JOHNSON TROLLEY LINE MISSING LINK

FEASIBILITY STUDY

FINAL REPORT
JUNE 2014

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

TOWNSHIP of LAWRENCE

PARSONS BRINCKERHOFF

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Introduction

The Interstate 95 (I-95) corridor presents a significant barrier to north/south travel through Lawrence Township, particularly to bicyclists and pedestrians. The four-lane limited access Interstate highway bisects the partially refurbished Johnson Trolley Line, to create sections north and south of the interstate. As a result, access for pedestrians and bicycles between the township's residential areas, schools, villages, main street centers, Rider University, and numerous parks and community amenities is severely constrained. Within the study area, only U.S. Route 206 provides north-south access across the highway via an overpass, but its right-of-way and connections to adjacent roadway facilities present numerous constraints to bicyclists and pedestrians, including limited shoulders, sidewalk and crosswalk gaps, high travel speeds, large trucks, heavy traffic volumes, and vehicle merging and weaving movements at the I-95 interchange. And it is exactly these constraints – in particular high travel speeds, and exposure to large trucks and heavy traffic volumes – that are often cited as impediments to achieving higher levels of biking and walking.

In addition to the local context and providing an off-road alternative to U.S. Route 206, the Johnson Trolley Line is also a part of a larger, regional off-road multi-use trail system, including the Lawrence-Hopewell Trail and the D&R Canal Tow Path Trail. The missing link between the northern and southern sections of the Johnson Trolley Line over I-95 is a critical gap in the regional network. The regional trail system is illustrated in Figure 1.

To address this need, Lawrence Township, with funding from a Delaware Valley Regional Planning Commission (DVRPC) grant, retained Parsons Brinckerhoff to conduct a feasibility study to evaluate engineering alternatives for connecting the northern and southern sections of the Johnson Trolley Line. This report summarizes the findings of the study, including public involvement activities, evaluation of existing conditions, and feasibility analysis of alternatives.

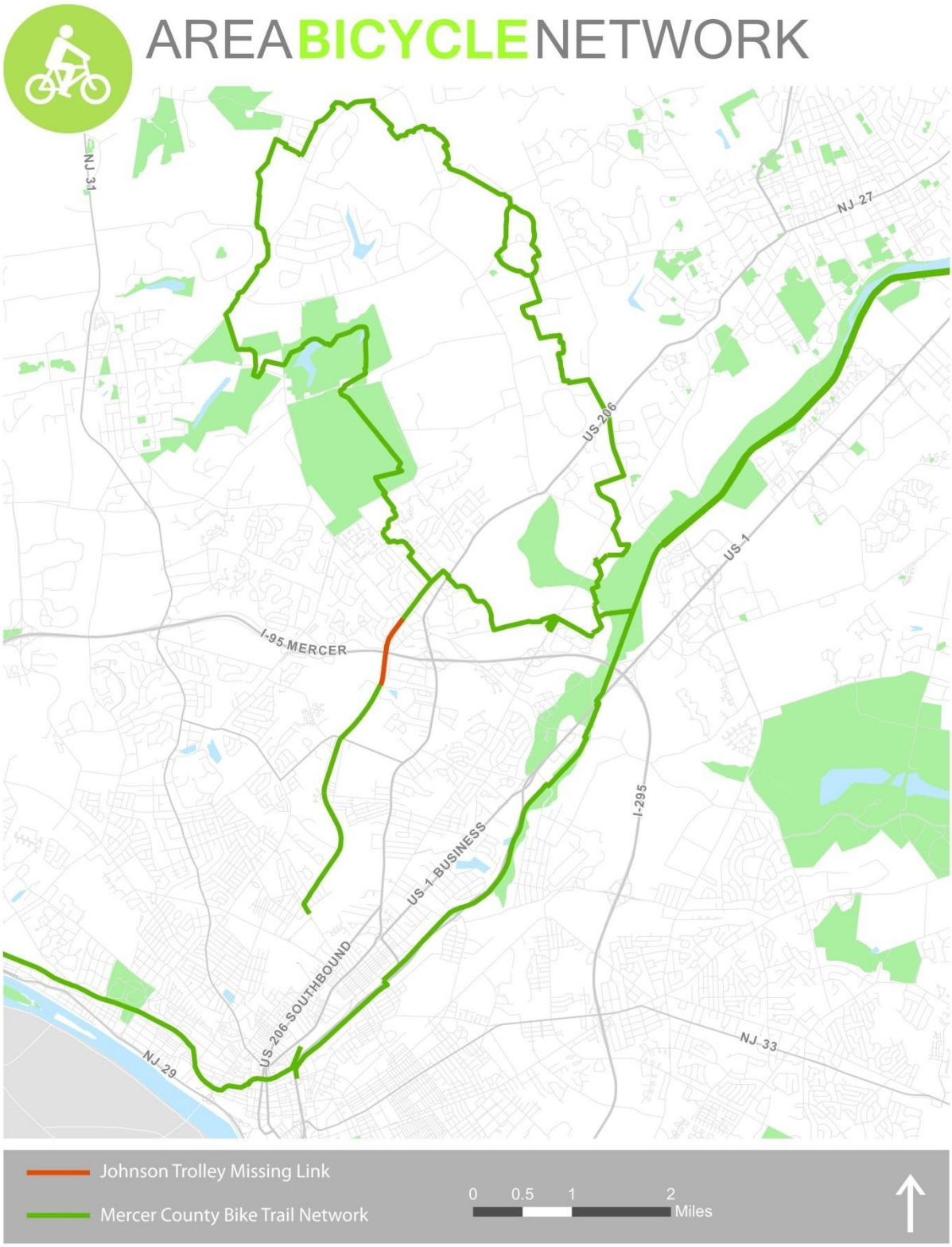


Figure 1: Area Bicycle Network

Public Involvement

An important element of the study was the involvement of local stakeholders and decision makers, who provided important information and feedback at key points along the way. Local input was primarily provided through two methods: a steering advisory committee (SAC) and a public information center (PIC).

A steering committee comprising local stakeholders and decision makers from local, regional, and state agencies provided guidance and feedback throughout the study. The SAC included representatives from Lawrence Township (engineering department, town government), local advocates (Main Street, Friends of Lawrence Greenways), Rider University, DVRPC, Mercer County Engineering and Planning, and the New Jersey Department of Transportation (NJDOT). The group met formally on two occasions to provide feedback at key milestones:

- Meeting 1: October 22, 2013 – Kick-off meeting to discuss study objectives and purpose, discuss findings of preliminary field assessments, and discuss preliminary concepts for further investigation.
- Meeting 2: February 24, 2014 – Presentation and discussion of several design alternatives, including strengths, constraints, and cost estimates.

A PIC was held on May 28th, 2014, from 4:00pm – 6:00pm. The PIC provided an open forum for all residents, stakeholders, and concerned citizens to learn about the study and provide input. The event was held at the Lawrence Municipal Building and advertised in the local paper, town website, and through email to various stakeholder groups. Approximately 40 people attended the PIC. During the PIC, the project team displayed a series of four boards illustrating site constraints, the four design options that were evaluated during the study, and comparing the cost estimates for each option. A PowerPoint presentation also ran continuously, providing additional information. The project manager also gave an informal presentation in order to provide some background information on the study and give an overview of the study purpose, methodology, and findings. Six members of the project team were available to discuss the study and answer questions throughout the open-house period. Materials from the public involvement efforts can be found in Appendix A.

Figure 2: Public Information Center, May 28th, 2014

Existing Conditions

This section documents existing on-street conditions for bicyclists and pedestrians within the study area, with particular emphasis on the connection between the existing southern section of the

Johnson Trolley Line terminating at Eggerts Crossing Road with the northern section terminating at Denow Road. The study area is illustrated in Figure 3. This section also recommends potential future improvements to the street network for bicyclists and pedestrians as part of a No Build scenario. Should the trail system improvements that are the focus of this study not advance, these options may be investigated in more detail in future studies.

Several alternatives are under consideration that would provide direct and convenient access between the northern and southern portion of the Johnson Trolley Line via a new trail crossing of Interstate 95. These alternatives are discussed in the next section.

Figure 3. Study Area Map.

Crash Analysis

Parsons Brinckerhoff (PB) evaluated crash data for the study area available through the Plan4Safety database. The data analysis includes crashes from 2006-2012, as well as the first half of 2013 (a full year of data is typically not available until the following mid-year).

Nine crashes occurred during the analysis period – six pedestrian crashes and three bicyclist crashes. One of the pedestrian crashes was fatal. Five of the crashes (three pedestrian and two bicyclist crashes) occurred in the vicinity of the intersection of U.S. Route 206 and Eggerts Crossing Road. One bicyclist crash also occurred at the I-95 and U.S. Route 206 interchange. The fatality occurred at the intersection of U.S. Route 206 and Oaklyn Terrace. The location of pedestrian and bicycle crashes are shown in Figure 4.

Three of the crashes occurred at intersections, while the remainder occurred away from the intersections. Five of the nine crashes, including the fatality, occurred during dark conditions. Contributing circumstances leading to the crashes included driver inattention (five), failed to yield right of way to vehicle/pedestrian (one), failed to obey traffic control device (one), and wrong way bicycling (one). Among the vehicles involved in the crashes, three were making a left turn, three were going straight ahead, two were a making right turn (not turn on red), and one was making a right turn on red at the time of the crash. Each of the three bicyclists involved in crashes was going straight ahead at the time of the crash. Among the pedestrians, one was crossing at an unmarked crosswalk.

The crashes involved a range of age groups. Three of the six pedestrians involved in the crashes were senior citizens, including the fatality. Among the bicyclists, two were young people (ages 14 and 16).

Existing Conditions

Eggerts Crossing Road

Pedestrian Facilities

Eggerts Crossing Road has a complete sidewalk network in both the eastbound and westbound direction. The sidewalks are generally in good condition and the width is four feet. Minor crossings of side streets are typically striped and have ADA-compliant curb ramps. Pedestrian crossings of Eggerts Crossing are provided at the Johnson Trolley Line trail crossing and the Lawrence Intermediate School. The crossings include high-visibility ladder crosswalk striping and pedestrian refuge islands to calm traffic and shorten the pedestrian crossing. There is no pedestrian scale lighting along the corridor. Corridor lighting is typically provided intermittently via utility pole-mounted fixtures along the eastbound side, oriented over the travel lanes. Lighting is provided at the Johnson Trolley Line trail crossing and at most intersections.

A lack of pedestrian scale corridor lighting is the main pedestrian deficiency along this segment of the study area.

Bicycle Facilities

Eggerts Crossing Road is bicycle compatible, based on NJDOT's bicycle compatibility guidelines. The roadway is two lanes with a 40 mph speed limit and an annual average daily traffic (AADT) of 8,272 vehicles. Lane widths are typically 12 feet with a 5 foot shoulder. The shoulder drops out approximately 300 feet west of the intersection at U.S. Route 206 in order to accommodate separate left and right turn lanes.

U.S. Route 206

Pedestrian Facilities

U.S. Route 206 has a complete sidewalk network along the southbound side of the roadway, providing a continuous walking path through the study area. Along the northbound side, there is no sidewalk north of Skillman Avenue, with the exception of a short section near Vanderveer Avenue. The sidewalks are generally in good condition and the width is four feet. Minor crossings of side streets are typically striped and have ADA-compliant curb ramps. The signalized intersection at Darrah Lane includes pedestrian signal heads with countdown timers and pedestrian push buttons, ADA-compliant curb ramps, a standard striped crosswalk for the U.S. Route 206 crossing, and a high visibility ladder crosswalk for the Darrah Lane crossing.

At the interchange with I-95, pedestrian crossings have been upgraded recently to current standards. Crosswalks with standard striping, ADA-compliant curb ramps, and pedestrian crossing signage (W11-2) are provided at the four ramp crossings along the southbound side. The crossings are positioned at locations that maximize visibility to on-coming drivers and minimize vehicle speed. The crosswalks are also striped perpendicular to the roadway, minimizing pedestrian crossing time and exposure.

There is no pedestrian scale lighting along the corridor. Corridor lighting is limited. It is provided via cobra-style light fixtures along the northbound and southbound approaches of the I-95 interchange and along both sides of U.S. Route 206 at the I-95 interchange. There is no light fixture in the vicinity of the pedestrian crossing of the I-95 eastbound off-ramp. South of the interchange, lighting is provided via utility pole-mounted fixtures and is more sporadic south of Rider University.

A lack of pedestrian scale lighting is the main pedestrian deficiency along this segment of the study area.

Bicycle Facilities

U.S. Route 206 is typically not bicycle compatible, based on NJDOT's bicycle compatibility guidelines, due to high traffic volumes and speeds and discontinuous shoulder facilities that could be used by bicyclists. Throughout the majority of the study area, the roadway has a 40 mph speed limit and AADT of 16,283. South of Skillman Avenue the speed limit is 35 mph. The speed limit was reduced in 2012 in response to pedestrian safety concerns and crash history, particularly in the vicinity of the intersection at Eggerts Crossing Road. The cross-section varies along the corridor:

- Between Eggerts Crossing Road and Reeder Avenue, the roadway has two 12-foot lanes and a 10-foot shoulder in the northbound direction. This section is therefore not bicycle compatible in the southbound direction.

- Between Reeder Avenue and West Long Drive, U.S. Route 206 is typically two 12-foot lanes with a striped median/left-turn lane and no shoulders. This section is therefore not bicycle compatible.
- Between West Long Drive and the south side of the I-95 overpass, U.S. Route 206 is four 12-foot lanes with no shoulders. This section is therefore not bicycle compatible.
- Between the I-95 interchanges and Franklin Corner Road, U.S. Route 206 is typically a median divided roadway. The roadway varies between two lanes with a shoulder and two travel lanes with two turning lanes. This section is therefore not bicycle compatible. Although the shoulder is sufficiently wide, it is intermittent and the merging interchange traffic creates a stressful environment for bicyclists.

At the intersection with Franklin Corner Road/Lawrenceville-Pennington Road, northbound bicycle traffic traveling to the northern portion of the Johnson Trolley line would need to make a left-turn via the jug-handle configuration.

Lawrenceville-Pennington Road (CR 546)

Pedestrian Facilities

Lawrenceville-Pennington Road has a sidewalk along the eastbound side only between U.S. Route 206 and Denow Road. It alternates between a concrete sidewalk adjacent to the roadway at the intersection with U.S. Route 206, and an asphalt path set back from the roadway closer to Denow Road. There is no sidewalk west of Denow Road to reconnect with the Johnson Trolley Line.

There is no crosswalk at the crossing of Denow Road. At the intersection with U.S. Route 206, there is a crosswalk at the northbound approach only.

Lighting along this portion of the corridor is poor. There is no pedestrian scale lighting, and minimal corridor street lighting. There are two utility pole-mounted fixtures between U.S. Route 206 and Denow Road, and one utility pole-mounted fixture between Denow Road and the Johnson Trolley Line trail.

Bicycle Facilities

Lawrenceville-Pennington Road is bicycle compatible, based on NJDOT's bicycle compatibility guidelines. The roadway is two lanes with a speed limit of 35 mph and daily traffic volume of approximately 5,200 vehicles. Pavement width is typically 32 feet, with 12-foot lanes and 4-foot shoulders, although the shoulder striping is variable.

Conclusions

The existing on-street route to connect the existing northern and southern segments of the Johnson Trolley Line trail system is inconvenient, as it adds approximately 1 mile to the trip distance for bicyclists and pedestrians. Existing infrastructure along the roadways is also inadequate for the bicycle and pedestrian activity. Some sections of the roadway network are bicycle compatible and pedestrian accessible while others are not. In the existing condition, the main pedestrian deficiency is an approximately 900 foot gap in the sidewalk network connecting the northern leg of the existing Johnson Trolley Line to Denow Road, as well as a lack of a crosswalk at Denow Road. For bicyclists, the existing infrastructure creates a stressful environment due to conditions along U.S. Route 206.

The roadway lacks sufficient on-street facilities to adequately accommodate bicyclists. While there are intermittent shoulders along the study area, the existing shoulder facilities do not provide a continuous network for bicyclists. The high traffic volumes, high number of heavy vehicles, high traffic speeds, and high volume of merging and weaving traffic at the I-95 interchange create difficult conditions for bicyclists. Additionally, for northbound bicyclists, the left-turn from U.S. Route 206 to Lawrenceville-Pennington Road requires the use of a jug-handle, which increases the trip distance for bicycle traffic.

The existing conditions deficiencies are summarized in Figure 4.

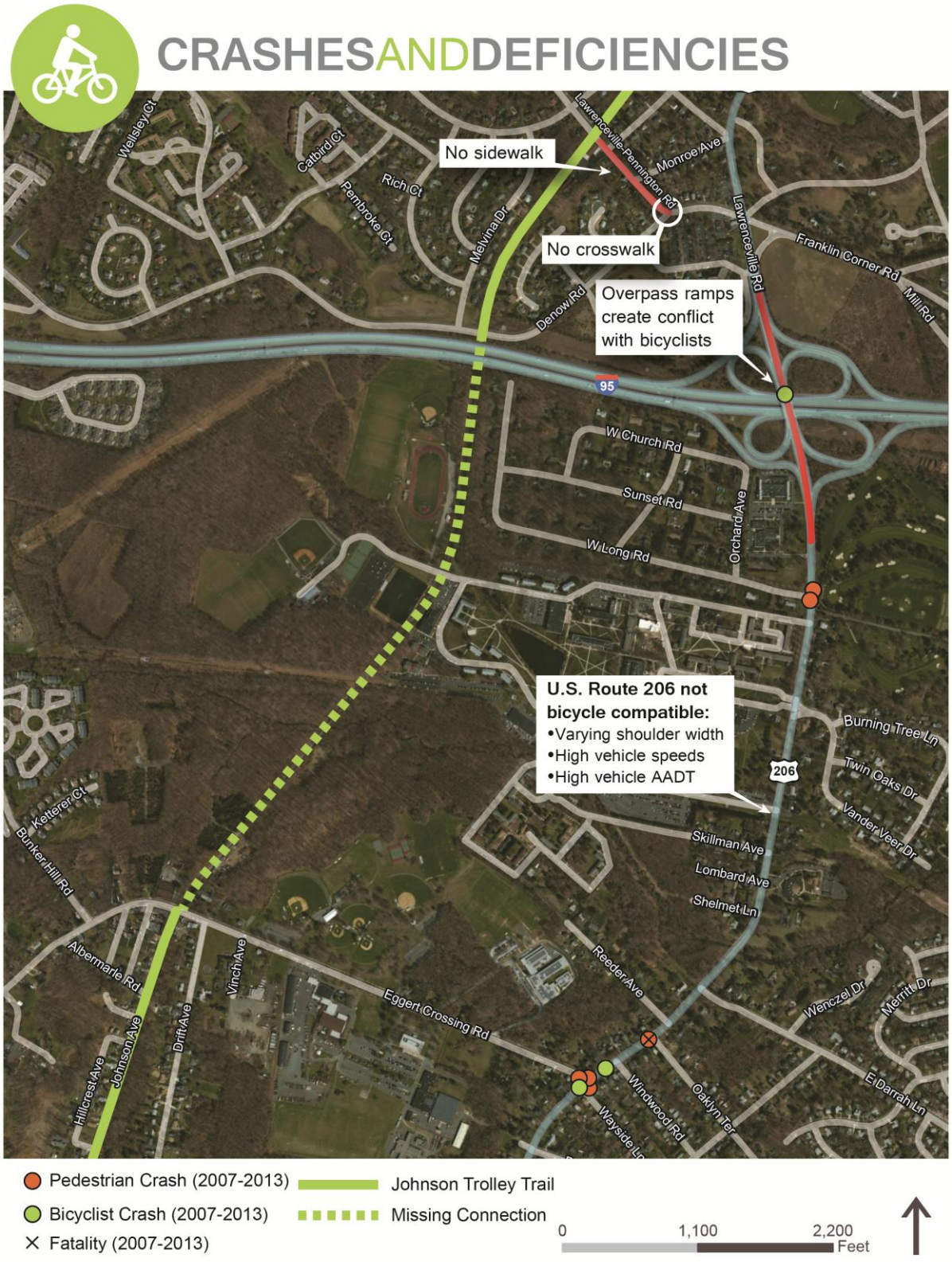


Figure 4. Crashes and Existing Bicycle and Pedestrian Deficiencies.

Potential Future Roadway Improvements

In the No Build Scenario, where no improvements are made to the trail system that would directly and conveniently connect the northern and southern legs of the Johnson Trolley Line, some improvements can be made to the on-street network to improve conditions for bicyclists and pedestrians. Should the trail system improvements that are the focus of this study not advance, the following potential improvements are generally low to medium cost options that may be investigated in more detail in future studies.

Pedestrian improvements:

- Install high visibility crosswalk, trail crossing signage (W11-15), and pedestrian refuge island at the intersection of the Johnson Trolley Line trail and Lawrenceville-Pennington Road
- Install sidewalk along Lawrenceville-Pennington Road eastbound, from the Johnson Trolley Line trail to Denow Road
- Install crosswalk and ADA-compliant curb ramps at northbound leg of Lawrenceville-Pennington Road/Denow Road

Bicyclist improvements:

- Convert shoulder on Eggerts Crossing Road to bike lane
- Convert shoulder on Lawrenceville-Pennington Road to bike lane
- Investigate alternatives to re-configure the U.S. Route 206 corridor and I-95 interchanges to improve bicycle access and mobility.

The improvement concepts are summarized in Figure 5.

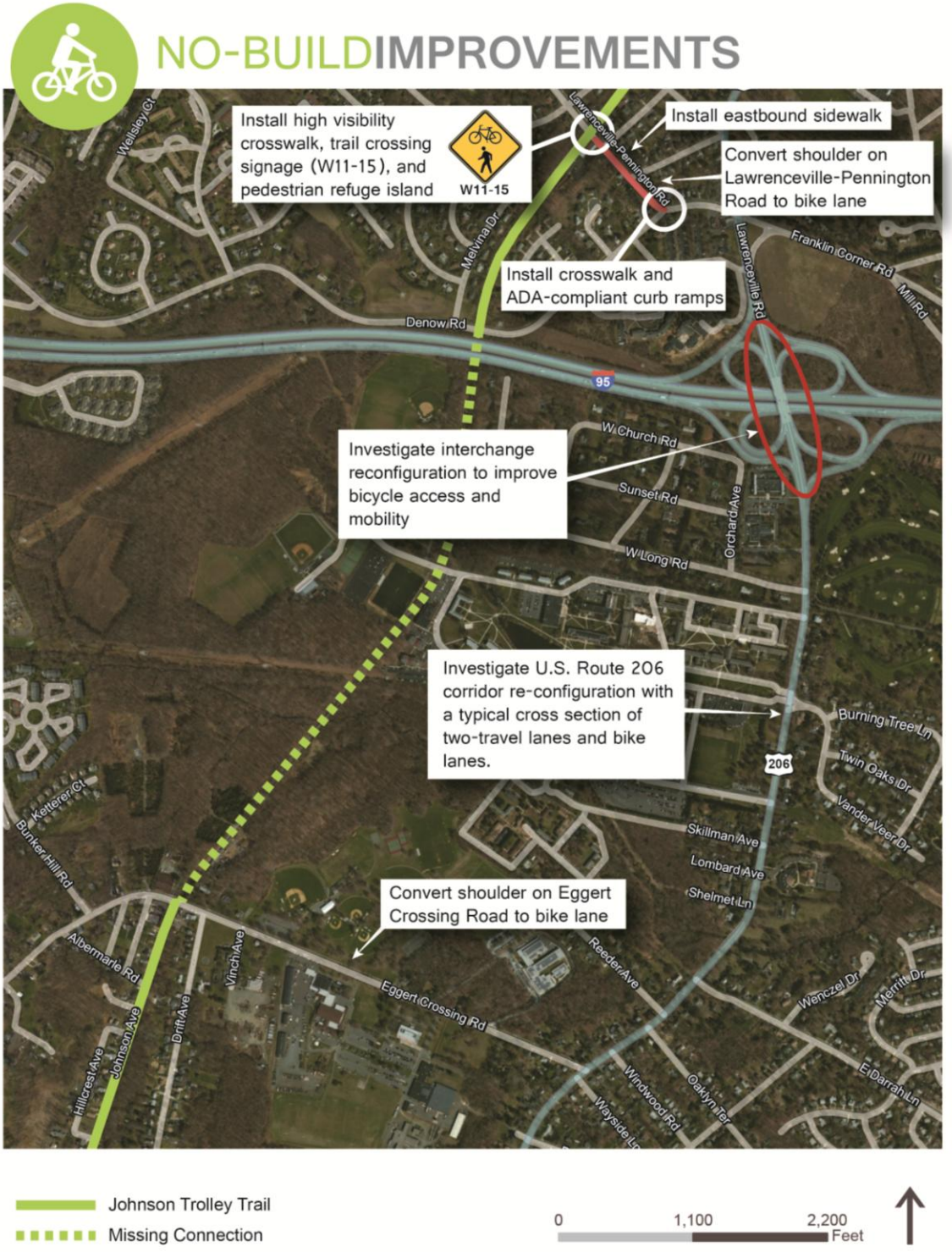


Figure 5. No Build On-Street Bicycle and Pedestrian Improvements.

Design Considerations

Before developing alternatives, it is necessary to provide an overview of the constraints, design considerations, and standards applied to the development of the alternatives. This section documents constraints including right-of-way, utilities, environmental factors, geotechnical concerns, and future land use plans.

Right-of-Way

The Johnson Trolley right-of-way is approximately 50 feet wide. The southern segment of the study area being evaluated is approximately 1,700 feet long, extending from Rider University at the south to Interstate 95 at the north. This portion of the right-of-way parcel is bounded by a single parcel owned by Rider University to the west, currently used for athletic fields and a solar panel array, and by seven separate parcels to the east, currently occupied by single family homes. New Jersey Department of Transportation (NJDOT) right-of-way abuts the Johnson Trolley parcel to the north.

The northern segment of the study area abuts the NJDOT right-of-way along I-95 and extends approximately 500 feet north from Denow Road. To the west, this segment is bounded by a utilities parcel for approximately 150 feet from Denow Road, followed by single family residential properties extending north. Similarly, the east side is bounded by a utilities parcel for approximately 310 feet from Denow Road, followed by single family residential properties extending north.

Utilities

Utilities represent a significant constraint within the study area. Overhead or aerial utilities consist of high tension transmission lines, pole-height wires of varying voltages, and pole-height cable and phone lines.

Aerial Utilities

The Public Service Electric and Gas Company (PSEG) owns and operates numerous aerial power lines throughout the study area. A high-voltage transmission tower lies to the north of Denow Road with transmission lines running east-west through the study area. The lowest wires are approximately 80 feet above ground level at the Johnson Trolley right-of-way. However, due to the high-voltage nature of transmission wires, radial clearance of 45 feet or more between the electric wire and the highest elevation point of any potential structure (i.e., the top of the fence) may be required.

In addition to the high-tension pole and power lines, there are numerous other pole-height utility wires in the study area, including wires which cross Interstate 95 at roughly the same point as a potential trail crossing structure. Utilities are shown in Figure 6.

Figure 6. Site Constraints.

Construction work in and around overhead electric lines must comply with applicable sections of the Occupational Safety and Health Administration (OSHA) , National Fire Protection Association (NFPA) National Electric Code, National Electrical Safety Code, and State and local codes. Equipment operating near energized lines should maintain clearance as noted in Table 1:

Table 1: Minimum clearances for electric wires

Wire Voltage (kV)	Clearance (feet)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1000	45
Over 1000	As established by utility owner

Source: Occupational Safety and Health Administration (OSHA)

Environmental

Existing Conditions

The study area includes areas of known wetlands on both the north and south side of Interstate 95. These wetland areas are comprised of mixed scrub/shrub wetlands and deciduous wooded wetlands. During design, wetlands should be delineated so that design can avoid and mitigate impacts as needed.

A review of the New Jersey Department of Environmental Protection (NJDEP) Landscape Project indicates documented habitat within the study area for Great Blue Heron (*Ardea Herodias*) and Cooper's Hawk (*Accipiter Cooperii*), both of which are species of special concern.

A stream traverses the study area lengthways along the parcel south of Interstate 95, known as an unnamed tributary of the Little Shabakunk Creek. Any potential trail would need to be constructed above the flood hazard area design elevation. The stream generally runs along the western side of the right-of-way, parallel to the former railroad bed. Any potential trail would need to cross the stream towards the south end of the study area near the Rider University Access Road. Bridge abutments from the former railroad bridge still remain at the stream crossing.

South of Interstate 95, an additional unnamed stream traverses the eastern edge of the study area between the former railroad bed and the adjacent residential parcels. Any potential trail would need to be constructed above the flood hazard area design elevation.

The stream constraints are illustrated in Figure 6.

Permit Requirements

During the next phase, the drainage areas for the unnamed streams will need to be determined in order to determine permitting requirements. An NJDEP freshwater wetlands permit under the

Freshwater Wetlands Protection Act (NJAC 7:7A) would likely be required to construct the trail in areas where the wetlands are impacted.

There are no mapped FEMA floodplains in the project area; however, determining the streams' drainage area is required to verify that flood hazard regulations are not triggered. If triggered, a permit to satisfy the Flood Hazard Area Control Act (NJAC 7:13-11.8) would be required for impacts to flood hazard area and riparian zone associate with the unnamed tributary near the south end of the parcel.

During the permit process, consultation would likely be needed with the NJDEP Bureau of Non-Game Species Natural Heritage Program and United States Fish and Wildlife Service Information, Planning and Conservation system to identify any potential threatened or endangered species within the study area.

Stormwater requirements may also be triggered by the proposed improvements if the improvements disturbs more than one acre of ground and/ or adds more than 0.25 acres of new impervious. One way to minimize stormwater impacts would be by utilizing a best management practice (BMP) such as porous pavement. Porous pavement reduces the quantity of stormwater runoff leaving a project site; but BMPs such as porous pavement require periodic maintenance so that they can continue to operate efficiently.

Geotechnical Conditions

Based on existing boring information available on the NJDOT GDMS online boring database, soil types in the study area can generally be categorized as approximately three to five feet of cohesive soil overlying approximately four to eight feet of decomposed rock. Weathered bedrock can generally be found at a mean elevation above sea level of 102' to 105', and consisted of shale and sandstone. In order to limit the area of disturbance needed to construct the structure foundations in the median and adjacent to Interstate 95, drilled shaft foundations were selected as the preferred foundation type for any potential trail structure.

Groundwater is present throughout the study area at a mean elevation above sea level of approximately 110' based on the existing boring information available. The varied terrain conditions result in groundwater reaching near the existing ground surface in some portions of the study area, particularly south of Interstate 95, and remaining at an approximate depth of up to six or eight feet in other portions of the study area. The relatively high groundwater table severely constrains any construction below grade. One of the preliminary trail crossing alternatives featured a tunnel under Interstate 95, but this option would require pumping to remove stormwater and was therefore eliminated from consideration.

Land Use

The Delaware River Joint Toll Bridge Commission (DRJTBC) has conducted an Environmental Assessment effort to evaluate the impacts of a replacement bridge on Interstate 95 over the Delaware River. These long term plans could potentially lead to a subsequent project to widen Interstate 95 from three lanes in each direction to four or five lanes in each direction through the study area. A new bicycle-pedestrian overcrossing should maximize buffer space around the existing

Interstate 95 facility to avoid narrowing the Interstate 95 right-of-way width and constraining potential future roadway expansion.

Alternatives

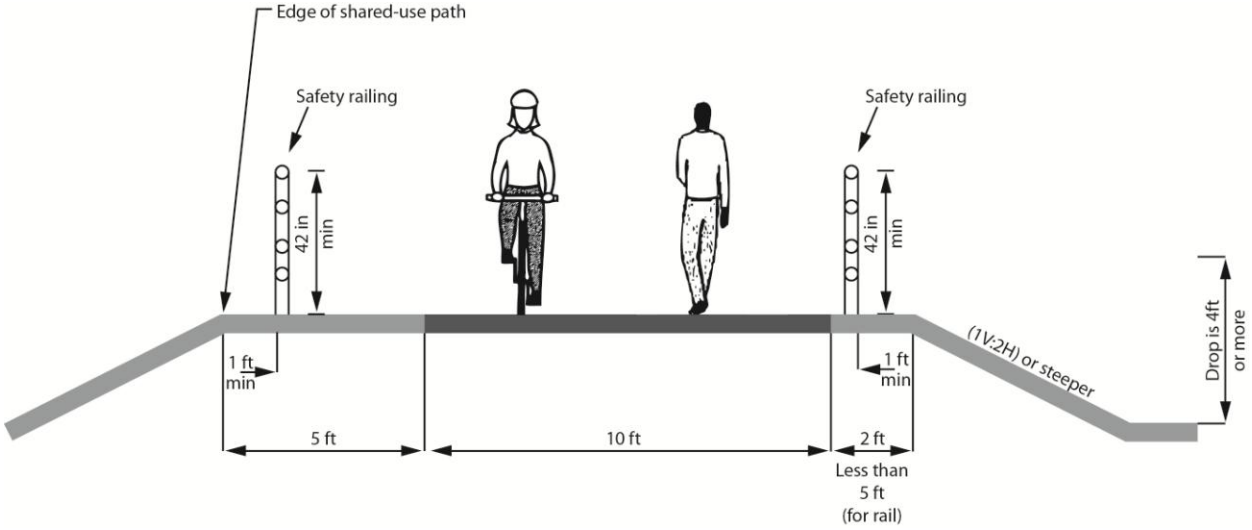
This section presents alternatives for connecting the two sections of existing trail that are currently bisected by the I-95 corridor.

Option 1: Interim Trail Improvements Connecting Through West Long Drive

Description

Option 1 involves extending the southern portion of the Johnson Trolley Line Trail to Interstate 95. To reduce capital costs, rather than construct a bicycle and pedestrian bridge over I-95, the trail would turn right south of I-95 and run parallel to the I-95 right-of-way to the West Long Drive cul-de-sac, where it would connect to the local street network.

Option 1 would involve construction of approximately 1,830 feet of trail, including clearing, excavation and grading, erosion control, and landscaping. The trail would be ten feet wide and surfaced with pervious pavement. The trail would utilize the existing former railroad bed, which is elevated approximately four feet above the surrounding grade. The typical trail cross section would have a five-foot vegetated buffer on one side and a two-foot buffer on the other side. A safety rail would run along both sides. The conceptual typical trail cross section is illustrated in Figure 7. Proposed Typical Trail Cross Section.Figure 7, and would be typical of trail construction in each of the proposed alternatives.



Source: AASHTO Guide for the Development of Bicycle Facilities, with modification

Figure 7. Proposed Typical Trail Cross Section.

The trail section would require two short prefabricated steel pedestrian bridges – one for a stream crossing at the south end of the trail extension in the vicinity of the Rider University Access Road and one to cross an open culvert area near I-95 connecting the Johnson Trolley Line to West Long Drive. The bridges would be approximately 50 feet long, have a width of eight feet, and would be similar to

the structure recently installed along the Johnson Trolley Line Trail segment between Eggerts Crossing Road and Rider University.

This option completes the missing trail segment between the Rider University Access Road and I-95, which is a critical component of any of the structural alternatives. Should a structural improvement alternative not be advanced at this time, this option would lay the ground work for future bridge construction by providing the required trail connection.

The proposed configuration of the trail extension is shown in Figure 8.

Figure 8: Option 1 Lay-out.

Feasibility Assessment

This option has few barriers to implementation. Because the option involves predominantly on-ground trail work and no raised structures in the vicinity of the existing utilities, the trail can be constructed around the utilities and there are no expected utility impacts. Option 1 involves two stream crossings. The stream crossing in the vicinity of the Rider University Access Road is a part of any Build Scenario, while the stream crossing near I-95 is related to connecting the trail to West Long Drive.

The main benefits to Option 1 are:

- Extends the off-road trail network, connecting trail users from Eggerts Crossing Road to I-95, where they are routed to U.S. Route 206 via a low volume, low speed residential roadway. This option thereby reduces the distance trail users, and bicyclists in particular, must travel on U.S. Route 206 to connect to the northern segment of the Johnson Trolley Line.
- Improves the southern segment of the Johnson Trolley Line trail approach for potential future bridge improvement options.
- Lower cost than I-95 bicycle and pedestrian bridge construction options.

Weaknesses to Option 1 include:

- Routing users through West Long Drive creates a somewhat circuitous route for north/south traffic, increasing trip distance by approximately 0.2 miles compared to the existing on-street, No Build alternative.
- Trail users must still utilize the on-street network via U.S. Route 206 to cross I-95 and connect to the northern portion of the Johnson Trolley Line trail. U.S. Route 206 is not bicycle compatible, and its exposure to high travels speeds, high vehicle volumes, and merging and weaving traffic patterns at the I-95 interchange creates a stressful environment for bicyclists.
- Lawrenceville-Pennington Road lacks a sidewalk to connect pedestrian trail users from the Johnson Trolley Line to Denow Road and the existing sidewalk network along U.S. Route 206 southbound.

Cost Estimate

Cost estimates for Option 1 are summarized below in Table 2.

Table 2. Cost Estimates for Option 1 – Interim Trail Improvements Connecting Through West Long Drive

SUMMARY	Option 1 Alternative No. 1, Trail Connecting Through West Long Drive
Earthwork	$165,019
Structures	$174,000
Signing & Striping	$2,000
Incidental Items	$185,306
Utility Relocation by State Contractor	$0
Erosion Control and General Items	$47,320
Landscaping	$80,570
Miscellaneous	$54,625
Construction Sub-Total	*$708,840*

LUMP SUM ITEMS

Item	
Maintenance & Protection of Traffic (5% - 8%)	$35,442
Performance Bond	$7,500
Final Cleanup	$5,000
Progress Schedule	$5,000
Construction Layout	$17,500
Clearing Site	$20,000
Insurance	$5,000
Mobilization (10%)	$80,428
Contingency (Non-Structure, 10%)	$53,484
Contingency (Structures, 20%)	$34,800

Construction Total	***$972,994***

ESCALATION

Years	2
% per year	2.0%
CONSTRUCTION COST ESTIMATE	***$1,012,303***

CONSTRUCTION ENGINEERING	$206,000
CONSTRUCTION CHANGE ORDER CONTINGENCIES	$46,000
UTILITIES RELOCATIONS BY COMPANIES/OWNERS	$0

TOTAL CONSTRUCTION COST	**$1,264,303**

Constructability

This option could be constructed offline (i.e. outside of the I-95 corridor), minimizing work zone and maintenance and performance of traffic (MPT) requirements. Access agreements or permitting would need to be established with Rider University to allow construction access and potentially a staging area for the trail construction activities. Similarly, a construction access point would likely be needed at the West Long Drive cul-de-sac trail connection. Construction impacts from overhead utilities along the Johnson Trolley right-of-way would also be minimal, as the bulk of the work is at grade. OSHA regulations would need to be followed to maintain appropriate clearances from the power lines, particularly when erecting the prefabricated structure at the stream crossing.

Option 2: Existing Alignment with Straight Bridge

Description

Option 2 links the northern and southern sections of the Johnson Trolley Line via a bicycle and pedestrian bridge over I-95. The proposed bridge would follow the Johnson Trolley Line alignment, spanning both I-95 and Denow Road. The total proposed bridge length is 735 feet, composed of seven spans.

The pedestrian bridge over Rt. I-95 will comprise two main spans of full depth prefabricated steel truss (with roofs) crossing over Rt. I-95 traffic lanes and shoulders, one adjacent approach span of full depth prefabricated steel truss (with roof) at each end of I-95 crossing, and several half depth prefabricated steel through truss spans at each end approach. All steel truss members and components will be made from weathering steel that does not require painting for corrosion control, so future maintenance cost can be minimized. Retaining walls support a 75-foot southern approach ramp and a 100-foot northern approach ramp. The main spans allow 17 feet of vertical clearance above I-95. The bridge and approaches provide a 10-foot wide clear path for trail users.

All full depth truss spans with translucent fiberglass roofs (with snow guards) will limit effort for cleaning snow on the pedestrian bridge. The translucent roofs will provide sufficient daylight to the main spans and adjacent approach spans.

Option 2 would also involve improving approximately 1,215 feet of trail on the south side of I-95, running from the Rider University Access Road to the southern bridge approach. Construction work includes clearing, excavation and grading, erosion control, and landscaping. The trail would be ten feet wide and surfaced with compacted stone dust. The trail would utilize the existing former railroad bed, which is elevated approximately four feet above the surrounding grade. The typical trail cross section would have a five-foot vegetated buffer on one side and a two-foot buffer with a safety rail on the other. The trail section would require one short prefabricated steel pedestrian bridge (approximately 50 feet long) for the stream crossing in the vicinity of the Rider University Access Road. The bridge has a width of eight feet and would be similar to the structure recently installed along the Johnson Trolley Line Trail segment between Eggerts Crossing Road and Rider University.

The proposed configuration of the bridge and trail extension is shown in Figure 9.

Figure 9: Option 2 Lay-out.

Feasibility Assessment

Utility constraints are a significant obstacle to implementation. The straight alignment of the bridge follows the former Johnson Trolley Line, which is currently utilized by several aerial utilities. The utility conflicts would require extensive coordination with the utility company, increasing the cost and time of construction. The proposed bridge would require relocating utilities south of I-95, over I-95, and north of I-95, raising the costs by an estimated $690,000, $140,000, and $410,000, respectively.

The main benefits to Option 2 are:

- Creates a direct and convenient off-road connection between the northern and southern segments of the Johnson Trolley Line, effectively completing the missing link of the regional trail system. Total travel distance would be reduced by approximately 1.0 miles compared to the existing on-street, No Build alternative.
- Straightest path and simplest structural design.
- Eliminates an at-grade trail crossing of Denow Road

Weaknesses to Option 2 include:

- Significant utility impacts, adding approximately $1,240,000 to cost estimates.
- Utility impacts extend the construction timeline and require significant additional coordination with utility companies.
- Longest and most expensive structural option.

Cost Estimate

Cost estimates for Option 2 are summarized below in Table 3.

Table 3. Cost Estimates for Option 2 – Existing Alignment with Straight Bridge

SUMMARY	Option 2 Alternative No. 2, Pedestrian Bridge over Denow Rd & I-95, (On Straight Alignment)
Earthwork	$92,670
Structures	$2,916,717
Signing & Striping	$2,000
Incidental Items	$252,235
Utility Relocation by State Contractor	$1,240,000
Erosion Control and General Items	$76,150
Landscaping	$76,950
Miscellaneous	$39,350
Construction Sub-Total	*$4,696,072*

LUMP SUM ITEMS

Item	
Maintenance & Protection of Traffic (5% - 8%)	$375,686
Performance Bond	$27,000
Final Cleanup	$7,500
Progress Schedule	$10,000
Construction Layout	$45,000
Clearing Site	$40,000
Insurance	$10,000
Mobilization (10%)	$521,126
Contingency (Non-Structure, 10%)	$177,936
Contingency (Structures, 20%)	$583,343

Construction Total	***$6,493,662***

ESCALATION

Years	2
% per year	2.00%
CONSTRUCTION COST ESTIMATE	***$6,756,006***

CONSTRUCTION ENGINEERING	$1,095,000
CONSTRUCTION CHANGE ORDER CONTINGENCIES	$258,000
UTILITIES RELOCATIONS BY COMPANIES/OWNERS	$0

TOTAL CONSTRUCTION COST	**$8,109,006**

Constructability

This option would involve bridge construction across the I-95 corridor, where the high speed and high volume of traffic would require significant work zone and MPT coordination to maintain traffic flow and a safe work zone and staging area. The prefabricated steel truss segments can be lifted and erected easily over Rt. I-95 during construction slowdowns around 30 minutes in I-95 off -peak hours. Each truss segment can be fabricated to a manageable weight that may facilitate the erection process and allow smaller equipment to be used.

Construction of the trail extension south of I-95 is offline (i.e. outside of the I-95 corridor), significantly reducing work zone and maintenance and performance of traffic (MPT) requirements for this portion of the project. Access agreements or permitting would need to be established with Rider University to allow construction access and potentially a staging area for the trail construction activities. Similarly, a construction access point would be needed north of I-95 for the trail connection and proposed bridge approach along Denow Road.

Construction impacts from overhead utilities along the Johnson Trolley Line alignment would significantly impact bridge construction over I-95. Coordination with the utility company is required to identify and mitigate utility conflicts. Conflicts are anticipated along the bridge approach north of I-95, along main span crossing I-95, and along the southern bridge approach. OSHA regulations would need to be followed to maintain appropriate clearances from the power lines during bridge construction, both for the I-95 overpass and erecting the prefabricated bridge over the stream crossing at the southern end of the trail extension.

Option 3: Offset Alignment with U-Shaped Bridge

Description

Option 3 links the northern and southern sections of the Johnson Trolley Line via a bicycle and pedestrian bridge over I-95. The proposed bridge is a U-shaped structure with the I-95 crossing offset approximately 310 feet west of the Johnson Trolley Line. The approach ramps would be located along the I-95 right-of-way between I-95 and Rider University and between I-95 and Denow Road. The total proposed bridge length is 642.5 feet, composed of six spans.

The pedestrian bridge over Rt. I-95 will comprise two main spans of full depth prefabricated steel truss (with roofs) crossing over Rt. I-95 traffic lanes and shoulders, one adjacent approach span of full depth prefabricated steel truss (with roof) at each end of I-95 crossing, and several half depth prefabricated steel through truss spans at each end approach. All steel truss members and components will be made from weathering steel that does not require painting for corrosion control, so future maintenance cost can be minimized. Retaining walls support a 100-foot southern approach ramp and a 67.5-foot northern approach ramp. The main spans allow 17 feet of vertical clearance above I-95. The bridge and approaches provide a 10-foot wide clear path for trail users.

All full depth truss spans with translucent fiberglass roofs (with snow guards) will limit effort for cleaning snow on the pedestrian bridge. The translucent roofs will provide sufficient daylight to the main spans and adjacent approach spans.

Option 3 would also involve improving approximately 1,730 feet of trail on the south side of I-95, running from the Rider University Access Road to the southern bridge approach. Construction work includes clearing, excavation and grading, erosion control, and landscaping. The trail would be ten feet wide and surfaced with compacted stone dust. The trail would utilize the existing former railroad bed, which is elevated approximately four feet above the surrounding grade. The typical trail cross section would have a five-foot vegetated buffer on one side and a two-foot buffer with a safety rail on the other. The trail section would require one short prefabricated steel pedestrian bridge (approximately 50 feet long) for the stream crossing in the vicinity of the Rider University Access Road. The bridge has a width of eight feet and would be similar to the structure recently installed along the Johnson Trolley Line Trail segment between Eggerts Crossing Road and Rider University.

North of I-95, improvements will be made at the intersection of Denow Road and the Johnson Trolley Line in order to provide an at-grade crossing between the new structure and the trail, including a high visibility ladder style crosswalk, rectangular rapid flashing beacons (RRFBs), curb ramps, advance warning trail crossing signage (W11-15), and removable bollards to prohibit vehicular trail and bridge access.

The proposed configuration of the bridge and trail extension is shown in Figure 10.

Figure 10: Option 3 Lay-out.

Feasibility Assessment

Utility constraints are a significant obstacle to implementation, though the offset U-shaped design is expected to mitigate many of the utility conflicts present in the straight design. There are no

expected utility conflicts on the north side of I-95 because the bridge approach is located along the I-95 right-of-way and rises to the west, away from the greater concentration of utilities. Some conflicts may remain with the utilities crossing I-95 and several utility poles to the south of I-95 located on the Rider University property in the vicinity of the I-95 right-of-way where the southern bridge approach would be located. Utility impacts are estimated at $140,000 and $230,000 for relocating utilities crossing I-95 and south of I-95, respectively. In the conceptual design layout, the bridge is offset approximately 25-30 feet from the existing utilities south of I-95. Depending on the type of utility line and the voltage carried by the lines, this may be insufficient clearance between the bridge and the electrical lines. Coordination would be required with the utility owner to determine the type of electrical lines and the corresponding clearance required prior to preliminary design. If additional clearance is required, the southern approach spans may be shifted slightly towards I-95.

The main benefits to Option 3 are:

- Creates a direct and convenient off-road connection between the northern and southern segments of the Johnson Trolley Line, effectively completing the missing link of the regional trail system. Total travel distance would be reduced by approximately 0.9 miles compared to the existing on-street, No Build alternative.
- Simple structural design.
- Reduced utility impacts relative to Option 2.

Weaknesses to Option 3 include:

- Larger footprint within I-95 right-of-way
- Requires at-grade crossing of Denow Road

Cost Estimate

Cost estimates for Option 3 are summarized below in Table 4.

Table 4. Cost Estimates for Option 3 – Offset Alignment with U-Shaped Bridge

	Option 3
SUMMARY	Alternative No. 3, U- Shape Pedestrian Bridge over I-95 South of Trail
Earthwork	$123,700
Structures	$2,777,636
Signing & Striping	$22,693
Incidental Items	$418,423
Utility Relocation by State Contractor	$370,000
Erosion Control and General Items	$81,300
Landscaping	$79,070
Miscellaneous	$71,400
Construction Sub-Total	*$3,944,222*

LUMP SUM ITEMS

Item	
Maintenance & Protection of Traffic (5% - 8%)	$315,538
Performance Bond	$27,000
Final Cleanup	$7,500
Progress Schedule	$10,000
Construction Layout	$45,000
Clearing Site	$40,000
Insurance	$10,000
Mobilization (10%)	$439,926
Contingency (Non-Structure, 10%)	$116,659
Contingency (Structures, 20%)	$555,527

Construction Total	***$5,511,372***

ESCALATION

Years	2
% per year	2.00%
CONSTRUCTION COST ESTIMATE	***$5,734,031***

CONSTRUCTION ENGINEERING	$929,000
CONSTRUCTION CHANGE ORDER CONTINGENCIES	$227,000
UTILITIES RELOCATIONS BY COMPANIES/OWNERS	$0

TOTAL CONSTRUCTION COST	**$6,890,031**

Constructability

This option would involve bridge construction across the I-95 corridor, where the high speed and high volume of traffic would require significant work zone and MPT coordination to maintain traffic flow and a safe work zone and staging area. The prefabricated steel truss segments can be lifted and erected easily over Rt. I-95 during construction slowdowns around 30 minutes in I-95 off -peak hours. Each truss segment can be fabricated to a manageable weight that may facilitate the erection process and allow smaller equipment to be used.

Construction of the trail extension south of I-95 is offline (i.e. outside of the I-95 corridor), significantly reducing work zone and maintenance and performance of traffic (MPT) requirements for this portion of the project. Access agreements or permitting would need to be established with Rider University to allow construction access and potentially a staging area for the trail construction activities. Similarly, a construction access point would be needed north of I-95 for the trail connection and proposed bridge approach along Denow Road.

Construction impacts from overhead utilities along the Johnson Trolley Line alignment would significantly impact bridge construction over I-95. Coordination with the utility company is required to identify and mitigate utility conflicts. Conflicts are anticipated primarily along the southern bridge approach. OSHA regulations would need to be followed to maintain appropriate clearances from the power lines during bridge construction, both for the I-95 overpass and erecting the prefabricated bridge over the stream crossing at the southern end of the trail extension.

Option 4: Offset Alignment with Switchbacks

Description

Option 4 links the northern and southern sections of the Johnson Trolley Line via a bicycle and pedestrian bridge over I-95. The proposed bridge has switchback approaches with the I-95 crossing offset approximately 95 feet west of the Johnson Trolley Line. The approach ramps would be located along the I-95 right-of-way between I-95 and Rider University and between I-95 and Denow Road. The total proposed bridge length is 650 feet, composed of eight spans.

The pedestrian bridge over Rt. I-95 will comprise two main spans of full depth prefabricated steel truss (with roofs) crossing over Rt. I-95 traffic lanes and shoulders, one adjacent approach span of full depth prefabricated steel truss (with roof) at each end of I-95 crossing, and several half depth prefabricated steel through truss spans at each end approach. All steel truss members and components will be made from weathering steel that does not require painting for corrosion control, so future maintenance cost can be minimized. Retaining walls support a 95-foot southern approach ramp and a 45-foot northern approach ramp. The main spans allow 17 feet of vertical clearance above I-95. The bridge and approaches provide a 10-foot wide clear path for trail users.

All full depth truss spans with translucent fiberglass roofs (with snow guards) will limit effort for cleaning snow on the pedestrian bridge. The translucent roofs will provide sufficient daylight to the main spans and adjacent approach spans.

Option 4 would also involve improving approximately 1,730 feet of trail on the south side of I-95, running from the Rider University Access Road to the southern bridge approach. Construction work includes clearing, excavation and grading, erosion control, and landscaping. The trail would be ten feet wide and surfaced with compacted stone dust. The trail would utilize the existing former railroad bed, which is elevated approximately four feet above the surrounding grade. The typical trail cross section would have a five-foot vegetated buffer on one side and a two-foot buffer with a safety rail on the other. The trail section would require one short prefabricated steel pedestrian bridge (approximately 50 feet long) for the stream crossing in the vicinity of the Rider University Access Road. The bridge has a width of eight feet and would be similar to the structure recently installed along the Johnson Trolley Line Trail segment between Eggerts Crossing Road and Rider University.

North of I-95, improvements will be made at the intersection of Denow Road and the Johnson Trolley Line in order to provide an at-grade crossing between the new structure and the trail, including a high visibility ladder style crosswalk, rectangular rapid flashing beacons (RRFBs), curb ramps, advance warning trail crossing signage, and removable bollards to prohibit vehicular trail and bridge access.

The proposed configuration of the bridge and trail extension is shown in Figure 11.

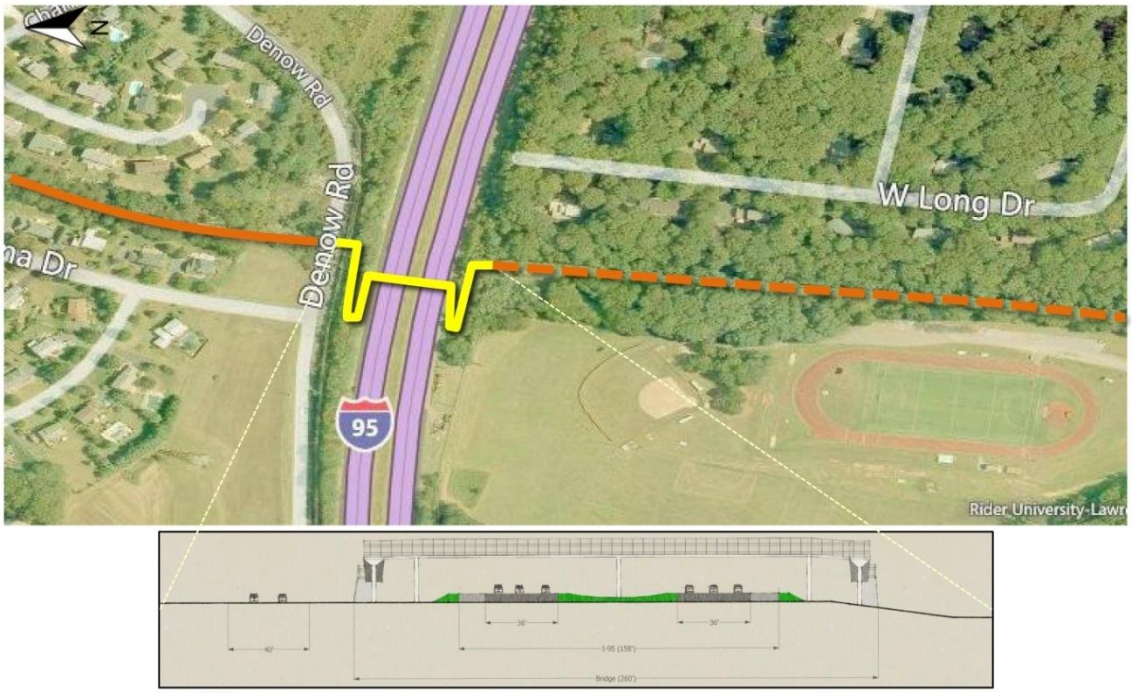


Figure 11: Option 4 Lay-out

Feasibility Assessment

Utility constraints are a significant obstacle to implementation, though the offset alignment and switchback design is expected to alleviate many of the utility conflicts present in the straight design. There are no expected utility conflicts on the north side of I-95 because the bridge approach is located along the I-95 right-of-way and rises to the west, away from the greater concentration of utilities. Some conflicts may remain with the utilities crossing I-95 and several utility poles to the south of I-95 located on the Rider University property in the vicinity of the I-95 right-of-way where the

southern bridge approach would be located. Utility impacts are estimated at $140,000 each for relocating utilities crossing I-95 and south of I-95. In the conceptual design layout, the bridge is offset approximately 25-30 feet from the existing utilities south of I-95. Depending on the type of utility line and the voltage carried by the lines, this may be insufficient clearance between the bridge and the electrical lines. Coordination would be required with the utility owner to determine the type of electrical lines and the corresponding clearance required prior to preliminary design.

The main benefits to Option 4 are:

- Creates a direct and convenient off-road connection between the northern and southern segments of the Johnson Trolley Line, effectively completing the missing link of the regional trail system. Total travel distance would be reduced by approximately 0.9 miles compared to the existing on-street, No Build alternative.
- Reduced utility impacts relative to Options 2 and 3.
- Reduced footprint in I-95 right-of-way relative to Option 3.

Weaknesses to Option 4 include:

- Potential conflict between southern ramp structure and existing utilities due to increased footprint width required by the switchbacks.
- Slightly increased complexity due to switchback design.
- Requires at-grade crossing of Denow Road

Cost Estimate

Cost estimates for Option 4 are summarized below in Table 5.

Table 5. Cost Estimates for Option 4 – Offset Alignment with Switchbacks

SUMMARY	Option 4 Alternative No. 4, Pedestrian Bridge with Switchbacks, South of Trail
Earthwork	$123,700
Structures	$2,717,852
Signing & Striping	$16,693
Incidental Items	$418,423
Utility Relocation by State Contractor	$280,000
Erosion Control and General Items	$81,300
Landscaping	$79,070
Miscellaneous	$71,400
Construction Sub-Total	*$3,788,438*

LUMP SUM ITEMS

Item	
Maintenance & Protection of Traffic (5% - 8%)	$303,075
Performance Bond	$27,000
Final Cleanup	$7,500
Progress Schedule	$10,000
Construction Layout	$45,000
Clearing Site	$40,000
Insurance	$10,000
Mobilization (10%)	$423,101
Contingency (Non-Structure, 10%)	$107,059
Contingency (Structures, 20%)	$543,570

Construction Total	***$5,304,743***

ESCALATION

Years	2
% per year	2.00%
CONSTRUCTION COST ESTIMATE	***$5,519,055***

CONSTRUCTION ENGINEERING	$895,000
CONSTRUCTION CHANGE ORDER CONTINGENCIES	$221,000
UTILITIES RELOCATIONS BY COMPANIES/OWNERS	$0

TOTAL CONSTRUCTION COST	**$6,635,055**

Constructability

This option would involve bridge construction across the I-95 corridor, where the high speed and high volume of traffic would require significant work zone and MPT coordination to maintain traffic flow and a safe work zone and staging area. The prefabricated steel truss segments can be lifted and erected easily over Rt. I-95 during construction slowdowns around 30 minutes in I-95 off -peak hours. Each truss segment can be fabricated to a manageable weight that may facilitate the erection process and allow smaller equipment to be used.

Construction of the trail extension south of I-95 is offline (i.e. outside of the I-95 corridor), significantly reducing work zone and maintenance and performance of traffic (MPT) requirements for this portion of the project. Access agreements or permitting would need to be established with Rider University to allow construction access and potentially a staging area for the trail construction activities. Similarly, a construction access point would be needed north of I-95 for the trail connection and proposed bridge approach along Denow Road.

Construction impacts from overhead utilities along the Johnson Trolley Line alignment would significantly impact bridge construction over I-95. Coordination with the utility company is required to identify and mitigate utility conflicts. Conflicts are anticipated primarily along the southern bridge approach. OSHA regulations would need to be followed to maintain appropriate clearances from the power lines during bridge construction, both for the I-95 overpass and erecting the prefabricated bridge over the stream crossing at the southern end of the trail extension.

Summary

The alternatives described present several options for improving the connection between the northern and southern sections of the Johnson Trolley Line multi-purpose trail. Options range from interim improvements to extend the trail system and route trail users over the existing U.S. Route 206 overpass, to several structural alternatives with varying alignments intended to mitigate utility constraints in the area. A comparison of the cost estimates for each option is shown below in Table 6.

Table 6: Cost Comparison of Design Options

Alternative	Structural		Trail / Grading		Utility Impacts		Mobilization, Contingencies, & Construction Engineering		Other*		Total** (incl. escalation)
	$ (1000s)	(%)	$ (1000s)	(%)	$ (1000s)	(%)	$ (1000s)	(%)	$ (1000s)	(%)	$ (1000s)
Option 1: Interim Trail Improvements	$174	(14%)	$535	(42%)	$0	(0%)	$421	(33%)	$134	(11%)	**$1,264**
Option 2: Existing Alignment	$2,917	(36%)	$539	(7%)	$1,240	(15%)	$2,635	(32%)	$778	(10%)	**$8,109**
Option 3: Offset U	$2,778	(40%)	$797	(12%)	$370	(5%)	$2,268	(33%)	$677	(10%)	**$6,890**
Option 4: Offset Switchbacks	$2,718	(41%)	$791	(12%)	$280	(4%)	$2,190	(33%)	$656	(10%)	**$6,635**

*Other includes: MPT, construction layout, clearing site, etc
**Includes escalation (2 years, 2.0% per year)

Next Steps

With the feasibility study complete, Lawrence Township can work with partner stakeholders, such as FHWA, NJDOT, DVRPC, Mercer County, and local interest groups, to identify potential sources of funding in order to advance one of the alternatives concepts through engineering, design, and construction.