles traveling from the Harvey Taylor Bridge. Further, it will eliminate a crossing where visibility is obscured due to trees, signage, and the vertical curve of the bridge.

Improve Connections to Riverwalk: The City should investigate opportunities to work with the Capital Area Greenbelt Association (CAGA) to improve connections between the Riverwalk and intersection.

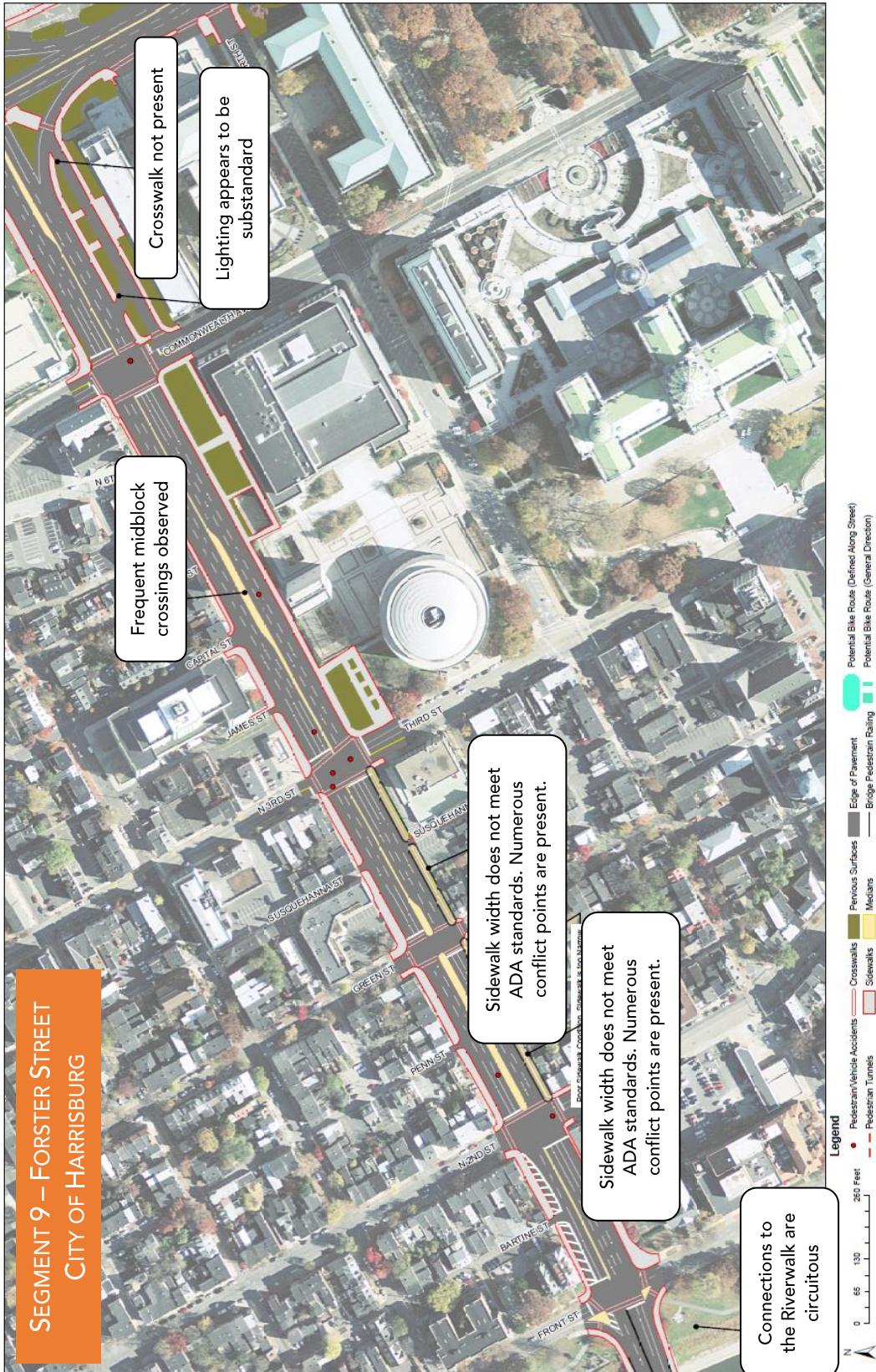
See Appendix A for additional engineering improvement drawings/plans/details.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
8-A	Optical Speed Bars	\$2,000	\$18,000	\$20,000
8-B	Speed Reduction Measures	\$1,000	\$10,000	\$11,000
8-C	Intersection Quadrant Modification	\$6,000	\$30,000	\$36,000
8-D	Curb Extension	\$10,000	\$40,000	\$50,000
8-E	Pavement Markings	\$1,000	\$10,000	\$11,000
8-F	Improve Connections to Riverwalk			\$0 (outreach only)

Segment 9 – Forster Street, Front Street to 7th Street (Harrisburg)



Description

Segment 9 is a 0.5 mile portion of Forster Street, located within Harrisburg, between Front Street and 7th Street. This segment transitions from the freeway portion of the study corridor (Harvey Taylor Bridge Bypass and the bridge) into the most densely developed segment within the study corridor. Within this segment the study corridor is fronted primarily by a mix of residential and commercial developments (south of 3rd Street) and state office buildings (north of 3rd Street). This segment includes six signalized intersections and an additional five unsignalized intersections that are configured as right-in/right-out intersections due to the presence of a curbed median. Additionally, several driveways associated with commercial developments and state offices are present within this segment. Each of the signalized intersections provides crosswalks and countdown pedestrian signal heads and significant pedestrian and bicycle activity was observed within this corridor. Sidewalks are provided throughout this segment, linking to the existing dense street grid. CAT bus service is provided along this corridor via numerous bus routes.

Existing Concerns

Several concerns for pedestrians and cyclists exist within this segment. While the sidewalk network is complete, the section of Forster Street northbound between Front Street and Third Street includes sidewalks that are substandard due to barriers that restrict width, including parking meters, utility poles, and advertising signage (Figure 24). Crosswalks within this segment are generally adequate, however the length of crossings at each of the signalized intersections (with the exception of Green Street) is excessive due to the lack of pedestrian refuge islands. Jaywalking was observed throughout this segment, particularly between 3rd Street and Commonwealth Avenue, where substantial midblock crossings were observed during each field view.

During peak periods congestion is substantial and travel speeds are reduced. However, outside of peak periods the width of the roadway and substantially lower traffic volumes creates opportunities for excessive speeding, particularly as drivers travel to and from the Harvey Taylor Bridge. This creates substantial challenges for pedestrians throughout the corridor but particularly at the intersections with Front Street and 2nd Street.

The recently improved intersection with 7th Street is also challenging for pedestrians. This intersection moves high numbers of pedestrian traffic between the 7th Street



Figure 24 – Sidewalk on Forster Street northbound, looking south. Note poor conditions and numerous obstructions

Parking Garage and state offices. While crosswalks at the intersection are well marked and visible, the crosswalks on the ramps connecting Forster Street with 7th Street are somewhat obscured by existing on-street parking that abuts the crosswalks. This violates current Pennsylvania Vehicle Code (Title 75 Section 3353), which requires that parking be limited to a minimum of 20 feet from a crosswalk at an intersection. Existing signage at these crosswalks are also obscured due to the presence of parking abutting the crosswalks (Figure 25).



Figure 25 – Crosswalk in ramp from 7th Street to Forster Street southbound.

Crash Data

Between 2007 and 2017 there were 289 reported crashes within this segment, with the most common type of reported crashes being angle crashes. Angle crashes indicate existing concerns at signalized or unsignalized intersections. This segment exhibited the highest number of total crashes within the study corridor, as well as the highest number of pedestrian crashes (17) for any segment within the corridor.

Crash Types from 2007 to 2017									
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Other	Total	Pedestrian Fatal	Fatal Injury
41	3	194	14	15	17	2	289	0	0

Proposed Alternatives

Programmable Traffic Signals: Evaluate installing programmable traffic signals which will visibly limit the field of view of a signal indication along the entire Forster Street corridor to minimize confusion of motorists seeing the wrong signal indication.

Speed Reduction Measures: Perform a speed study to investigate reducing speed limit to 25 or 30 MPH on Forster Street.

Midblock Crossing: Evaluate installing a midblock crossing near PennDOT Central Office along Forster Street between 3rd Street and 7th Street (Figure 26). Consider implementing a pedestrian education/ awareness program and innovative crosswalk treatments to encourage safer pedestrian behaviors (Figure 27).

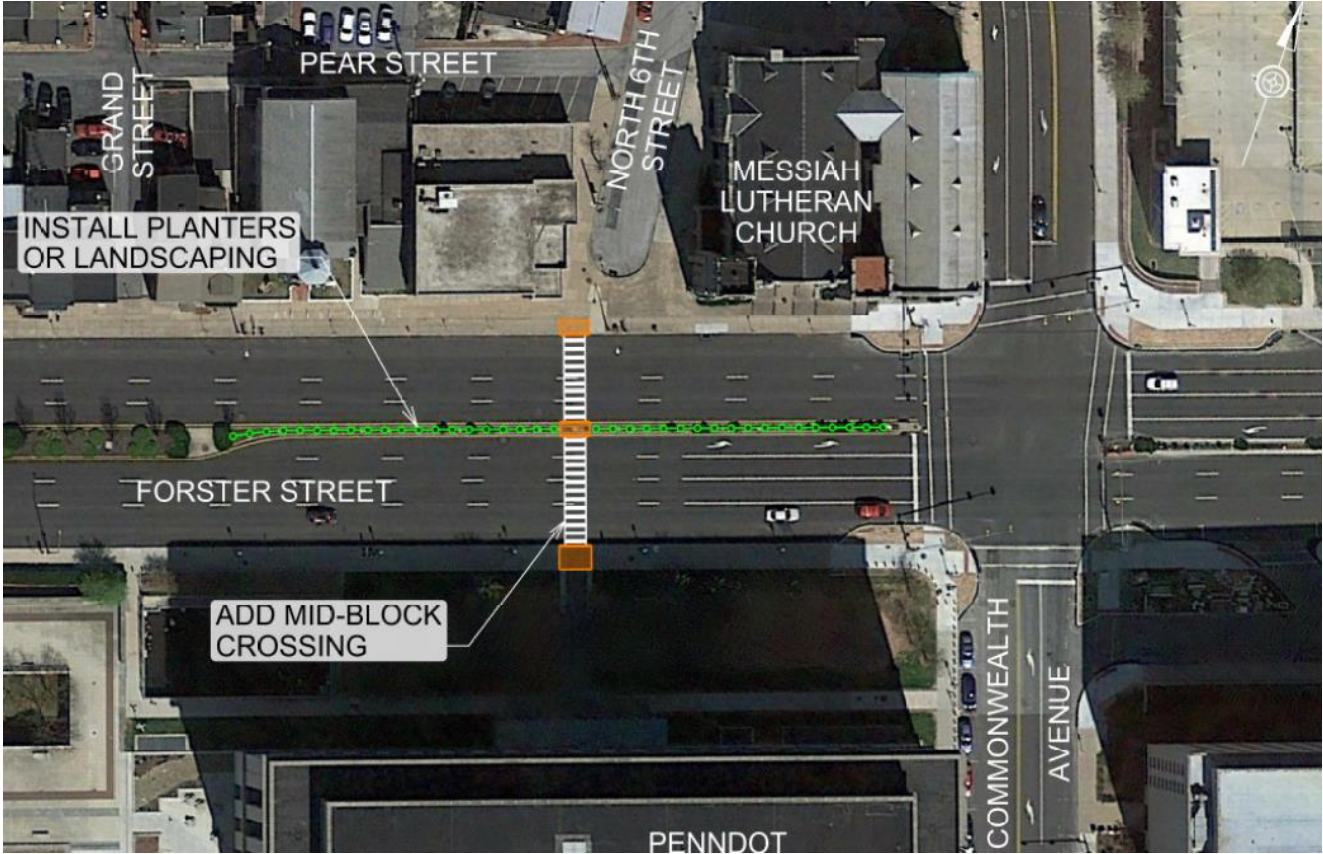


Figure 26 – Proposed mid-block improvement concept, Forster Street at 6th Street

Parking Removal: Remove existing parking spaces within the channelized right turn ramps at the intersection of 7th Street and Forster Street. These spaces violate current Pennsylvania Vehicle Code, obscure the existing crosswalks, and may expose PennDOT to liability concerns for pedestrian crashes at these locations.

Lane Reduction Study: Perform traffic study to evaluate the potential to reduce Forster Street to a four-lane cross-section.

Lane Reduction Treatment: Based on the findings of the Lane Reduction Study, advance a lane reduction treatment with median pedestrian refuges along the Forster Street corridor, as illustrated in Figure 28. As part of this effort, look to advance opportunities for coordination with local agencies (Capital Region Water) for proposed median area stormwater credits by incorporating bioretention areas, tree filters, permeable pavements sections, etc.

Leading Pedestrian Interval: A Leading Pedestrian Interval (LPI) provides pedestrians with a “head start” to enter an intersection via a crosswalk. An LPI is particularly effective to increase visibility of pedestrians in crosswalks where conflicts with permissive left or right turns exist. Therefore, LPIs should be considered at signalized intersections within this corridor at 2nd Street, 3rd Street, 4th Street, Commonwealth Avenue, and 7th Street.



Figure 27 – Pedestrian safety markings, Boulder, Colorado

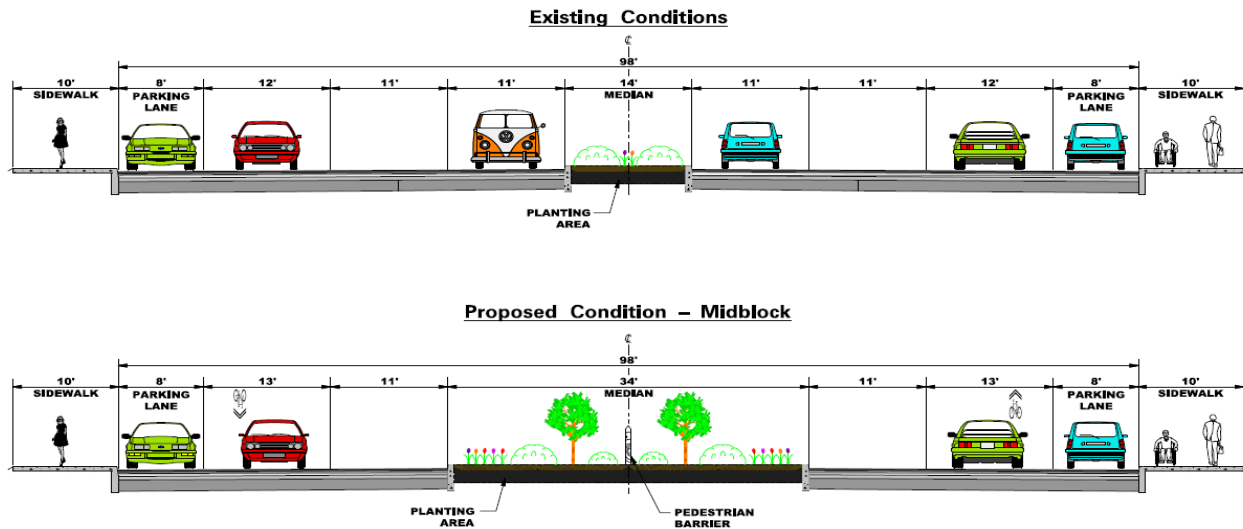


Figure 28 – Potential lane reduction concept for Forster Street

Sidewalk Upgrades: Investigate opportunities to widen/improve existing sidewalk along Forster Street NB between Front Street and 3rd Street.

Reduce Lane Width of Slip Ramps: Restripe existing channelized right turn lanes at intersection of Forster Street and 7th Street to narrow travel lanes and slow traffic.

Pavement Markings: Upgrade remaining crosswalks in corridor that are currently striped using standard transverse lines to continental style for consistency with recently upgraded crossings.

DHS Driveway Crosswalk: Install continental-style crosswalk and ramps across existing DHS driveway to southwest of intersection at Forster Street and 7th Street.

Pedestrian Bridge Feasibility Study: Investigate feasibility of pedestrian bridge between parking garage and Capitol Complex.

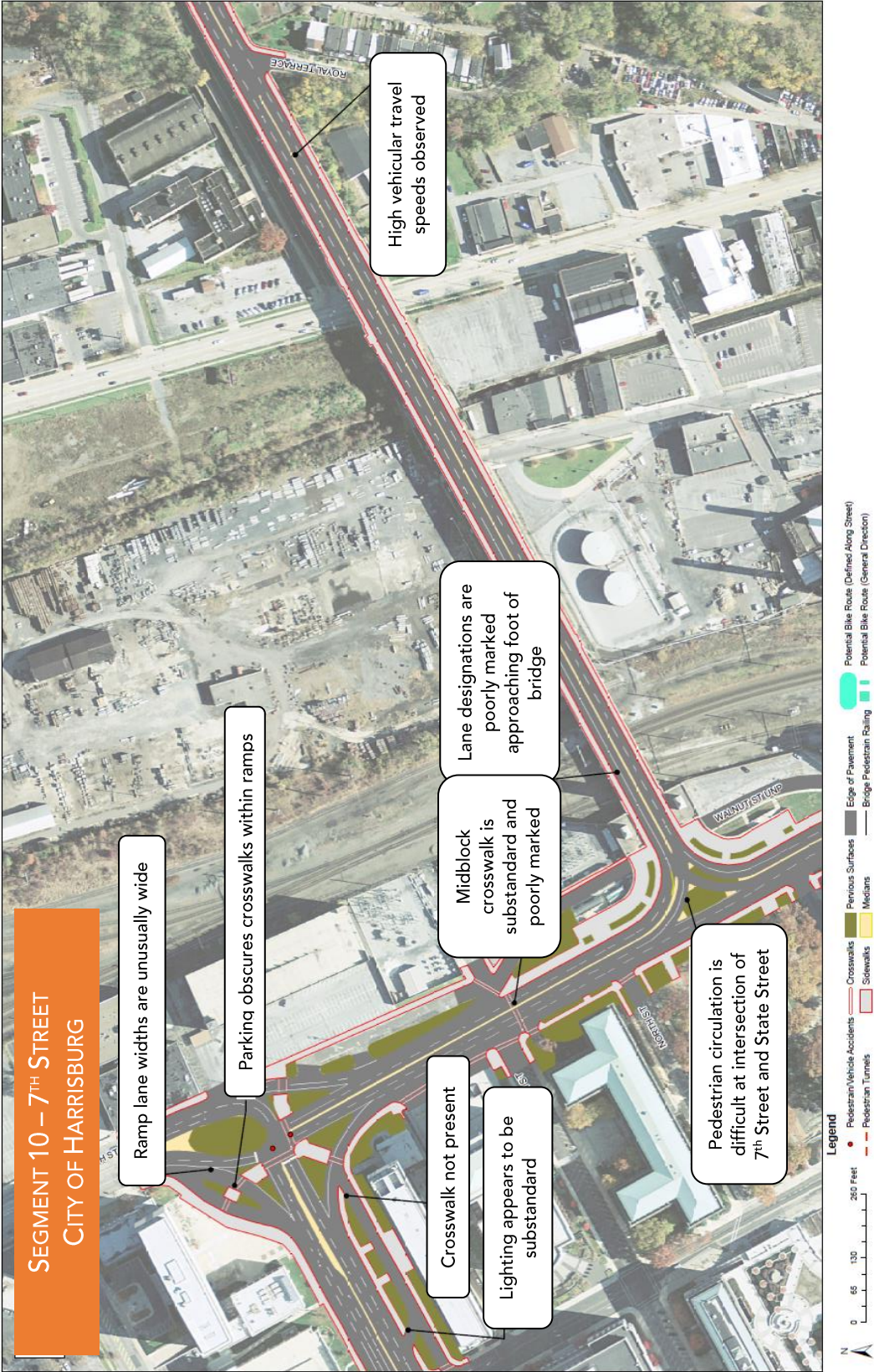
See Appendix A for additional engineering improvement drawings/plans/details.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
9-A	Programmable Traffic Signals	\$5,000	\$20,000	\$25,000
9-B	Parking Removal	\$1,000	\$7,000	\$8,000
9-C	Speed Reduction Measures (Study Only)			\$10,000
9-D	Midblock crossing	\$9,000	\$40,000	\$49,000
9-E	Lane Reduction Study			\$75,000 (study only)
9-F	Lane Reduction Treatment	\$180,000	\$1,500,000	\$1,680,000
9-G	Sidewalk Upgrades	\$8,000	\$85,000	\$93,000
9-H	Restripe Slip Ramps	\$5,000	\$20,000	\$25,000
9-J	Pavement Markings	\$5,000	\$20,000	\$25,000
9-K	DHS Driveway Crosswalk	\$5,000	\$15,000	\$20,000
9-L	Pedestrian Bridge Feasibility			\$75,000 (study only)
9-M	Leading Pedestrian Interval	\$5,000		\$5,000

Segment 10 – 7th Street, Forster Street to State Street; State Street Bridge (Harrisburg)



Description

Segment 10 is comprised of an approximately 1,000-foot segment of 7th Street between Forster Street and State Street, as well as the State Street Bridge (terminating at Royal Terrace), which links the Capitol Complex with Harrisburg’s 8th Ward. The 7th Street segment of the study corridor primarily serves as a link between downtown Harrisburg and points east (via the State Street Bridge) and is flanked by the Capitol Complex, state offices, and ancillary uses. A signalized intersection is present at Forster Street and unsignalized intersections are provided at North Street (right-in only), North Drive (right-out only), Walnut Street (right-out only) and at State Street, which provides ramp connections between the bridge and 8th Street. Several driveways associated with state offices are present within this corridor as well. Significant pedestrian activity was observed within this corridor, including at the unsignalized crossing provided at North Street/Walnut Street. CAT bus service is provided along this corridor via the 12, 17, and 27 routes.

Existing Concerns

The primary concern within the 7th Street segment for pedestrians is the existing unsignalized crosswalk at North Street/Walnut Street that is excessively long and somewhat obscured for higher speed traffic travelling from the State Street Bridge. Additionally, the crosswalk across Walnut Street linking sidewalks along 7th Street is abutted by existing parking, again in violation of existing Pennsylvania statute. Finally, pedestrian circulation at the intersection of 7th Street and State Street is challenging. While pedestrian circulation for pedestrians wishing to cross State Street is provided along the Walnut Street underpass, this route is circuitous and field observations indicated that most pedestrians choose to jaywalk across State Street rather than use the provided route.

The State Street Bridge is approximately 0.35 miles in length and presents several concerns for pedestrians and cyclists. While sidewalks are provided adjacent to travel lanes in both directions, no separation is provided between the sidewalk and adjacent travel lanes. Given the high vehicular travel speeds observed within this segment, pedestrian circulation is generally uncomfortable. Further, the lack of marked crossing opportunities within this segment create a situation where many pedestrians cross midblock along the bridge throughout this segment.

Crash Data

Between 2007 and 2017 there were 75 reported crashes within this segment, with the most common type of reported crashes being same-direction rear end or fixed object crashes. Same-direction rear crashes are indicative of driver inattention within congested conditions, while fixed object crashes are often due to existing elements that are perceived hazards. In this case, the fixed object most commonly struck is likely the curb associated with the existing median provided within this segment. Five pedestrian crashes were reported within this segment. This segment exhibited the highest number of fatal crashes, including a fatal pedestrian crash.

Crash Types from 2007 to 2017								
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Total	Pedestrian Fatal	Fatal Injury
29	2	7	27	2	5	75	1	3

Proposed Alternatives

Roundabout with Midblock Crossing Treatment: As illustrated in Figure 29, consider installation of a roundabout and improved midblock crossing at the intersection of 7th Street/State Street Bridge.



Figure 29 – Proposed roundabout concept, State Street at 7th Street

Optical Speed Bars: Install optical speed bars on the State Street Bridge deck surface southbound, approaching 7th Street and northbound approaching 13th Street. Optical Speed Bars are transverse stripes spaced at gradually decreasing distances. The rationale for using them is to increase a driver’s perception of speed and cause them to reduce speed. The preferred material is thermoplastic because of the exposure to traffic volume over time.

Speed Reduction Measures: Install advance speed limit ahead pavement markings and reduced speed ahead signage on the bridge deck. Further, supplement pavement markings with flexible bollards to delineate right-turn and left-turn lanes on bridge approaching 7th Street.

Pavement Markings: Re-stripe midblock crosswalk on 7th Street with continental style layout and high visibility material.

Curb Extension: As shown in Figure 30, install curb extension on southern leg of existing midblock crosswalk on 7th Street at North Street. This will shorten the crossing distance by removing currently unused pavement.

Pedestrian RRFB: Install pedestrian-actuated Rectangular Rapid Flashing Beacon (RRFB) signage, as illustrated in Figure 31, at existing crosswalk. This will reinforce visibility of the crossing and awareness for vehicular traffic.

See Appendix A for additional engineering improvement drawings/plans/details.

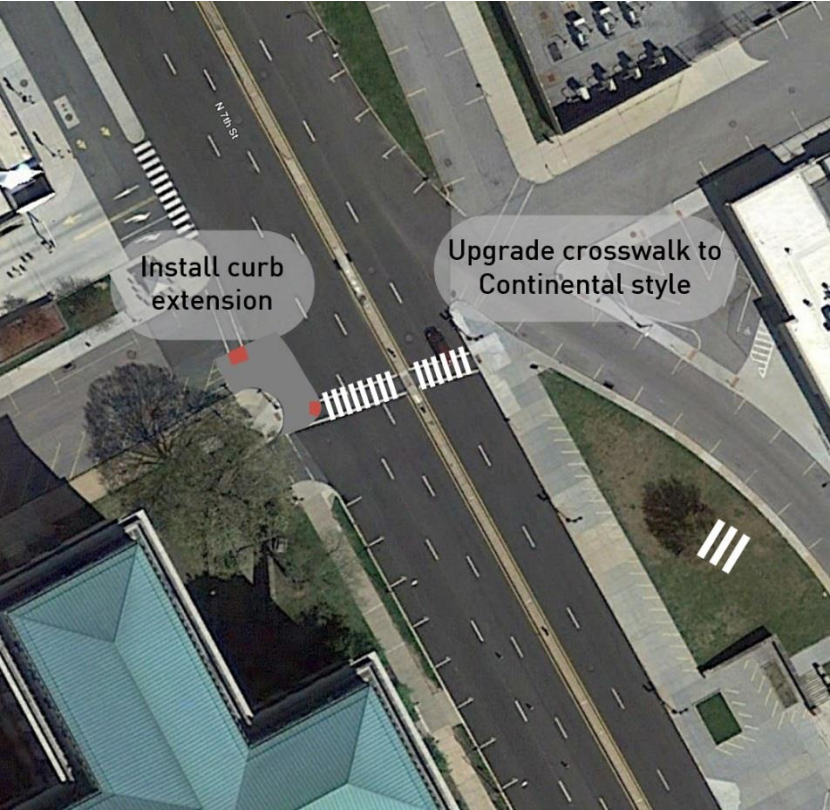


Figure 30 – Proposed midblock crosswalk improvements, 7th Street at North Street



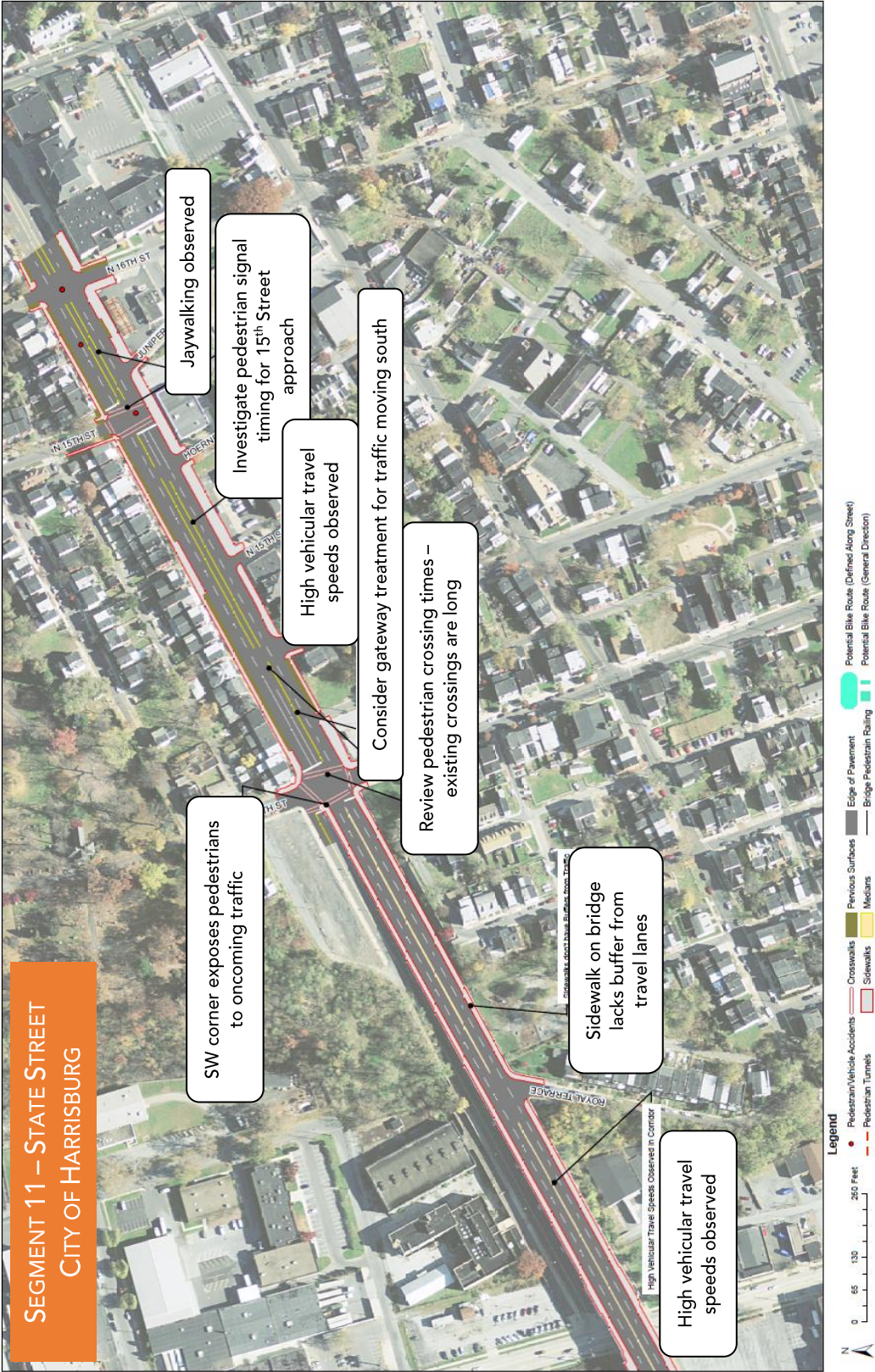
Figure 31 – Rectangular Rapid Flashing Beacon (RRFB), Main Street, Doylestown, Pennsylvania

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
10-A	Study Roundabout with Midblock Crossing Treatment	\$240,000	\$2,100,000	\$2,340,000
10-B	Construct Roundabout with Midblock Crossing Treatment	\$0	\$0	\$50,000 (study only)
10-C	Optical Speed Bars	\$2,000	\$18,000	\$20,000
10-D	Speed Reduction Measures	\$1,000	\$10,000	\$11,000
10-E	Pavement Markings	\$1,000	\$10,000	\$11,000
10-F	Curb Extension	\$10,000	\$30,000	\$40,000
10-G	Pedestrian RRFB	\$5,000	\$25,000	\$30,000

Segment 11 – State Street, Royal Terrace to 17th Street (Harrisburg)



Description

Segment 11 is an approximately 0.35-mile segment of State Street between Royal Terrace and 17th Street, which is the northern terminus of the study corridor. This segment is comprised primarily of single-family residential homes (rowhouse or twin), with some commercial development evident as well. Signalized intersections are present at 13th Street, 15th Street, and 17th Street, while unsignalized intersections are present at seven additional cross streets. Crosswalks and countdown pedestrian signal heads are present at each signalized intersection and sidewalks are provided throughout this corridor. CAT bus service is provided along this corridor via the 12, 17, and 27 routes.

Existing Concerns

This segment of the study corridor is challenging for all modes of transportation due to the generally uncontrolled nature of turning and crossing movements, coupled with high travel speeds due to the width of the roadway. Existing crosswalks at the signalized intersections provide crossing opportunities but the length of the crossings can be challenging (Figure 32), particularly for those with mobility concerns. The State Street crossings at 13th Street are particularly difficult, due to the additional movements associated with the State Street ramp to Cameron Street as well as the transition area between the 8th Ward and the bridge, where travel speeds increase. An additional concern at this intersection is the northwest corner (adjacent to the ramp) where pedestrians feel particularly exposed to oncoming traffic on State Street southbound. In general, pedestrian crossings were observed throughout this segment during field views.



Figure 32 – State Street at 13th Street, looking south

Crash Data

Between 2007 and 2017 there were 84 reported crashes within this segment, with the most common type of reported crashes being angle crashes. Angle crashes indicate existing concerns at signalized or unsignalized intersections. Eleven pedestrian crashes were reported within this segment. While several other segments experienced significantly more total crashes, this segment exhibited the highest number of fatal crashes within the study corridor (3) including two fatal pedestrian crashes.

Crash Types from 2007 to 2017								
Rear End	Head-On	Angle	Fixed Object	Sideswipe	Pedestrian	Total	Pedestrian Fatal	Fatal Injury
16	2	36	6	11	11	84	2	3

Proposed Alternatives

Intersection of 13th Street and State Street Improvements: Short term – As shown in Figure 33, this concept would include curb extensions to shorten existing crossings and provide a pedestrian refuge for the northbound approach. Long term – Reconfigure State Street ramp to utilize Miller Street/Herr’s Lane to remove current awkward approach at intersection, or as shown in Figure 34, construct a roundabout at this location that will accommodate all current vehicular/pedestrian movements.

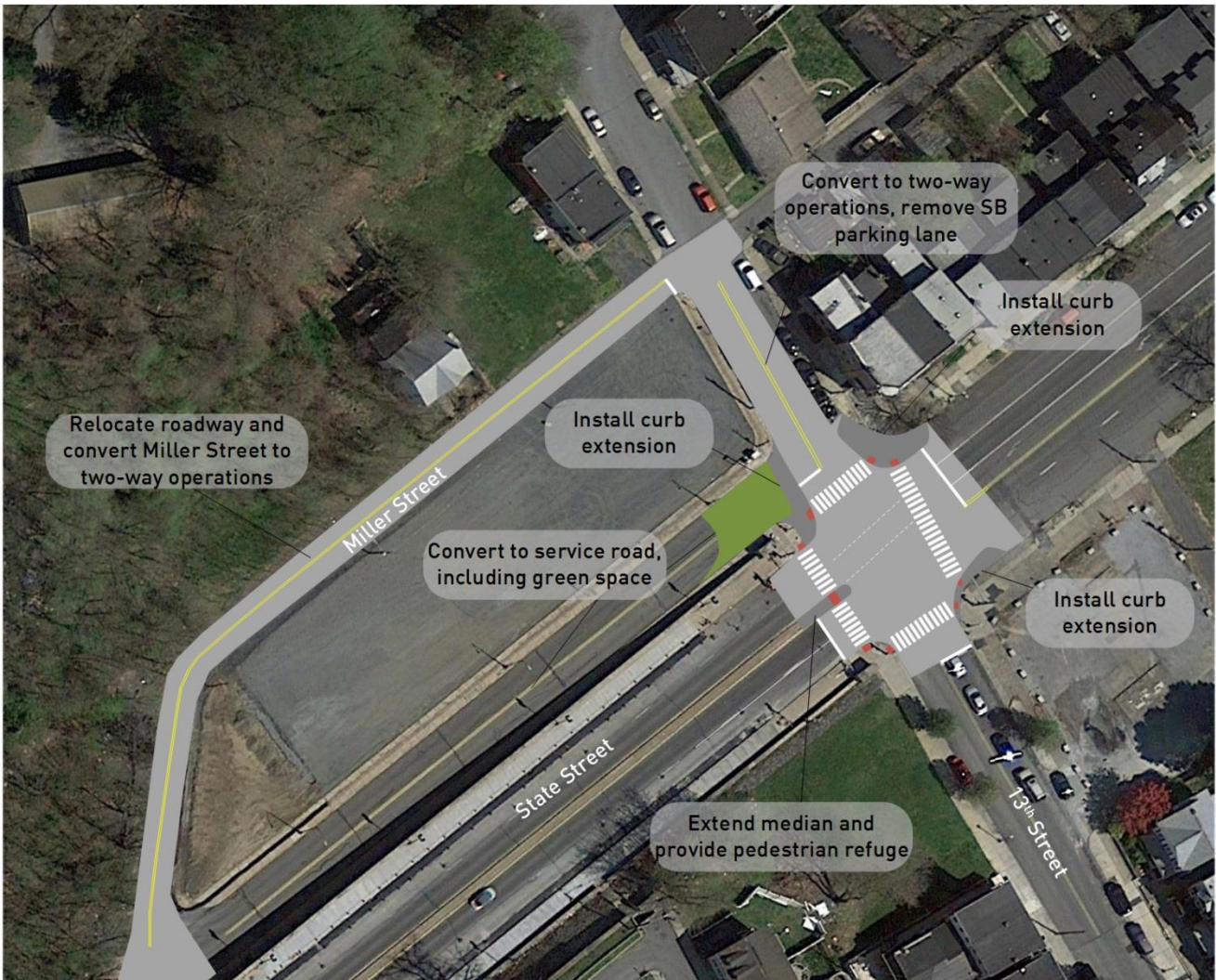


Figure 33 – Proposed short/mid-term improvements, State Street at 13th Street

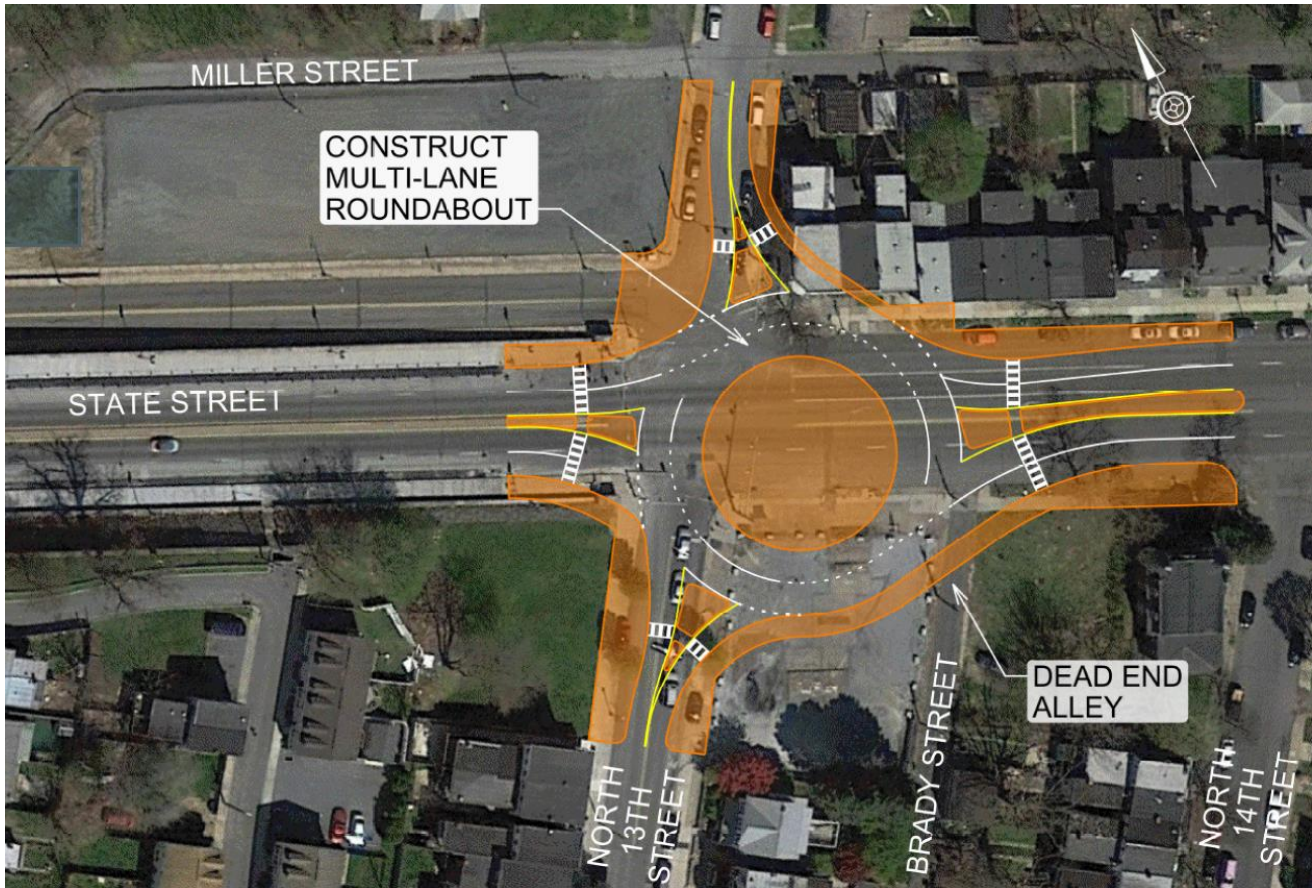


Figure 34 – Proposed roundabout concept, State Street at 13th Street

State Street Bridge Sidewalk Treatment: Evaluate a separation concept on State Street Bridge sidewalk to accommodate both pedestrians and bicycles.

Programmable Traffic Signals: Evaluate installing programmable traffic signals which will visibly limit the field of view of a signal indication along the entire State Street corridor to minimize confusion of motorists seeing the wrong signal indication.

Signing/Pavement Markings: Install permanent radar speed limit signs within the corridor and on the State Street bridge deck. Re-stripe all crosswalks as continental style with high visibility material.

Corridor Restriping: To achieve lower travel speeds, reduce existing travel lane widths from 12 feet to 11 feet by restriping the State Street corridor between 7th Street and the vicinity of 20th Street (approximately 1.1 miles).

The segment of State Street between 7th Street and 13th Street (effectively the State Street Bridge) currently has 54 feet of cartway width including four 12-foot travel lanes and a 6-foot raised curb median. As shown in Figure 35, 11-foot travel lanes are proposed for this segment, flanked by 1-foot shoulders adjacent to each curb. While this would likely require a design exception request, due to substandard shoulder widths, the result is an improvement over the current striping plan, which includes no shoulders. It would also result in additional separation between the travel lanes and existing sidewalk.

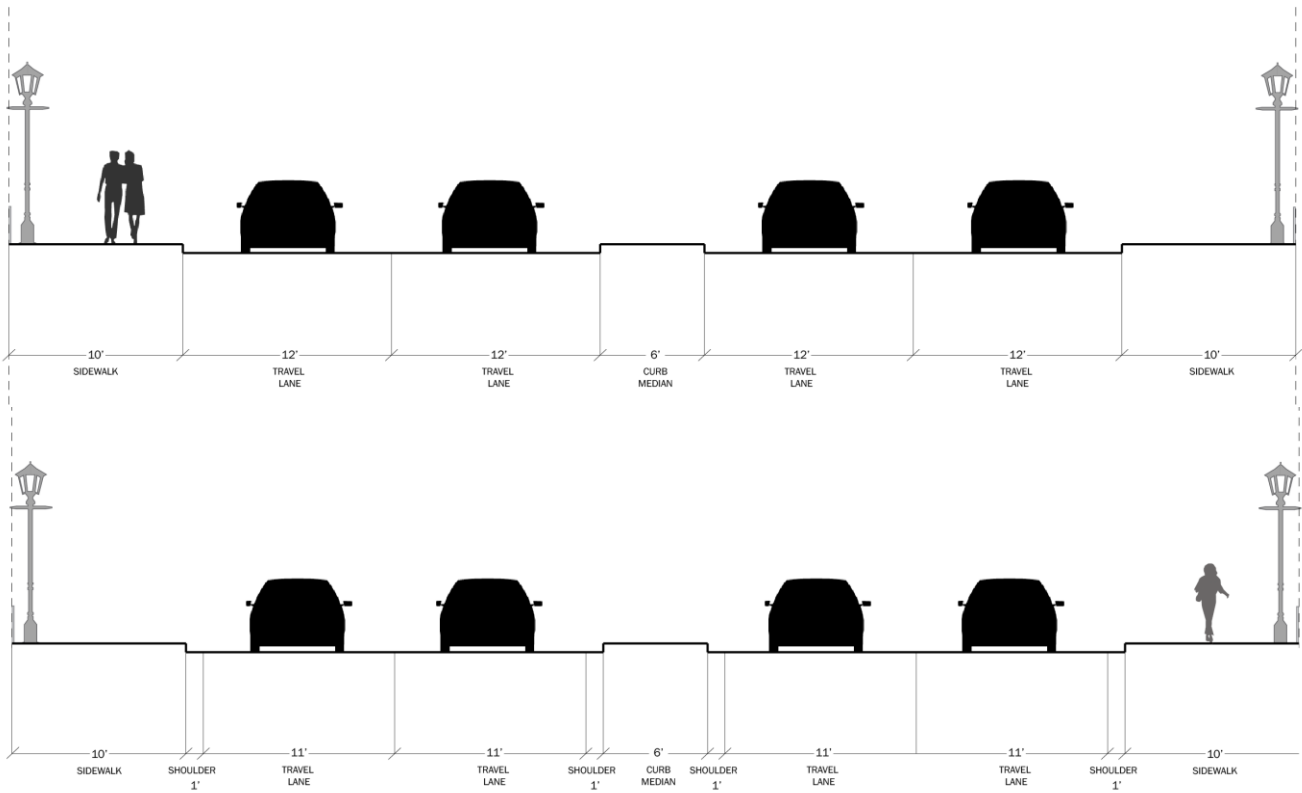


Figure 35 – Existing (top) and Proposed (bottom) cross section, State Street (7th Street to 13th Street)

The segment of State Street between 13th Street and the vicinity of 20th Street currently has 76 feet of cartway width, including two 8-foot parking lanes, four 12-foot travel lanes, and a 12-foot two-way left turn lane. As shown in Figure 36, 11-foot travel lanes are proposed for this segment, with a widened 16-foot two-way left turn lane, which aligns with guidelines set forth by the AASHTO Green Book.

The proposed narrowed lane widths more closely align with the corridor north of Parkway Drive (Walnut Street), where the current cartway width is 42 feet, including two 11-foot travel lanes and two 10-foot travel lanes, with no shoulder.

This striping scheme would also provide a template for the proposed boulevard concept detailed below.

While it is preferred that a restriping scheme be completed in conjunction with the resurfacing of these segments, this concept can be advanced without resurfacing. However, this would require the additional cost of removing existing markings through typical removal methods (grinding, waterblasting, etc.).

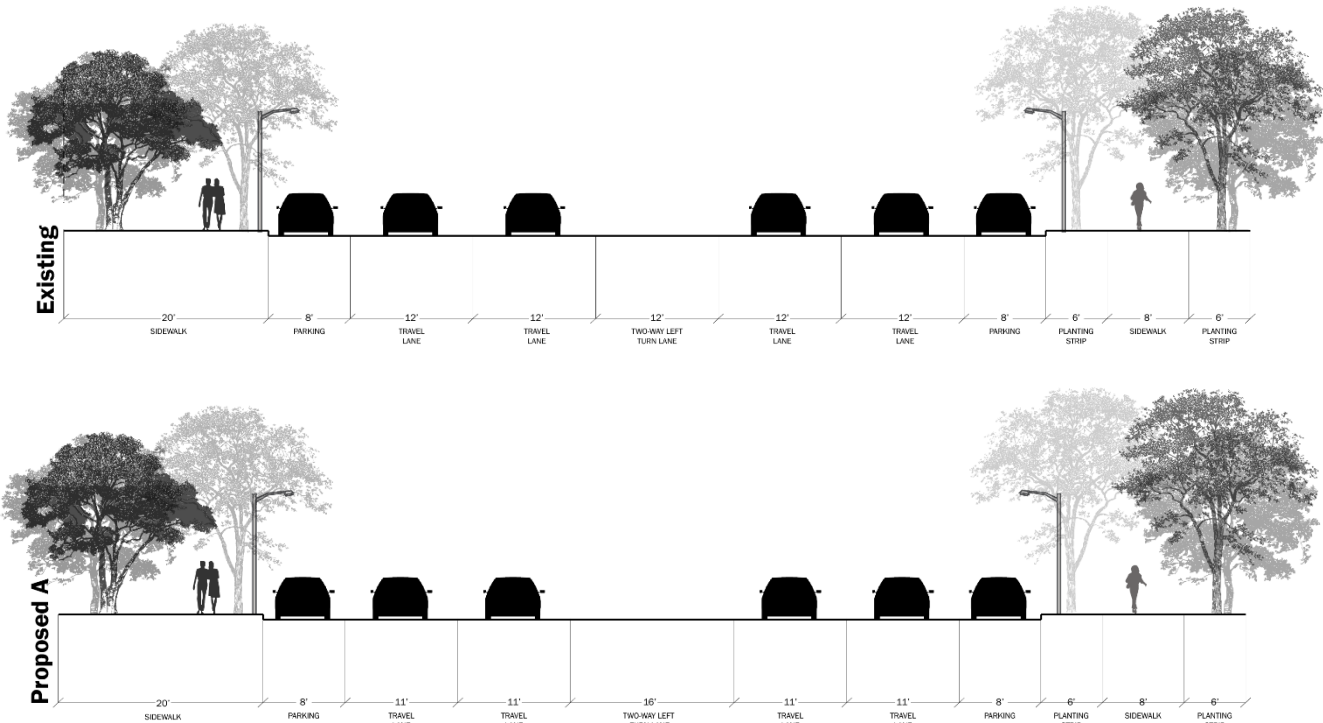


Figure 36 – Existing (top) and Proposed (bottom) cross section, State Street (13th Street to 20th Street)

Boulevard Concept: Following a successful advancement of the corridor restriping concept above, a boulevard treatment should be installed for State Street between 13th Street and Parkway Drive. This concept, illustrated in Figure 37, would repurpose the 16-foot two-way left turn lane within the restriping concept above and provide a 12-foot curb median flanked by 2-foot shoulders. Left-turn slots would be provided at currently signalized intersections with 13th, 15th, 17th, and 18th Streets, and Parkway Drive. Left-turn slots may be provided at select unsignalized intersections, but an analysis of the potential to limit access to right-in and/or right-out movements should be considered.

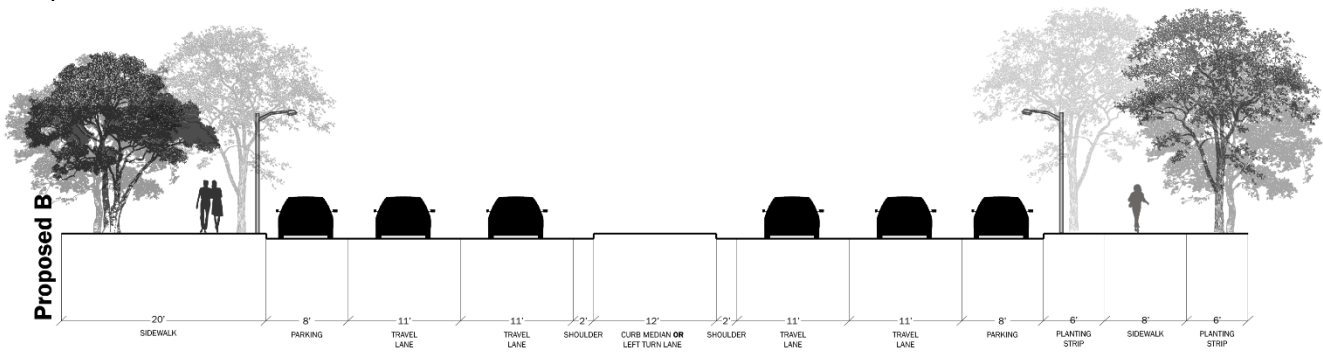


Figure 37 –Proposed Boulevard Concept cross section, State Street (13th Street to 20th Street)

This concept would further slow speeds through the corridor while providing median refuge areas for pedestrians. It would further improve safety within the corridor by limiting left-turn movements. As part of this effort, look to advance opportunities for coordination with local agencies (Capital Region Water) for proposed median area stormwater credits by incorporating bioretention areas, tree filters, permeable pavements sections, etc.

Lane Reduction Study: Perform traffic study to evaluate the potential to reduce State Street to a three- or four-lane cross-section. This study may be able to be done in tandem with roundabout feasibility studies proposed at 7th Street and 13th Street. This study should also include an analysis of impacts to State Street beyond Harrisburg into Penbrook Borough.

Lane Reduction Treatment: Based on the findings of the Lane Reduction Study, advance a lane reduction treatment with median pedestrian refuges along the State Street corridor. As part of this effort, look to advance opportunities for coordination with local agencies (Capital Region Water) for proposed median area stormwater credits by incorporating bioretention areas, tree filters, permeable pavements sections, etc.

Lighting: The segment area is poorly lit and would greatly benefit from increased lighting, especially on the State Street Bridge Deck.

Royal Terrace Intersection Improvements: Improve signage for turning movements to Royal Terrace. Restripe existing crosswalk as continental style.

Leading Pedestrian Interval: A Leading Pedestrian Interval (LPI) provides pedestrians with a “head start” to enter an intersection via a crosswalk. An LPI is particularly effective to increase visibility of pedestrians in crosswalks where conflicts with permissive left or right turns exist. Therefore, LPIs should be considered at signalized intersections within this corridor at 13th Street, 17th Street, and 18th Street

See Appendix A for additional engineering improvement drawings/plans/details.

Cost Estimate Matrix

Below is a summary of estimated costs associated with each of the proposed alternatives detailed above.

Concept	Description	Design Cost	Construction Cost	Total Cost
11-A	13th St. and State St. Improvements	\$5,000 (Short) \$200,000 (Long)	\$50,000 (Short) \$2,000,000 (Long)	\$55,000 (Short) \$2,200,000 (Long)
11-B	State Street Bridge Sidewalk Treatment	\$5,000	\$50,000	\$55,000
11-C	Programmable Traffic Signals	\$5,000	\$20,000	\$25,000
11-D	Signing/Pavement Markings	\$6,000	\$32,000	\$38,000
11-E	Lane Reduction Study			\$75,000 (study only)
11-F	Lane Reduction Treatment	\$160,000	\$1,200,000	\$1,360,000
11-G	Lighting	\$15,000	\$110,000	\$125,000
11-H	Royal Terrace Intersection Improvements	\$5,000	\$15,000	\$20,000
11-J	Corridor Restriping	\$20,000	\$100,000	\$120,000
11-K	Boulevard Concept	\$100,000	\$625,000	\$725,000
11-L	Leading Pedestrian Intervals	\$5,000		\$5,000

Implementation Matrix

The table below summarizes each of the improvement concepts detailed within the study. These concepts are intended to be advanced individually, but can be grouped where cost savings may be accomplished. While these improvements are incremental, the ultimate goal is to realize overall circulation and safety improvements for pedestrians, cyclists, and vehicular traffic throughout the corridor as each concept is advanced. Each concept includes a summary of needs, implementation term, cost estimate, and lead and supporting agencies.

Location	Concept Number	Improvement	Mitigating Circumstances	Implementation Term	Cost	Key Partners
32nd Street at PA 581	1-A	Speed Transition/reduction signage on Route 15 NB	Corridor context change, high speed traffic	Mid	\$20,000	PennDOT D8-0, Camp Hill Borough
	1-B	Install speed bars on US 11 NB on bridge approaching Camp Hill; Install speed bars on PA 581 ramp to US 11	Corridor context change, high speed traffic	Immediate	\$8,000	PennDOT D8-0, Camp Hill Borough
	1-D	Reconfigure signal at US 15 and PA 581 Ramp	Substandard merge area from PA 581	Short	\$190,000	PennDOT D8-0, Camp Hill Borough
	1-I	Investigate potential for gateway treatment on bridge (NB)	Corridor context change, high speed traffic	Mid	\$30,000	Camp Hill Borough, TCRPC, PennDOT D8-0
32nd Street at Camp Hill Mall	1-J	Study relocating main signalized entrance from Harvard Avenue intersection to northern driveway	Pedestrian safety spacing from PA 581 interchange	Mid	\$30,000	TCRPC, PennDOT D8-0, Camp Hill Borough, Cedar Realty Trust
32nd Street at Chestnut Street/Trindle Road	1-G	Review signal timings and investigate removing pedestrian-only phase or providing diagonal crosswalks	Congestion, pedestrian safety	Immediate	\$15,000	PennDOT D8-0, Camp Hill Borough
	1-E	Restripe crosswalks as continental style	Pedestrian safety	Short	\$7,000	PennDOT D8-0, Camp Hill Borough
	1-F	Replace damaged sidewalk over culvert south of intersection	Pedestrian circulation	Mid	\$29,000	PennDOT D8-0, Camp Hill Borough
32nd Street at Market Street	1-G	Review signal timings and investigate removing pedestrian-only phase or providing diagonal crosswalks	Congestion, pedestrian safety	Immediate	\$15,000	PennDOT D8-0, Camp Hill Borough
	1-E	Restripe crosswalks as continental style	Pedestrian safety	Short	\$7,000	PennDOT D8-0, Camp Hill Borough
32nd Street Corridor	1-C, 2-B	Lighting improvements within segment	Pedestrian and vehicular safety	Mid	\$110,000; \$135,000	PennDOT D8-0, Camp Hill Borough, Cedar Realty Trust
	1-H	Investigate School Zones within segment	Pedestrian safety	Immediate	\$35,000	Camp Hill Borough, TCRPC

Cumberland Boulevard at 32nd Street	2-A	32nd Street Intersection Closure	Pedestrian safety	Mid	\$185,000	TCRPC, PennDOT D8-0, Camp Hill Borough, East Pennsboro Township
Cumberland Boulevard at Brentwater Road	2-E	Reduce width of WB/SB right turn lane	High speed vehicular traffic	Short	\$5,000	PennDOT D8-0, Camp Hill Borough
	2-C	Restripe crosswalks as continental style	Pedestrian safety	Short	\$8,000	PennDOT D8-0, Camp Hill Borough
Cumberland Boulevard Corridor	3-C	Study traffic impacts of reducing side-street access, including potential for right-in/right-out or full closures	Pedestrian and vehicular safety	Short-Mid	\$20,000	TCRPC, PennDOT D8-0, Camp Hill Borough
	2-D, 3-A, 3-B	Install sidewalk connections along corridor	Pedestrian safety and circulation	Mid	\$110,000; \$290,000; \$230,000	PennDOT D8-0, Camp Hill Borough
	3-D	Sidewalk repairs in vicinity of Eisenhower School	Pedestrian safety and circulation	Mid	\$56,000	PennDOT D8-0, Camp Hill Borough
	3-F	Lighting improvements within segment	Pedestrian and vehicular safety	Mid	\$145,000	PennDOT D8-0, Camp Hill Borough
	3-G	Restripe crosswalks as continental style	Pedestrian safety	Immediate	\$15,000	PennDOT D8-0, Camp Hill Borough
	3-H	Investigate School Zones within segment	Pedestrian safety	Immediate	\$30,000	Camp Hill Borough, TCRPC
Cumberland Boulevard Pedestrian Tunnels	3-E	Improve wayfinding signage to each pedestrian tunnel	Pedestrian safety	Immediate	\$106,000	Camp Hill Borough
	3-E	Upgrade lighting within pedestrian tunnels	Pedestrian safety	Short		Camp Hill Borough
	3-E	Install security cameras within pedestrian tunnels	Pedestrian safety	Mid		Camp Hill Borough
21st Street Corridor	4-A	Restripe 21st Street	Congestion	Short-Mid	\$28,000	Camp Hill Borough, East Pennsboro Township
Camp Hill Bypass approaching 21st Street	4-D	Install advance "No Left Turn at Intersection" signage	Crash reduction	Immediate	\$5,000	PennDOT D8-0, Camp Hill Borough
	4-B	Speed Reduction Measures/Gateway	High speed vehicular traffic	Mid	\$60,000	PennDOT D8-0, Camp Hill Borough
	4-C	Install speed bars on bypass SB indicating speed limit drop ahead	High speed vehicular traffic	Immediate	\$5,000	PennDOT D8-0, Camp Hill Borough
	4-E	Lighting improvements within segment	Vehicular safety	Mid	\$180,000	PennDOT D8-0, Camp Hill Borough
Camp Hill Bypass at Erford Road	4-B	Investigate potential for gateway treatment on bridge (SB)	High speed vehicular traffic	Mid	\$90,000	PennDOT D8-0, TCRPC, Camp Hill Borough, East Pennsboro Township
	4-D	Improve signage for 21st Street left exit	Vehicular safety	Immediate	\$25,000	PennDOT D8-0, East Pennsboro Township
Route 11 Bicycle Route	4-F	Route 11 Bicycle Route Study	Bicycle circulation	Short	\$30,000	TCRPC, Wormleysburg Borough, Lemoyne Borough, East Pennsboro Township, Camp Hill Borough, PennDOT D8-0

Forster Street at Front Street	8-B	Install advance speed limit ahead pavement markings and signage on bridge approach	Corridor context change, high speed traffic	Immediate	\$11,000	PennDOT D8-0, City of Harrisburg
	8-E	Install lane designation signage for EB left lane approaching indicating "To 2nd Street"	Crash reduction	Immediate	\$11,000	PennDOT D8-0, City of Harrisburg
	8-E	Install elephant track striping for Forster Street approaches through intersection	Crash reduction	Immediate		PennDOT D8-0, City of Harrisburg
	8-A	Install speed bars on bridge approach	Corridor context change, high speed traffic	Immediate	\$20,000	PennDOT D8-0, City of Harrisburg
	8-C	Improve removal of slip ramp from Harvey Taylor Bridge to Front Street	Pedestrian safety	Short-Mid	\$36,000	PennDOT D8-0, City of Harrisburg
	8-D	Install curb extensions on NW corner	Pedestrian safety	Short	\$50,000	PennDOT D8-0, City of Harrisburg
	8-F	Investigate linkages between intersection and riverfront path	Pedestrian circulation	Immediate	\$0	City of Harrisburg, TCRPC, CAGA
Forster Street at Grant Street	9-D	Study to investigate mid-block crossing, including potential striping and signing configurations	Pedestrian circulation	Mid	\$49,000	PennDOT D8-0, PennDOT Central Office, City of Harrisburg, TCRPC
Forster Street Corridor	9-A	Install programmable traffic signals	Crash reduction	Mid	\$25,000	PennDOT D8-0, City of Harrisburg
	9-C	Perform speed study to investigate reducing speed limit to 25 or 30mph	Corridor context change, high speed traffic	Immediate	\$10,000	PennDOT D8-0, City of Harrisburg, TCRPC
	9-E	Study to investigate lane reduction between Front and 7th Streets	Corridor safety	Short	\$75,000	TCRPC, City of Harrisburg, PennDOT D8-0
	9-F	Lane reduction treatment between Front and 7th Streets	Corridor safety	Mid	\$1,680,000	PennDOT D8-0, City of Harrisburg
	9-G	Study to investigate opportunities to widen/improve existing sidewalk along Forster Street NB between Front and 3rd Streets	Pedestrian circulation	Short	\$93,000	PennDOT D8-0, City of Harrisburg, TCRPC
7th Street at Forster Street	9-B	Remove parking spaces that encroach on existing crosswalks in slip ramps	Pedestrian safety	Immediate	\$8,000	City of Harrisburg, PennDOT D8-0, Park Harrisburg, DHS
	9-H	Reduce lane width of existing slip ramps	Pedestrian safety	Short	\$25,000	PennDOT D8-0, City of Harrisburg
	9-J	Restripe crosswalks as continental style	Pedestrian safety	Short	\$25,000	PennDOT D8-0, City of Harrisburg
	9-K	Install crosswalk and ramps across existing DHS driveway	Pedestrian safety and circulation	Short	\$20,000	PennDOT D8-0, City of Harrisburg, DHS
	9-L	Study to investigate feasibility of pedestrian bridge between parking garage and capital complex.	Pedestrian safety and circulation	Long	\$75,000	TCRPC, City of Harrisburg, PennDOT D8-0
	9-M	Leading Pedestrian Interval	Pedestrian safety and circulation	Immediate	\$1,000	PennDOT D8-0, City of Harrisburg
7th Street Midblock Crosswalk (between State Street and Forster Street)	10-E	Restripe crosswalks as continental style	Pedestrian safety	Short	\$11,000	City of Harrisburg, PennDOT D8-0
	10-F	Extend western curb to shorten crossing	Pedestrian safety	Mid	\$40,000	City of Harrisburg, PennDOT D8-0
	10-G	Install pedestrian-actuated RRFB	Pedestrian safety	Mid	\$30,000	City of Harrisburg, PennDOT D8-0

State Street at 7th Street	10-D	Install flexible bollards to delineate right-turn and left-turn lanes on WB approach of bridge, advance pavement markings and signage	Crash reduction	Short	\$11,000	PennDOT D8-0, City of Harrisburg, SHPO
	10-C	Install optical speed bars	Crash reduction	Short	\$20,000	PennDOT D8-0, City of Harrisburg, SHPO
	10-A	Study to investigate feasibility of roundabout to replace current intersection	Crash reduction	Short-Mid	\$50,000	PennDOT D8-0, City of Harrisburg, SHPO, TCRPC
	10-B	Construct Roundabout	Crash reduction	Short-Mid	\$2,340,000	PennDOT D8-0, City of Harrisburg, SHPO, TCRPC
State Street at Royal Terrace	11-H	Improve signage for Royal Terrace turning movements	Crash reduction	Immediate	\$20,000	City of Harrisburg, PennDOT D8-0
	11-H	Restripe crosswalks as continental style	Pedestrian safety	Short		City of Harrisburg, PennDOT D8-0
State Street at 13th Street	11-A	Install elephant track striping through intersection for State Street approaches	Crash reduction	Short	\$55,000	City of Harrisburg, PennDOT D8-0
	11-A	Restripe crosswalks as continental style	Pedestrian safety	Short		City of Harrisburg, PennDOT D8-0
	11-A	Extend existing median on State Street (EB approach) to provide pedestrian refuge	Pedestrian safety	Mid		City of Harrisburg, PennDOT D8-0
	11-A	Install curb extensions on NE and NW corners	Pedestrian safety	Mid		City of Harrisburg, PennDOT D8-0
	11-A	Reconfigure Intersection, including State Street ramp to use Miller Street/Herrs Lane	Intersection optimization	Mid	\$2,200,000	City of Harrisburg, PennDOT D8-0
State Street at 15th Street	11-D	Restripe crosswalks as continental style	Pedestrian safety	Short	\$38,000	City of Harrisburg, PennDOT D8-0
State Street Bridge	11-G	Upgrade existing pedestrian lighting	Pedestrian safety	Mid	\$125,000	SHPO, City of Harrisburg, PennDOT D8-0
	11-B	Improve separation for pedestrians on bridge (bollards/decorative railings)	Pedestrian safety	Mid	\$55,000	PennDOT D8-0, City of Harrisburg, SHPO
State Street Corridor	11-E	Corridor study to advance boulevard concept	Corridor optimization	Short	\$75,000	City of Harrisburg, PennDOT D8-0, TCRPC, Penbrook Borough
	11-F	Lane reduction treatment for State Street	Corridor optimization	Mid	\$1,360,000	PennDOT D8-0, City of Harrisburg
	11-C	Install programmable traffic signals	Crash reduction	Mid	\$25,000	PennDOT D8-0, City of Harrisburg
	11-G	Lighting improvements within segment	Crash reduction	Mid	\$125,000	PennDOT D8-0, City of Harrisburg
	11-J	Corridor Restriping	Pedestrian safety, circulation, crash reduction	Short	\$120,000	PennDOT D8-0, PennDOT D8-0, TCRPC, Penbrook Borough
	11-K	Boulevard Concept	Pedestrian safety, circulation, crash reduction	Mid	\$725,000	PennDOT D8-0, PennDOT D8-0, TCRPC, Penbrook Borough
	11-L	Leading Pedestrian Interval	Pedestrian safety and circulation	Immediate	\$5,000	PennDOT D8-0, City of Harrisburg

Proposed for Project Implementation TIP
Line Item: **\$293,000**