BUFFALO VALLEY RAIL TRAIL – FINAL SECTION FEASIBILITY STUDY

For

Buffalo Valley Recreation Authority

Prepared by:

LARSON DESIGN GROUP
1780 Route 522
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And

BUCKNELL UNIVERSITY
DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING

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TABLE OF CONTENTS

TABLE OF CONTENTS

SUPPLEMENTAL INFORMATION

LIST OF FIGURES AND TABLES

EXECUTIVE SUMMARY

The Buffalo Valley Rail Trail (BVRT) currently runs 9.2 miles between Mifflinburg and Lewisburg. The purpose of this feasibility study is to consider options for an extension of the existing BVRT from its current trailhead on 12th Street, through downtown Lewisburg (via the historic railroad alignment) and across the railroad bridge traversing the West Branch Susquehanna River.

The project team included a Bucknell University Senior Design Team, working closely with Larson Design Group (LDG) staff throughout the spring 2013 semester. LDG was contracted by the Buffalo Valley Recreation Authority (BVRec) to complete preliminary design of the Route 15 to 5th Street section of the trail and conceptual design of the 5th Street through railroad bridge section. A mini grant from the Susquehanna Greenways Partnership was obtained in March of 2013 to fund the preparation of this report for the concept design.

The Buffalo Valley Rail Trail crossing of Route 15 is recommended to be a fully signalized, at-grade crossing with a pedestrian crossing island. Installation of traffic signals is permitted by the successful satisfaction of a warrant defined in the Manual on Uniform Traffic Control Devices. Additionally, the new traffic signal will need to be integrated with the other signals in the corridor. Traffic queuing occurring over the rail trail crossing will also need to be eliminated. The traffic light will operate in a constant green phase until a trail user activates the pedestrian signals. Pedestrians will cross in stages by stopping traffic flow in a single direction and crossing to the crossing island in the middle of the roadway.

St. John Street was analyzed based on six different reconfiguration options. The six different options were analyzed based on bicycle LOS and BCI, parking availability, cost, and safety. Additionally, public opinion was obtained to assist in the decision making process. The final recommendation for St. John Street is Option 1 which provides for a short term, low-cost option with the installation of painted sharrow markings and share the road traffic signs. Long-term, Option 4A/B (for one-way vehicular traffic) and Option 3A/B (for two-way vehicular traffic) are recommended. The final long-term option selection can be made following further study of neighborhood parking and traffic patterns to determine impacts.

The railroad bridge is recommended to be decked with 5 1/8" glued laminated timber panels and the railing system will be constructed of pressure treated lumber. The trail is recommended to be continued for 150 feet on the east side of the bridge to extend the trail to Route 405. This small extension would require PennDOT review and an access easement from a private property owner.

This study determined estimates for construction, with a total probable project cost of $3.29 million. This report includes appendices with a breakdown of project costs based on trail segments reviewed under this Feasibility Study.

1.0 INTRODUCTION

The Buffalo Valley Rail Trail in Union County, PA currently runs on the former West Shore Railroad line. The West Shore Railroad line began as the Lewisburg, Centre & Spruce Creek Railroad, with the intention to run from Montandon to Tyrone in Blair County. After overcoming the challenges of both the Civil War and the St. Patrick's Day flood of 1865, the branch line in Union County began carrying freight and passengers in 1869. In 1879, the incomplete Lewisburg, Centre & Spruce Creek Railroad was reorganized and named the Lewisburg & Tyrone Railroad. Several more reorganizations occurred over the history of the railroad. In 1970 the rail one from Mifflinburg to Coburn was abandoned. In 1983, Conrail sold the line from Montandon to Mifflinburg to the West Shore Railroad Co. The line from Montandon to Lewisburg ceased operations in 1988. The remaining line from Lewisburg to Mifflinburg continued freight and excursion train operations, with a connection to the Lewisburg & Buffalo Creek, until 1997.

In the early 2000's, Union County expressed interest in the purchase or establishment of an easement for potential construction of a rail trail. A rail trail feasibility study was completed in 2003. Utilizing PA Department of Conservation and Natural Resources acquisition funding, the BVRec, then Lewisburg Are Recreation Authority, and the Union County Planning Commission acquired the right of way of the old rail line between Mifflinburg and Montandon in 2009. In November 2011, Phase 1 of the Buffalo Valley Rail Trail was completed, spanning 9.2 miles from 10th Street in Mifflinburg east to 12th Street in East Buffalo Township. BVRec envisions the trail continuing from the current trailhead at 12th Street through the Borough of Lewisburg, passing over the railroad bridge at the West Branch Susquehanna River. This feasibility study focuses on planning and designing the extension of the rail trail from 12th street to the bridge over the West Branch Susquehanna River.

This feasibility study was developed over a six month period and included assistance from an ad-hoc design committee to review the design process, options and public outreach. Meetings with the design committee occurred on:

- January 29th Kick-off meeting
- February 13th Railroad meeting
- February 27th
- March 22nd
- April 26th

Meeting minutes from each of these meeting are attached in Appendix A.

2.0 LOCATION

The Buffalo Valley Rail Trail currently consists of a nine mile stretch between the Boroughs of Mifflinburg and Lewisburg Pennsylvania. The trail exists on the right of way of the former West Shore Railroad Line. This right of way extends across Route 15, through residential neighborhoods of Lewisburg to the railroad bridge crossing over the West Branch Susquehanna and located just north of the Route 45 Bridge, as shown in Figure 2.1.

Figure 2.1 - Proposed extension from 12th Street in Lewisburg to the bridge across the Susquehanna. (Source data: Google Maps, 2012)

In its entirety, this proposed trail extension runs through two municipalities, which are East Buffalo Township and Borough of Lewisburg. The only section in East Buffalo Township is from the existing trail head to the centerline of Route 15. In order to obtain the data on the municipalities surrounding the trail, census data from 2010 was collected and categorized. This can be seen in Table 1 below.

2010 U.S. Census Data	Lewisburg	East Buffalo	Union County	PA	U.S.
Population	5,792	6,414	44,949	12,702,379	308,745,538
Persons Per Household	1.9	2.51	2.34	2.47	2.59
Households	2,013	2,154	14,963	4,940,581	114,235,996
Median Household Income	$33,101	$67,352	$45,474	$50,398	$51,914

Table 1.1 Demographic Summary (U.S. 2010 Census).

3.0 SCOPE

The scope of this study is to design an extension of the Buffalo Valley Rail Trail in Lewisburg, PA. The current trail is 9.2 miles long and connects Mifflinburg and Lewisburg. The trail will be extended about 1.1 miles into downtown Lewisburg and to the railroad bridge over the West Branch Susquehanna River. A proposal for a Mini-Grant from the Susquehanna Greenway Partnership was granted to BVRec to develop a conceptual design for the rail-trail extension from Fifth Street to the River. The initial work that this design team is performing was used in the mini-grant application. The following information describes the location of the trail extension.

3.1 12th Street – Route 15 Intersection

The first segment of the trail to be designed is from 12th Street, where the current trailhead and restrooms are located, to Route 15. The trail is proposed to follow the existing railroad alignment to Route 15.

3.2 Route 15 Intersection

Three possible locations were considered for the Route 15 intersection are the intersection of St. Mary's Street and Route 15 (1), a crossing at the existing trail alignment (2), and the intersection of Route 45 and Route 15. These three locations can be seen on Figure 3.1.

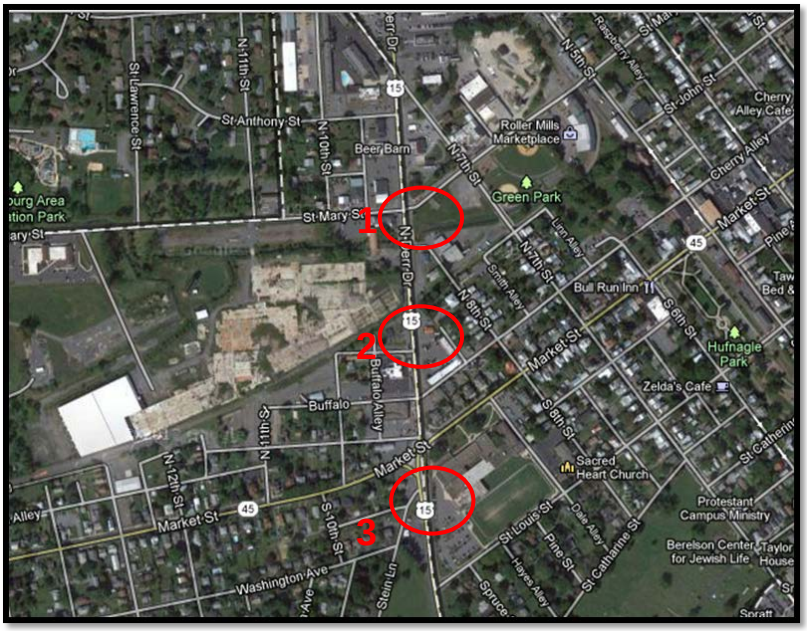


Figure 3.1 - Possible locations of pedestrian crossings across Route 15. (Source data: Google Maps, 2012)

After crossing the intersection, the trail will continue along the previous railroad right-of-way (ROW), crossing 8th Street, and running adjacent to Green Alley. The trail will cross over Limestone (Run) Run where an existing railroad bridge currently exists. Then the trail will cross 5th Street and along St. John Street for five blocks until the intersection of St. John Street and Water Street, where it will continue toward the abandoned railroad bridge. The scope of this extension project will end at the east side of the railroad bridge.

3.3 Route 15 to 5th Street

Between Route 15 and 5th street the trail will follow the alignment of the original railroad tracks until the bridge over Limestone (Bull) Run and then extend directly to St. John Street as show in Figure 3.2.

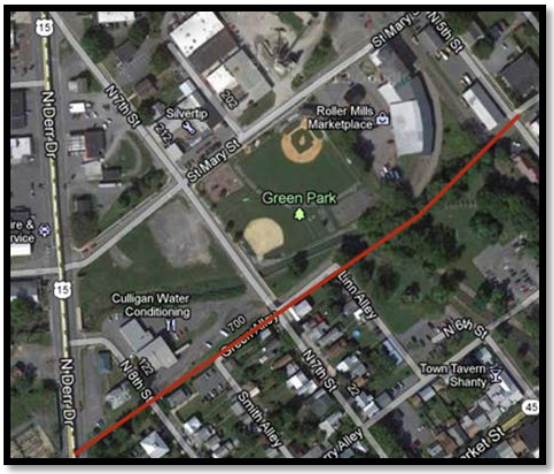


Figure 3.2 - Proposed extension from Route 15 to 5th Street. (Source data: Google Maps, 2012)

3.4 Extension to Market Street

This section of the trail will be a spur off of the main trail alignment and travel south adjacent to the active Lewisburg & Buffalo Creek Railroad to create a trail extension to Market Street as seen in Figure 3.3. A new trailhead at the Borough parking lot is proposed in this location. This spur will be constructed within existing Borough property previously purchased from the Lewisburg & Buffalo Creek Railroad in 1990 as documented in db 242, pg 293.

Figure 3.3 - Extension to Market Street. (Source data: Google Maps, 2012)

3.5 St. John Street

The trail is proposed to follow the existing St. John Street alignment from 5th Street to N. Water Street as illustrated in Figure 3.4. The existing street has two different curb to curb cross sections. A 30-foot curb to curb roadway exists between N. 5th Street and N. 3rd Street and between Chestnut Tree Alley and N. Water Street. A 36-foot curb to curb roadway exists between N. 3rd Street and Chestnut Alley. A cross sectional view of these different cross sections is shown later in this report along with a typical intersection for each of the two cross sections.

Figure 3.4 - Proposed extension along St. John Street. (Source data: Google Maps, 2012)

3.6 Railroad Bridge

The trail will continue from N. Water Street to across the existing railroad bridge by providing a new deck and railing system. On the east side of the bridge, the trail will continue down a slope to Route 405 as seen in Figure 3.5.

Figure 3.5 - Proposed extension on East side of Railroad Bridge. (Source data: Google Maps, 2012).

4.0 OBJECTIVES

Specific objectives for each segment were identified in order to more accurately define the goals of the rail trail extension project.

4.1. 12th Street to Route 15 Intersection

- Connect the current trail head at 12th Street with a pedestrian intersection at Route 15.

4.2. Route 15 Intersection

- Provide rail trail users with safe access across Route 15.
- Provide most direct crossing of Route 15 possible with minimal need for detours off the original railroad alignment.
- Minimize the impact on the flow of vehicular traffic on Route 15.

4.3. Route 15 to 5th Street

- Connect the Route 15 intersection with 5th street in the most direct way that can provide a safe and efficient means of transportation.
- Provide safe intersection crossings at each street crossing.
- Cross Limestone (Bull) Run in a safe manner that is also aesthetically pleasing.

4.4 Trail Spur to Market Street

- Provide a safe pedestrian connection between the main trail and the downtown commercial district of Lewisburg.
- Improve opportunities for economic development through signage and a direct trail connection to the downtown commercial district of Lewisburg.
- Provide another trail head for the rail trail.
- Offer a secondary, aesthetic use of the existing concrete railroad pilings that can be an icon for Lewisburg.
- Provide an opportunity to continue the trail south toward Bucknell University.

4.5. St. John Street

- Allow for a connection between 5th Street and N. Water Street for the extension of the rail trail to the railroad bridge.
- Provide a safe connection that does not impede traffic in the adjacent neighborhoods or significantly reduce the amount of parking spaces available on St. John Street.
- Raise awareness of the trail in Lewisburg by showcasing the trail co-existing with a Borough street and providing added signage and information kiosks.

4.6. Railroad Bridge

- Provide a safe and accessible way for trail users to cross the Susquehanna River.
- Incorporate scenic outlook considerations to make the bridge a destination on the trail and allow trail users to enjoy the scenery.
- Maintain the historical integrity of the bridge and complement the natural environment.

5.0 EXISTING CONDITIONS

The current rail-trail runs, generally, parallel to Route 45 on a relative flat and straight alignment. A majority of the trail surface is a crushed trail aggregate mix with two asphalt trail segments occurring at each end of the trail where heavy trail usage occurs. There are many access points along the trail which provide users with dining options such as Ard's Farm Market, the Purple Cow, and Sheetz. The trail also provides access to residential areas, small business, and larger businesses. The major challenge for users of downtown Lewisburg to access the trail is the dangerous intersection crossing of Route 15. Figure 5.1 identifies the current BVRT and the planned extension.

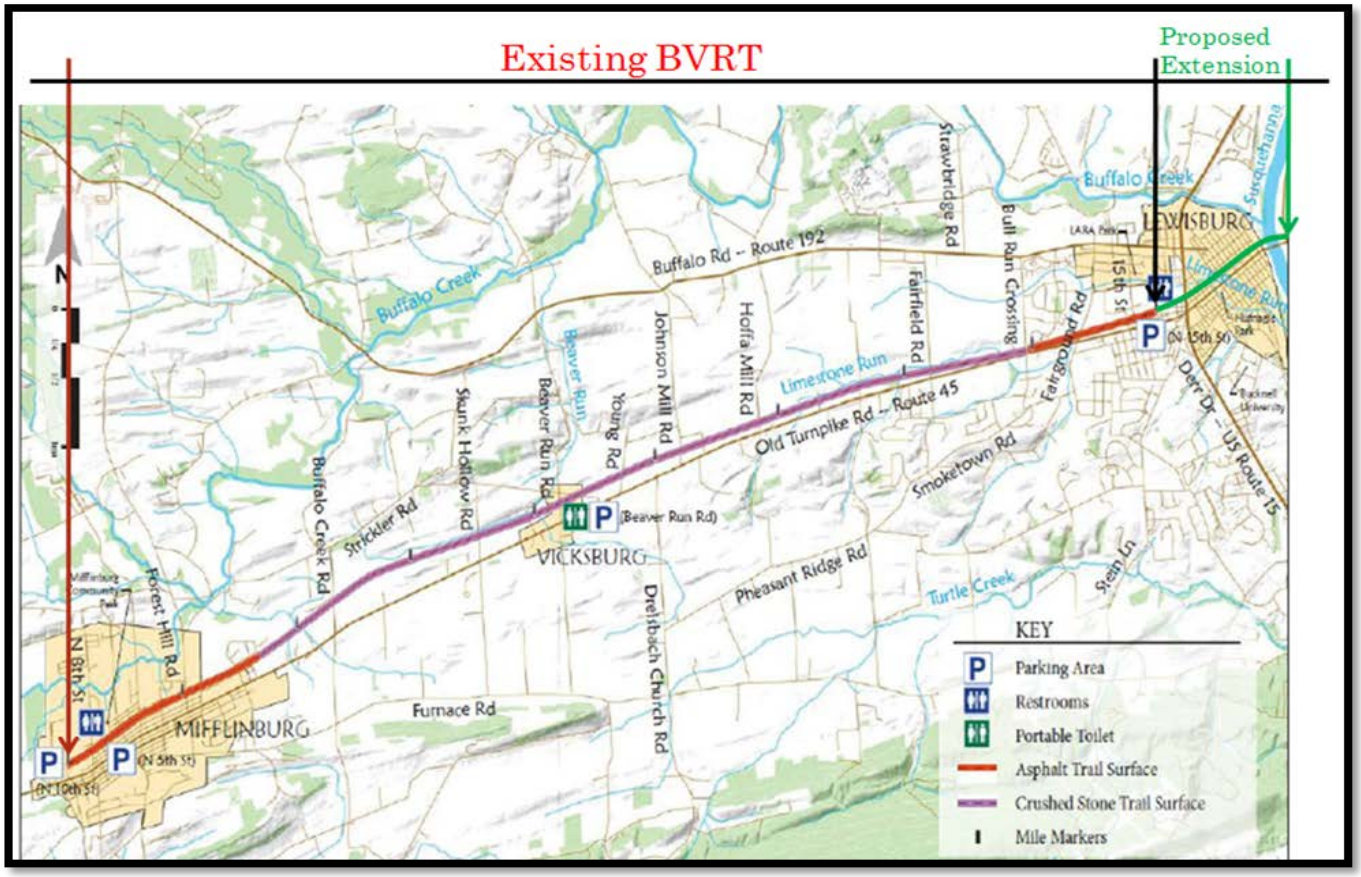


Figure 5.1 - Map of the current BVRT and the proposed extension. (BVRec, 2011)

5.1. Railroad Bridge

The abandoned railroad bridge over the West Branch Susquehanna River is owned by the BVRec. The bridge is an eight-span, 1,264 foot, steel thru-truss structure resting on stone masonry abutments and piers (Figure 5.1). The bridge has not been in service since the late 1980s, and the rail has been removed from the approaches. (Lewisburg PPR Railroad Bridge, 2012). There is a significant amount of vegetation that has grown through and around the structure, which impedes the access to the bridge (Conrad, 2006).

Figure 5.2 - Railroad bridge over the Susquehanna River. (Alexander Mitchell IV, 2010)

The existing bridge is intended to be rehabilitated to provide a pedestrian and biking area for trail users. The vision of the Buffalo Valley Rail Trail involved the bridge as a throughway for pedestrians and cyclists to use to cross the river and enter Montandon. However, BVRec recently abandoned their right-of-way for one mile on the east side of the bridge due to liability and ownership issues. This abandonment inhibits the funding support for a potential extension beyond the bridge, therefore, this study does not consider the bridge as a thruway without BVRec sanctioned routes on the east side of the bridge. However, BVRec would like the bridge to serve as a destination where trail users could stop at a scenic outlook point to enjoy the scenery of the West Branch Susquehanna River.

5.1.1. Bridge Inspection

An inspection of the bridge was performed in August 2006 by John Conrad when the right of way of the bridge was acquired. The inspection was made to assess the current condition of the structural members and stone masonry to determine if the bridge will be sufficient to support pedestrian and bike traffic.

Mr. Conrad's inspection methodology involved identifying each span and each individual member of the bridge. Visual inspections of these members were made by climbing the structure and removing dirt and debris in order to access as many of the critical points on the bridge as possible.
The findings of the investigation show that the bridge is in very good condition and will be able to safely support the pedestrian and bike loads expected on the structure. Mr. Conrad identified a few items that must be addressed prior to opening the bridge to traffic:

- All vegetation will need to be removed from the bridge
- Timber ties need to be removed and replaced with an appropriate deck structure

- An appropriate railing will need to be installed on the bridge

Mr. Conrad also recommends that a few of the joints on the masonry piers will need to be sealed and large rip-rap should be placed around the piers to protect the timber mat foundation. He observed that the steel is in very good condition, despite a few areas of surface rust and corrosion. Since the bridge was originally designed for railroad loads, the minor section loss and slightly decreased capacity resulting from this corrosion is not an issue (Conrad, 2006).

5.1.2 Bridge Fire

On March 26, 2012, a fire burned many of the wooden ties but did not affect the structural stability of the bridge overall. John Conrad performed an emergency inspection on the burned section of the bridge and deemed that the steel is still in good condition and the bridge has sufficient capacity to support pedestrian loads (Conrad, 2012).

5.2 Rail Trail Demand

During the summer of 2012, a travel demand and economic impact analysis was conducted on the rail-trail by Dr. Michelle Beiler (nee Oswald), Dr. Thomas Kinnaman, Kelly Burkhart, and Mike Nicholson. This study estimated trail usage and economic impact during the trail's first year of use. Results show that 1,136 users visit the trail an estimated 12,026.7 times in the month of June 2012. Extrapolating this data shows over 100,000 trips are made annually on the BVRT. Furthermore, the study showed that recreational purchases are estimated at $280,635 annually. The study also showed that the extension of the trail would provide an economic benefit to the average trail user is estimated (via demand analysis) at $1,357.81 per year and the total willingness-to-pay for a trail extension is estimated at $926,984 (Oswald, et al., 2012). This study clearly demonstrates the demand for an extension into the Borough that would greatly benefit both local residents and businesses. The full study entitled *Buffalo Valley Rail Trail 2012 User Survey and Economic Impact Analysis* can be downloaded at www.bvrt.org.

5.3. Route 15 Crossing Challenges

5.3.1 Challenge

The Buffalo Valley Rail Trail (BVRT) currently ends at 12th Street in Lewisburg, on the opposite side of Route 15. An extension into Lewisburg Borough from the existing trailhead will need to cross Route 15. Route 15 is a high volume highway, with an average daily traffic of 25,000 vehicles per day. At peak hours, upwards of 1,600 vehicles per hour have been observed. Additionally, during the peak hour, traffic queuing occurs over the proposed trail alignment. This creates difficult conditions for trail users who desire to cross Route 15 and continue along the trail on the opposite side. These conditions necessitate the design of a safe intersection that will safely convey trail users across Route 15. Previous review by BVRec and Union County Planning considered other crossing options including a tunnel option and bridge option. Further review of these options was not included in the scope of this study since they were determined to be physically and/or economically unfeasible. This study will focus only on the design of an at-grade pedestrian intersection that will provide trail users the safest means possible of crossing Route 15.

5.3.2 Crossing Options

5.3.2.1 Adjacent Signalized Intersection

The US 15 Smart Transportation Corridor Improvement Plan contemplates three crossing type options the BVRT could potentially utilize. The first is a crossing at an adjacent signalized intersection. This would involve re-routing trail users to one of the two nearest signalized intersections, St. Mary Street or Market Street. There are two distinct benefits of this option. A signalized crossing at an existing traffic signal is provided within 700 feet of the trail crossing and it allows pedestrians and bikes to cross on a controlled pedestrian phase at an established signal. There are several logistical issues, however, that make this option both unfeasible. Re-routing trail users would require an approximately 1,500 foot diversion from the trail right-of-way and would require acquisition of addition right-of-way and would create inconvenient with trail users. In addition, the Market Street crossing option would require the closure of the Rural Avenue connection to Route 15 and the St. Mary Street crossing option would require coordination with the Penn House Commons land development. Estimated costs of this option range from $5,000 to $10,000 (US 15 Smart Transportation Corridor Improvement Plan, 2012).

5.3.2.2 At-Grade Crossing on Existing Trail Alignment

The second series of options consist of at-grade crossings along the existing alignment. The first of the at-grade crossing options is an unsignalized crossing with a median refuge. This type of crossing provides the most direct crossing of Route 15 (along trail alignment). There is also strong community support for this crossing location. In addition, minimal disruptions in traffic flow will occur if pedestrians and bikes wait for gaps in the flow to cross. The main concern of this option is safety. Pedestrians must rely on gaps in the traffic stream to cross. Without any means of stopping traffic, they may be forced to wait for an excessive amount of time. The longer trail users wait; there is a higher likelihood that "risky" crossings may be attempted. Conflicts also arise with vehicles queued back from Market Street or St. Mary Street during peak periods. This intersection option would include a yield line and YIELD TO PEDESTRIANS IN CROSSWALK sign. In addition, the FHWA provides that unsignalized intersections are not appropriate when daily traffic volume exceeds 15,000 vehicles per day. Estimated costs of this option range from $10,000 to $15,000 (US 15 Smart Transportation Corridor Improvement Plan, 2012).

The second at-grade crossing option is a fully signalized crossing with a median refuge. Like the unsignalized crossing option, it provides the most direct crossing of Route 15 and there is strong community support for this location. In addition, pedestrian signals provide full control and exclusive assignment of right of way, equating to a safer option or pedestrians. The disadvantages are mainly centered on the vehicular traffic. Moderate disruption of coordinated traffic flow is likely due to the randomness of pedestrian arrivals and uneven signal spacing. Signals cannot be installed without first undergoing an engineering study. The MUTCD provides warrants for pedestrian signals and it is recommended that signals only be installed in the instances dictated by the MUTCD. Initial studies by McCormack Taylor in the US 15 Corridor Study indicate the warrant is not satisfied (US 15 Smart Transportation Corridor Improvement Plan, 2012).

5.3.3 Recommended Alternative

After reviewing the pros and cons of each crossing option, a fully-signalized intersection with a pedestrian refuge was selected as the best option. A pedestrian refuge in the middle of Route 15 is a critical component. AASHTO recommends the use of a crossing island at midblock locations where the crossing distance exceeds 60 feet or where there are a limited number of gaps in traffic. A crossing island is defined as "a raised area separating two main directions of traffic movement" (AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities, 2004). The main benefit of providing a crossing island is that it separates conflicts in time and place. Without one, a trail user would be forced to cross five lanes of traffic at one time. A median allows trail users to cross one direction of traffic at a time and wait safely in the middle of the street for an opportunity to cross the remaining distance.

According to the Route 15 Corridor Study, the at-grade crossing is more favorable to a grade-separated crossing because lower costs, ease of implementation, and likelihood of use by trail users. A signalized crossing is safer for trail users because cars are being stopped and pedestrians and bicyclists are being given exclusive right-of-way. While pedestrian signals have the potential to interrupt traffic flow between Market Street and St. Mary Street, the pedestrian refuge provides a means of minimizing this. Because pedestrians only cross one direction of traffic at a time, traffic need only be stopped in single direction while trail users are crossing. Once they have reached the crossing island, traffic in that direction resumes and traffic can be stopped in the opposite direction to give users the opportunity to complete the crossing.

One concern expressed by PennDOT is the potential for queuing of traffic at peak hours. If traffic queuing from adjacent traffic signals causes vehicles to stop in the crosswalk, pedestrians and bicyclists will likely attempt to dodge through cars to cross Route 15. This creates a potentially unsafe condition for pedestrians and PennDOT will not approve a crosswalk installation if queuing back into the trail alignment continues. According to the Route 15 corridor study, if "vehicle queuing could be substantially and reliably reduced (either by improving the efficiency of the signal system or as the result of traffic volume reductions), an at-grade alternative may become favorable" (US 15 Smart Transportation Corridor Improvement Plan, 2012). It is recommended that the newly created Route 15 corridor committee consider methods to improve signal efficiencies, such as the continued pursuit of adaptive signal control technology. Likely, reduced traffic volume can only be achieved with the construction of the proposed Central Susquehanna Valley Thruway. Another impediment to the installation of a fully signalized pedestrian crossing is satisfying the warrants provided in the MUTCD. The MUTCD provides a warrant for traffic signals at midblock crosswalks which is based on both peak hour vehicular traffic volume and peak hour pedestrian crossings.

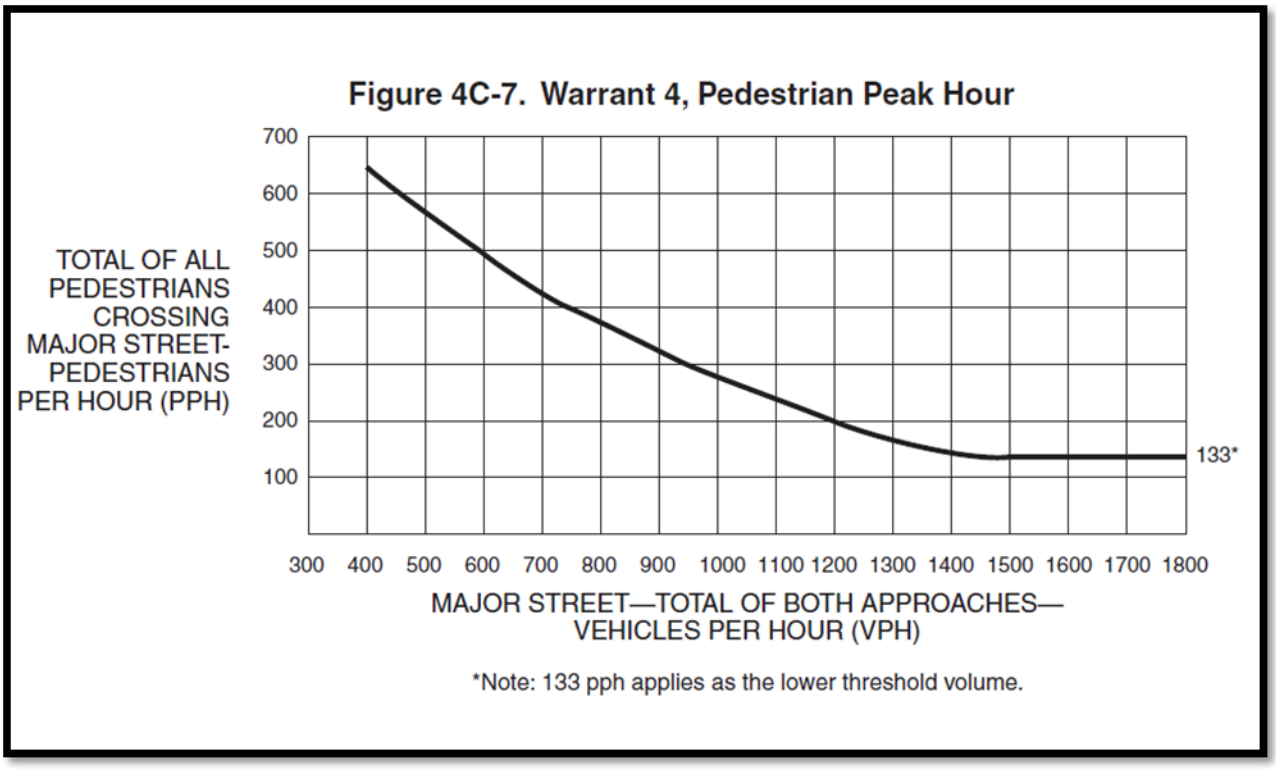


Figure 5.3 - MUTCD Warrant 4, Pedestrian Peak Hour

As is shown in figure 5.3, to satisfy the warrant, one needs to demonstrate a minimum number of pedestrians are attempting to cross during peak hour. The number of pedestrians needed decreases as the number of vehicles per hour increases. According to the US 15 Corridor Study, although Route 15 has demonstrated enough vehicular volume to require the minimum number of pedestrians, a pedestrian study indicates less than 60 pedestrians and bikes per hour were observed crossing Route 15 at St. Mary Street and Market Street combined. Thus, according to the US 15 Corridor Study, the warrant is not satisfied even if all the pedestrian and bicycle traffic at St. Mary Street and Market Street was diverted to the rail-trail crossing. Legally, the liability of installing unwarranted signals is undesirable because no legally tenable justification for the signals can be established. Unwarranted traffic control devices, however, may still be installed if the liability issue is resolved through an indemnification process. In addition, the installing agency also has the option of installing the signal and subsequently proving the warrant is satisfied by newly generated pedestrian crossings not present before the installation of the crosswalk. If the warrant is still not proven to be satisfied after implementation of the signalized crosswalk, PennDOT may choose to require the installing agency to remove the signals.

6.0 DATA COLLECTION

After it was determined that the current, best method to cross Route 15 was an at-grade signalized trail crossing, data was collected at Route 15 to determine whether or not the warrant in the MUTCD is presently satisfied. Although the US 15 Corridor Study revealed that the pedestrian counts were not high enough, further verification seemed prudent. Two types of data were collected: total number of vehicles crossing the trail alignment at peak hours and number of pedestrians crossing Route 15 via the intersection of Market Street and Route 15 at peak hours.

6.1 Peak Hour Vehicle Data for Route 15

6.1.1 Procedure

Using a handheld counter, one observer counted southbound vehicles and another counted northbound vehicles. Counts were done in fifteen minute intervals over the course of one hour. Peak hours were determined from the US Route 15 Corridor Study. Peak morning and evening hours was determined to be 6:00 am to 8:15 am and 3:00 pm to 5:00 pm, respectively. Data was collected in one hour intervals at each of the peak hours (6:00 to 7:00 and 7:00 to 8:00, etc). Figure 6.1 shows the location of data collection.

Figure 6.1 - Location of data collection along Route 15

6.1.2 Results

The results of vehicle counts are synthesized in the following table.

Date	Time	Total Counts
2/5/2013	3:00 PM to 4:00 PM	1600
2/6/2013	4:00 PM to 5:00 PM	1649
2/9/2013	11:00 AM to 12:00 PM	1294
2/26/2013	6:00 AM to 7:00 AM	889
3/5/2013	7:00 AM to 8:00 AM	1395

Table 6.1 - Abridged summary of peak hour traffic volume results.

6.1.3 Analysis

The highest observed peak hour volume was 1649 vehicles between 4:00 pm and 5:00 pm on 2/6/2013. With regard the Pedestrian Peak Hour warrant in the MUTCD, a peak hour volume of 1649 vehicles means, to warrant the signal, one must demonstrate 133 pedestrian crossings are being generated across the roadway. In the case of the rail trail, since no pedestrian crossings are being made at the current trail alignment, pedestrian crossings at Market Street and Route 15 were collected to determine if the warrant is satisfied.

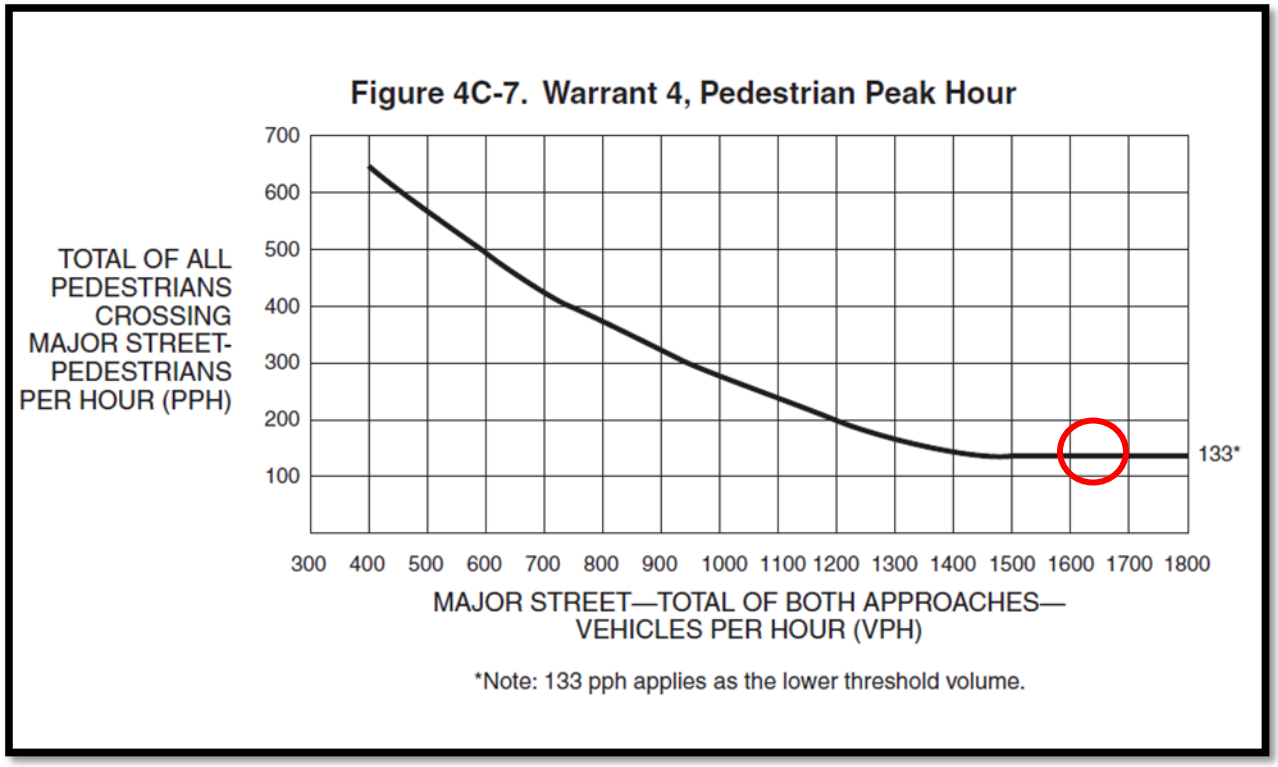


Figure 6.2 - MUTCD Pedestrian Peak Hour warrant with number of required pedestrians indicated in red.

6.2 Pedestrian Peak Hour Data Collection for Route 15

6.2.1 Procedure

The total number of pedestrian crossings at peak hour was collected at the intersection of Route 15 and Market Street, adjacent to Lewisburg High School. This location was used because, at present, no pedestrians are crossing at the trail alignment. These crossings counts are used under the assumption that all pedestrian traffic crossing Route 15 at Market Street will utilize the rail trail crossing after it has been designed and constructed. Counts were taken from 2:30 pm to 3:30 pm in an effort to document the maximum number of pedestrians. Lewisburg High School classes concluded between 2:30 and 3:00 and many students walk to and from school by crossing Route 15. Thus, to document the majority of students walking home from school across Route 15, 2:30 to 3:30 was selected as the optimal time.

6.2.2 Results

Over a one hour period from 2:30 pm to 3:30 pm, 36 pedestrians were observed crossing Route 15 via Market Street.

6.2.3 Analysis

36 pedestrian trips do not satisfy the pedestrian peak hour warrant. The design of the signalized intersection, therefore, is conducted under the assumption that installation of the signalized crosswalk will encourage enough trail users to cross Route 15, thereby satisfying the warrant.

6.3 St. John Street

Vehicular data counts were completed on St. John Street on two occasions at the peak hours of the day. The peak hours were assumed to be similar to that of Route 15 which was determined based on the US 15 Corridor Study. Data counts were completed two times to assure consistency between the days. The data were taken on two separate days of the week from 3:00PM – 4:00PM and 4:00PM-5:00PM. In completing the data counts, the data was taken from the corner of St. John Street and N. 3rd Street. This location was chosen because it was at roughly the midpoint of the 5th street and N. Water Street. In completing the data counts, the design team counted the total amount of vehicles on the entire section of the street between 5th Street and N. Water Street to get the total vehicles traveling on the section in a complete hour. Overall the data counts were very low with totals for the hour of 148 and 206. For conservative measures, in completing capacity calculations, the 206 vehicles/hour was used.

Parking counts were also completed on St. John Street in order to complete a parking analysis of St. John Street for its proposed reconfiguration options. The parking counts were assessed by counting up all the spots used for parking at assumed most heavily parked times. The data was taken on four different occasions. Data was also taken from Google Maps to compare data between the current parking and parking on September 9th, 2012. The data was completed and distributed based on three sections along St. John Street. The three sections were:

1. N. Front - N. Water Street
2. N. 3rd – N. Front Street
3. N 5th – N. 3rd Street

It should also be noted that days when the data collection was completed on Tuesday morning are more likely to have extra parking spots used because two of the four adjacent streets have restricted parking for street maintenance and cleaning which makes more residents to park on St. John Street.

6.4 Railroad Bridge

Measurements were taken of the steel on the railroad bridge to determine the existing sizes of the members. Existing measurements of the length of the bridge and the approximate size of the truss were provided in the bridge inspection report from John Conrad. These measurements, along with measurements taken by team members were used to compile sketches of the existing conditions of the bridge, which can be found in the appendix.

Measurements of the slope of the ground on the east side of the bridge were also taken. This will be the effective end of the trail. The ground slopes down to Route 405 at an approximately 7.5% percent slope, which is compatible with Accessible trail regulations. There are some segments of this 150 foot long stretch that are slightly steeper than the required minimum grade, so some regrading will be required before the finished trail pavement is installed.

7.0 DESIGN OF EXTENSION

7.1 Design of Section 1

(Note: Larson Design Group did not review or verify the methodology, input or output of the following Route 15/Rail Trail Intersection Signal Design)

7.1.1 Signal Timing

Because vehicle queuing back across the rail trail alignment was observed during afternoon peak hours, PennDOT restrictions would prevent installation of a crosswalk. Queuing presents a major safety concern for pedestrians and bicyclists attempting to cross. When vehicles back up into the designated crosswalk, pedestrians are forced to dodge around cars in an attempt to cross, dramatically increasing the likelihood of a collision. Queuing can be ameliorated through a retiming of the signals along Route 15.

7.1.2 HCS 2010

Using HCS 2010 (Highway Capacity Software) from McTrans, an optimized signal plan for Route 15 between Market Street and St. Mary Street intersections was created. Signal plans were obtained from Shawn McLaughlin, Planning Director for Union County. These plans were contained in the Route 15 Corridor Study technical appendix. An abridged signal timing plan for the Market Street intersection is shown below.

Cycle No.	Split No.	Phase								Cycle Length (sec)	Offset
		1	2	3	4	5	6	7	8		
1	1	15	38	15	17	15	38	15	17	85	28
1	2	17	31	17	20	17	31	17	20	85	41
2	1	15	41	19	25	15	41	19	25	100	98

Table 7.1 - Signal timing plan for Route 15 and Market Street Intersection

Phases 1 and 5 represent northbound and southbound left turning movements respectively. Phases 2 and 6 represent northbound and southbound through movements respectively. Phases 3 and 7 represent eastbound and westbound left turning movements respectively. Phases 4 and 8 represent eastbound and westbound through movements respectively. For the purposes of HCS, phases 1 and 5 were assumed to occur simultaneously, following by 2 and 6 simultaneously, 3 and 7 simultaneously, and finally, 4 and 8 simultaneously. Cycle 1, split 1 occurred during the morning peak hours and cycle 2, split 1 occurred during the afternoon peak hours.

The following table shows an abridged signal timing plan for the St. Mary Street intersection.

Cycle No.	Split No.	Phase								Cycle Length (sec)	Offset
		1	2	3	4	5	6	7	8		
1	1	20	55		40	20	55		40	115	60
2	1	20	55		25	20	55		25	100	50
3	1	20	65		40	20	65		40	125	65

Table 7.2 - Signal timing plan for Route 15 and St. Mary Street Intersection

Like the signal plan for Market Street, phases 1 and 5 represent north and southbound left turn movements respectively. Phases 2 and 5 represent north and southbound through movements respectively. Phases 4 and 8 represent east and westbound through movements with permitted left and right turn movements. For the purposes of HCS, one cycle consists of phases 1 and 5 occurring simultaneously, followed by phases 2 and 5 simultaneously, ending with phases 4 and 8 occurring simultaneously.

St. Mary Street signals are timed differently on different days. The traffic volume data used in the HCS model was collected on a Thursday, so the signal timing plan for Thursdays was used. Cycle 1, split 1 was used for morning peak hours and Cycle 3, split 1 was used for afternoon peak hours.
The existing signal timing for the intersection of Route 15 and Market Street and Route 15 and St. Mary Street (both AM and PM peak hours) were entered into HCS. In addition, HCS required vehicle volume for each turning movement, and intersection characteristics. Vehicle volumes for each turning movement were obtained from the Route 15 Corridor Study technical appendix.

When all the inputs were entered, HCS then calculated the level of service for the intersection in each direction. A full printout of the HCS signal timing results can be found in the appendix. The following table shows the results of the HCS Level of Service Analysis on the original signal timing plan for the St. Mary Street and Market Street intersections. Because the potential for queuing only exists in the northbound lanes at the St. Mary Street intersection and southbound lanes at the Market Street intersection, those levels of service were the primary focus. The following table shows the existing level of service of the two aforementioned intersections.

Intersection	Time of Day	LOS SB	LOS NB
Market St	7:00AM to 8:00AM	C	C
Market St	4:00PM to 5:00PM	D	C
St. Mary St	7:00AM to 8:00AM	B	B
St. Mary St	4:00PM to 5:00PM	B	B

Table 7.3 - Existing Intersection Level of Service at St Mary Street and Market Street Intersections

To minimize queuing taking place across the rail trail alignment, the level of service for southbound Route 15 travel lanes at the Market Street intersection had to be improved as well as the level of service on the northbound Route 15 travel lanes at St Mary Street intersection. The optimized signal plan, therefore, focused primarily on improving the level of service in these two directions.

The level of service was optimized by achieving the best level of service possible given the traffic volume and physical constraints of the intersection. A level of service A represents the best possible flow conditions through the intersection. It would not have been possible to induce a level of service A in the north and southbound lanes of Route 15 at Market Street and St Mary Street without giving almost unlimited green time to those lanes. This is not practical or realistic, since the west and eastbound lanes, as well as left turn lanes, all need green time from time to time. The optimization process, therefore, focused on giving as much green time to the north and southbound lanes on Route 15 without entirely compromising the level of service on the east and westbound lanes.

The results of the optimization for the north and southbound lanes are provided in the table below.

Intersection	Time of Day	LOS SB	LOS NB
Market St	7:00AM to 8:00AM	B	C
Market St	4:00PM to 5:00PM	C	C
St. Mary St	7:00AM to 8:00AM	A	A
St. Mary St	4:00PM to 5:00PM	A	A

Table 7.4 - Optimized Level of Service for St. Mary Street and Market Street Intersections

The optimization was achieved by changing the signal timing as shown in the plans below.

Cycle No.	Split No.	Phase								Cycle Length (sec)	Offset
		1	2	3	4	5	6	7	8		
1	1	8	40	15	22	8	40	15	22	85	28
1	2	17	31	17	20	17	31	17	20	85	41
2	1	13	43	18	26	13	43	18	26	100	98

Table 7.5 - Improved signal timing plan for Route 15 and Market Street Intersection

Cycle No.	Split No.	Phase								Cycle Length (sec)	Offset
		1	2	3	4	5	6	7	8		
1	1	8	81		26	20	81		26	115	60
2	1	20	55		25	20	55		25	100	50
3	1	8	91		26	8	91		26	125	65

Table 7.6 - Improved signal timing plan for Route 15 and St. Mary Street Intersection

7.1.3 Synchro Model

After creating an optimized signal timing plan for the St. Mary Street and Market Street intersections, Synchro was used to model traffic flow on Route 15 between St. Mary Street and Market Street to determine if the optimized signal timing plans would cause a queue to back up into the proposed rail trail crossing. In addition, the model was created to demonstrate the effect a new traffic signal would have on the traffic flow between those two busy intersections.

One shortcoming of Synchro is the inability to accurately model bike trails or mid-block crosswalks. To account for the rail trail in between St. Mary Street and Market Street, a new road and intersection was modeled at the rail trail alignment to simulate pedestrian traffic along the rail trail alignment. No turning movements were allowed at this intersection, only through movements.

The signal timing of the rail trail intersection was built on numerous assumptions. The student team assumed the minimum number of pedestrians required to warrant the signal (133) would cross the intersection in one hour. The student team then assumed they would come in groups of four because families often travel together on the rail trail. This gave approximately 34 pedestrian trips in a one hour period. The student team then calculated the pedestrian signal phase required by the MUTCD for pedestrians to cross the trail.

The MUTCD provides a method of determining the minimum pedestrian interval based on three phases: the walk interval, pedestrian change interval, and a buffer interval. The walk

interval should be a minimum of 7 seconds but may be reduced in some instances. The MUTCD requires the pedestrian clearance time should be sufficient to allow a pedestrian to cross the street at the end of the walk indication traveling at a speed of 3.5 ft/s to cross to the far side (MUTCD 2009), the crossing distance to the crossing island would be 24 ft. The required pedestrian clearance time then becomes 6.857 seconds, rounded to an 7 seconds. The MUTCD also requires that the pedestrian change interval and walk interval should, together, be long enough to allow a person walking at 3 ft/s to cross the intersection after having left from a location six feet from the edge of the pavement (MUTCD 2009). With a crossing length of 24 feet, this means the walk interval and pedestrian clearance interval together must be 10 seconds. With the minimum walk interval of 7 seconds added to the calculated pedestrian clearance interval of 7 seconds, the two added together equal 14 seconds, which satisfies the MUTCD requirements. In addition, the MUTCD requires a minimum buffer time of 3 seconds be added to the end of the pedestrian clearance interval or incorporated into the pedestrian clearance interval (MUTCD 2009). As a conservative safety measure, the buffer was added to the end of the pedestrian change interval. This created a total pedestrian signal interval of 17 seconds.

With added safety factor, a total pedestrian interval of 20 seconds was used. In the Synchro model, the signal timing at the rail trial intersection was then determining the time between each pedestrian group's arrival at the intersection. Since 34 total groups arrived over an hour long period, it was determined that one group arrives every 106 seconds. Thus, the north and southbound lanes on Route 15 were given a 106 second split and the east and westbound lanes representing the trail were given a 20 second split. Synchro requires inputs of vehicle volume, signal timing, turning movements, and physical roadway characteristics (speed limit, lane width, etc…) in order to model traffic flow. The optimized signal timing determined from HCS was used as the signal timing for the synchro model. The vehicle volumes and turning movements were the same as used in the HCS model.

A Synchro model for both AM and PM peak hours was created. Running the traffic flow model revealed no queues formed back across the rail trail crossing with the new signal timing at either the afternoon peak hours or morning peak hours. Since so many assumptions went into both the Synchro model and the HCS signal timing optimization, the results are far from definitive. A more comprehensive signal timing study will have to be accomplished before one can confidently say no queuing will occur. For the purposes of this report, the design will proceed under the assumption that no queuing will occur across the rail trail alignment.

7.1.4 Trail Layout from Trail Head to Route 15

Below is the proposed layout of the trail from the current trail head at 12th Street in Linntown to Route 15. The trail will be 10 feet wide and paved with asphalt. The Penn House Commons Development border is shown on the map for reference as well as the current trail head and BVRec Right-of-Way.

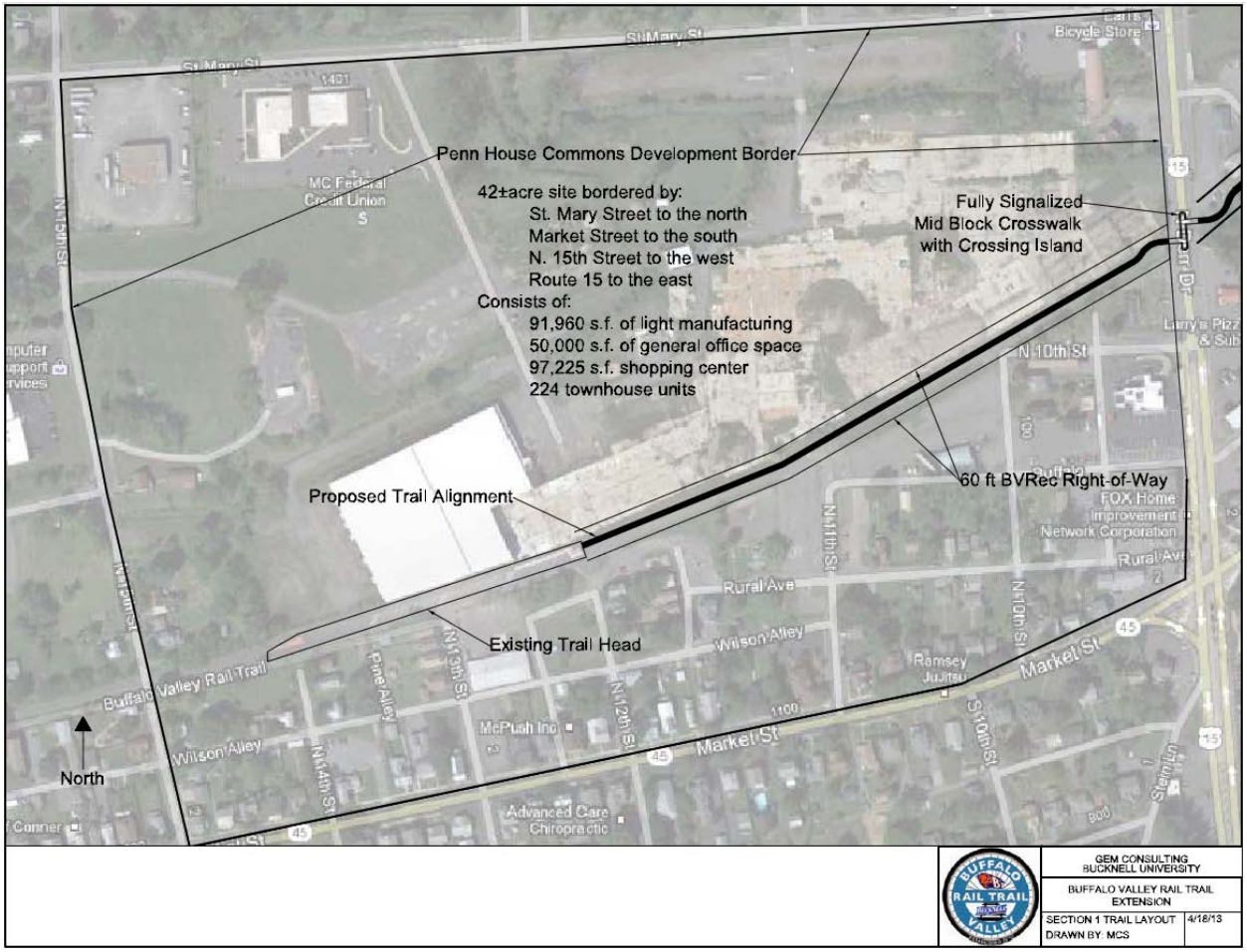


Figure 7.1 - Trail layout drawing from existing trail head to Route 15

7.1.4.1 Curves and Path Layout Leading to Tail

An important design consideration of a shared use path approaching a roadway intersection is that the shared use path should intersect the roadway at a 90 degree angle. The trail approaches the road at approximately a 60 degree angle, thus a curve must be designed approaching the trail. Since all trail users approaching the intersection are assumed to be pedestrians and bicyclists, design speed is not a critical factor on the approach to the intersection, thus a large curve will be more of a conservative safety measure than a critical design factor.

When traveling on a shared use path, a bicyclist must lean while going around a curve to prevent falling outward due to forces associated with turning movements. A lean angle of 20 degrees is considered the typical maximum lean angle for most users. Calculating the minimum radius of curvature based on lean angle is typically used for paved paths where users feel comfortable leaning while they turn. Shared use path curves can also be design using superelevation and the coefficient of friction, much like a vehicular roadway. This method is generally used on unpaved paths where users feel less comfortable leaning as they turn. This portion of the trail will be paved with asphalt, therefore the minimum radius of curvature was determined using the lean angle method (AASHTO Guide for the Planning, Design and Operation of Bicycle Facilities 2012).

The minimum radius of a curve on a shared use path was determined by the following equation:

$$R = \frac{0.67V^2}{tan\theta} \quad \text{(eq. 1)}$$

where R is the minimum radius of curvature (ft), V is the design speed (mph), and theta is the lean angle from the vertical (degrees).

Assuming a lean angle of 20 degrees and a design speed of 15 mph, the minimum radius of curvature becomes 41.42 ft. Generally, AASHTO recommends a design speed of 20 mph for shared use paths (AASHTO Guide for the Planning, Design and Operation of Bicycle Facilities 2012). Because all users are being considered pedestrians for purposes of crossing the street, however, a design speed of 15 mph was selected.

For a conservative measure of safety, the curves on the trail approaching the intersection were chosen to be 50 ft.

7.1.4.2 Sight Distance

The first step in designing the layout of the intersection across Route 15 is sight distance considerations for pedestrians entering the roadway. The following sight triangles represent the line of site needed by a trail user approaching the roadway. Ordinarily, the sight triangles on a shared use path are used to determine the control on the path leading to the intersection (stop or yield). In this case, however, I am assuming all trail users approaching the road will press the pushbutton, wait for traffic to stop, and proceed across on foot, as a pedestrian. The "b" leg of the sight triangle, therefore, was used to determine how much perpendicular trail was needed approaching the roadway. The following image is taken from the AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities and shows a diagram of the sight triangles.

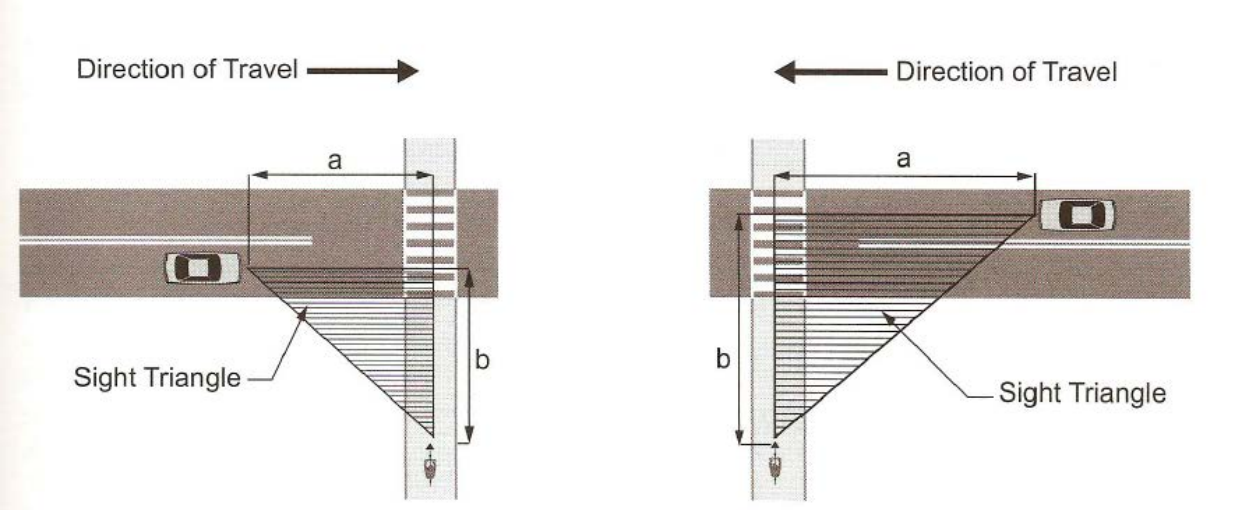


Figure 7.2 - Sight triangles (AASHTO Guide for the Planning, Design and Operation of Bicycle Facilities 2012)

The following equations are used to calculate the roadway leg of the sight triangle.

$$t_a = \frac{S}{1.47V_{path}} \quad \text{(eq. 2)}$$

$$t_g = t_a + \frac{W+L_a}{1.47V_{path}} \quad \text{(eq. 3)}$$

$$a = 1.47V_{road}t_g \quad \text{(eq. 4)}$$

Where t_a is the travel time to reach the road from the decision point for a path user that doesn't stop (s), t_g is the time to reach and clear the road (s), a is the length of the leg sight triangle along the roadway approach (ft) , w is the width of the intersection to be crossed (ft), L_a is the typical bike length (assumed to be 6ft), V_{path} is the design speed of the path (mph), V_{road} is the design speed of the road (mph), and S is the stopping sight distance for the path user traveling at design speed (ft).

t_a is assumed to be zero for this calculation because the design team assumes all users approaching the intersection as pedestrians that stop and push the button before crossing. Since the user is crossing to the crossing island and not across the entire roadway in a single crossing, W is equal to 24 ft. L_a is equal to six because, even though all users are being treated as pedestrians; those with bicycles will be walking with them, taking up just as much room. Since all users are being treated as pedestrians, the design speed of the path assumption for this calculation (V_{path}) is different than that of the curve design assumption. Here, it is assumed users are traveling at the standard pedestrian design speed, 3.5 ft/s (2.73 mph) (MUTCD 2009). Finally, V_{road} is assumed to be 40 mph, which is equal to the posted speed limit of Route 15 at that location (35mph) plus 5 mph.

Solving for a results in a length of the roadway leg of the sight triangle of 439.824 ft. Solving for the length of the path leg of the sight triangle is accomplished with the following equations:

$$t_a = \frac{1.47V_e - 1.47V_b}{a_i} \quad \text{(eq. 5)}$$

$$t_g = t_a + \frac{W+L_a}{0.88V_{road}} \quad \text{(eq. 6)}$$

$$b = 1.47V_{path}t_g \quad \text{(eq. 7)}$$

Where t_g = the travel time to reach and clear the paths (s), t_a = travel time to reach the path from the decision point for a motorist that doesn't stop (s), V_e = the speed at which the motorist would enter the intersection after decelerating (assumed 0.6 x road design speed), V_b = speed at which braking by the motorist begins (mph) (same as road design speed), a_i = motorist deceleration rate in intersection approach when braking to a stop not initiated (ft/s^2) (assume -5 ft/s^2), W = width of the intersection to be crossed, L_a is the length of the design vehicle (ft), V_{path} is the design speed of the path (mph), and V_{road} = design sped of the road (mph).

V_e, assumed to be 0.6 x road design speed (40 mph) is equal to 24 mph. W is still 24 ft because the distance to be crossed is the distance to the crossing island (24 ft). L_a is assumed to be 19 ft (Whitmoyer 2012). The rest of the assumptions for calculation of b are the same as the assumptions for the calculation of a.

Calculation of b results in a length of 24 ft. This is measured from the center of the second northbound travel lane. This means a minimum of 6 feet of perpendicular trail is needed before the intersection after the curves. For clarification, see the figure below.

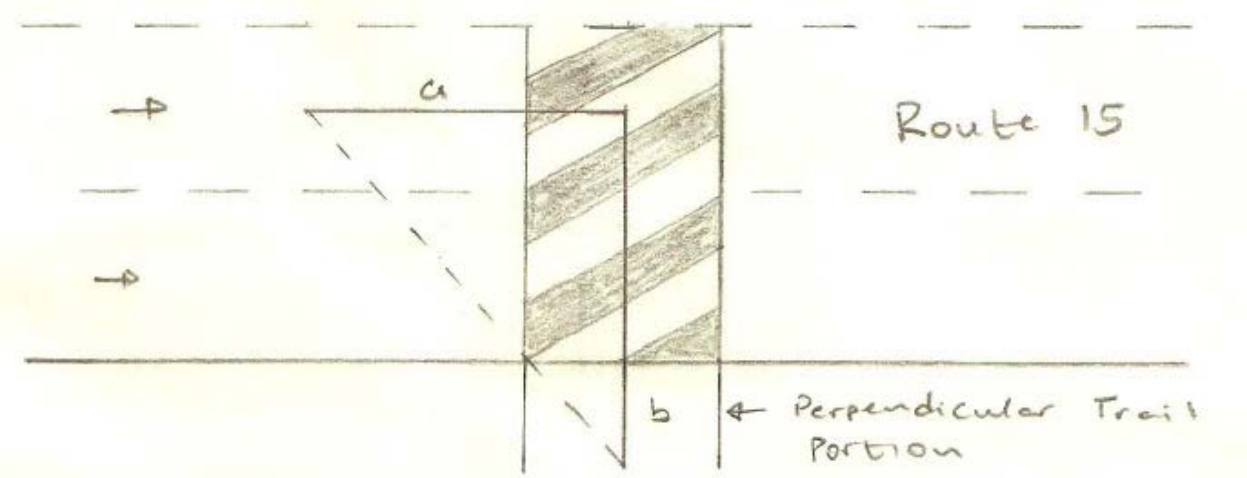


Figure 7.3- Sight triangle with perpendicular trail portion shown.

The first swing gate was placed 8 feet back on the trail perpendicular to the roadway and the next swing gate was placed 8 feet back from that. Swing gates were added to the trail approach to the intersection. See the appendix for standard swing gate dimensions. The purpose of the swing gates is to both alert trail users to the presence of an upcoming intersection and to force them to slow down. Swing gates block half of the path, forcing trail users to slow down and go around them. In this case, a set of swing gates was used. They were spaced closer than normal to encourage trail users to dismount and continue to the intersection on foot. It would be unsafe for users to ride through the intersection on their bicycles, and these swing gates will encourage them to do otherwise. The typical placement distance of the swing gates is 20 ft apart. Since both physical constraints (the length of trail perpendicular to the roadway) and the need to encourage bicyclists to dismount, the swing gates were placed 8 ft apart on the approach to the intersection.

7.1.5 Crosswalk Design

7.1.5.1 Crossing Island

As previously discussed, a crossing island was determined to be a critical portion of providing trail users safe access across Route 15. According to AASHTO, a crossing island should be included in a mid-block crosswalk when the crossing distance exceeds 60 feet (AASHTO Guide for the Planning, Design and Operation of Pedestrian Facilities 2012). Route 15 is 60 feet across, therefore a crossing island is both necessary and practical. Below is the proposed intersection with crossing median.

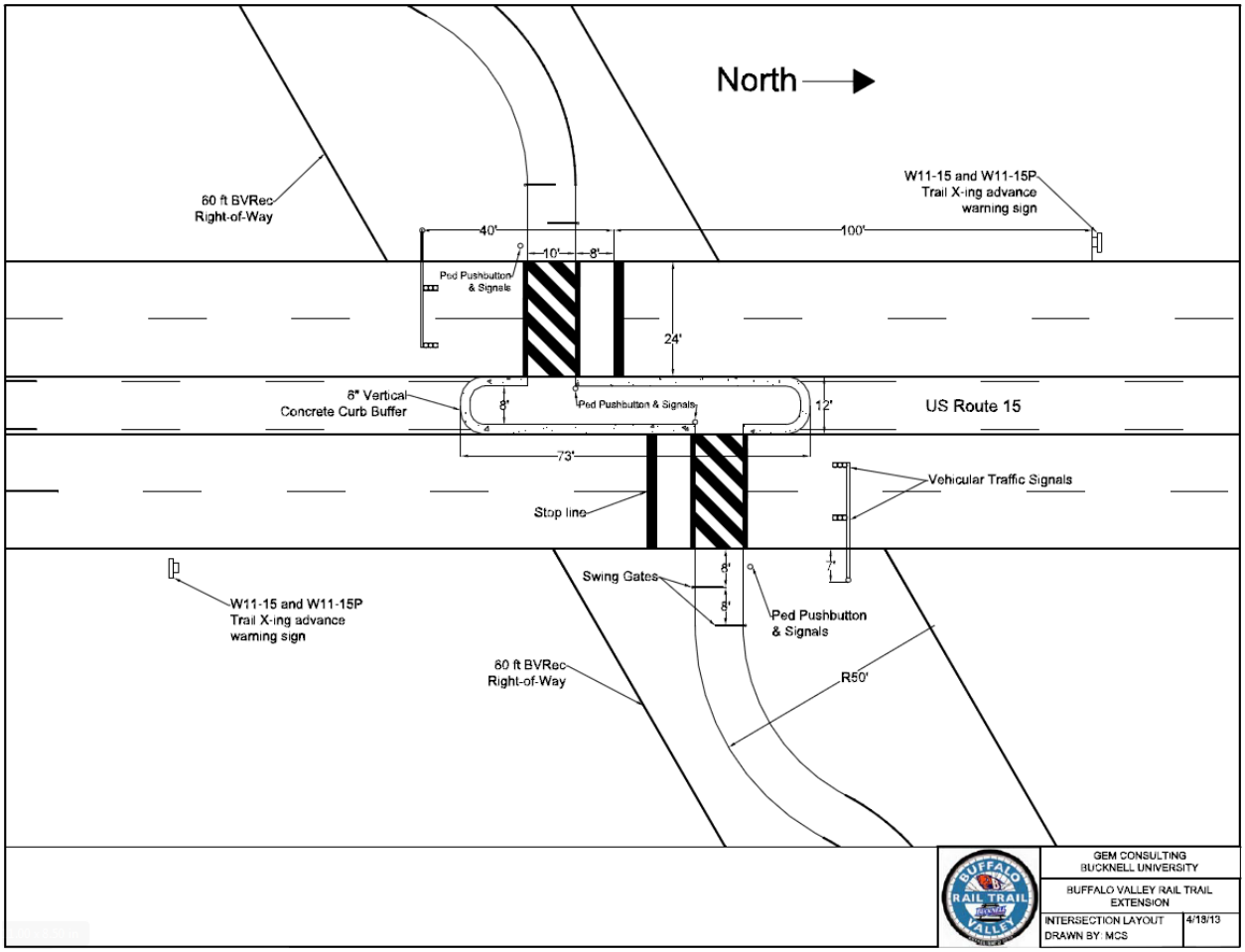


Figure 7.4 - Intersection layout drawing.

The wait area inside the crossing island was made as large as possible with the available space to accommodate as many trail users as possible. Many users will be walking into the median with bicycles, and the average bicycle length is around 6 ft; therefore more room is needed in the crossing island to store them. The island itself is outlined with a 2 ft wide, 6 in high concrete curb. AASHTO indicates island delineation is most often accomplished with a 6 in curb. The curb chosen for this median was a 6 in vertical curb.

The Penn House Commons Development, a major commercial development to be built in between St. Mary Street and Market Street, will include new access point adjacent to the BVRT and new crosswalk at Route 15. To eliminate sight distance concerns with drivers pulling in and out of these driveways, the crossing island was delineated only by a 6 in curb. Higher barriers such as fences or concrete barriers were proposed but were ultimately decided against due to concerns with driver sight distance.

7.1.5.2 Crosswalk Markings

Two sets of roadway striping are needed to complete the intersection. Lines delineating the actual crosswalk and stop lines are needed. The MUTCD recommends stop lines be 12 to 24 inches wide (MUTCD 2009). The stop lines at this crosswalk are 24 inches wide.
At a fully signalized intersection, AASHTO recommends a minimum of 40 feet between the nearest signal indicator and stop line (MUTCD 2009). They give no guidance on stop line

distance from the crosswalk. For a conservative measure of safety, I placed the stop lines 8 ft from the crosswalk.

Diagonal crosswalk markings were chosen because they offer the highest visibility. AASHTO recommends the diagonal lines be 12 to 24 inches wide and separated by gaps of 12 to 60 inches (MUTCD 2009).

7.1.5.3 Pedestrians Signals

Pedestrian signals in the new crosswalk should be hot response signals. A hot response signal is one in which an almost immediate walk indication is given to pedestrians. When the button is pushed to call a walk indication, the vehicular traffic signal should almost immediately turn yellow. Once the vehicular signal is red, the pedestrians will be given the walking phase. The pedestrian signals will be timed as described above in the section detailing the Synchro model. The walk interval will be 7 seconds, the pedestrian change interval will be 10 seconds, and the buffer interval will be three seconds, for a total pedestrian interval of 17 seconds. The vehicular traffic lights will be in a constant green phase until the pushbutton is pushed.

Four pedestrian pushbuttons will be installed in the locations indicated on the intersection layout drawing. One pushbutton will be placed at each of the approaches to the intersection, and the other two will be placed in the median. In this way, a trail user approaching the intersection will push the button, wait for traffic to stop, and cross to the median. When the trail user is safely in the crossing island, traffic can resume in the stopped direction, and the trail user can push the button to stop traffic in the opposite direction. The trail user will then proceed across the intersection and traffic can resume. This signal plan allows traffic to be stopped in a single direction at a time, reducing the overall interruption to vehicular flow along Route 15. An example diagram of a pedestrian using this sort of system can be seen below.

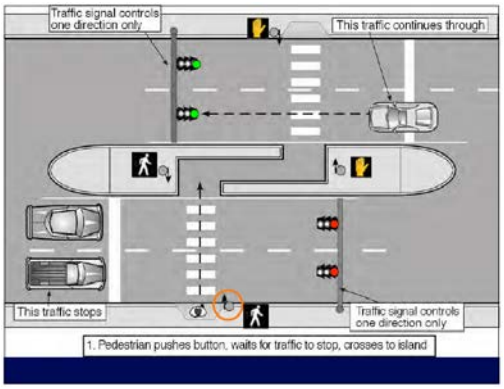


Figure 7.5 - Pedestrian pushes button, waits for traffic to stop, crosses to island.

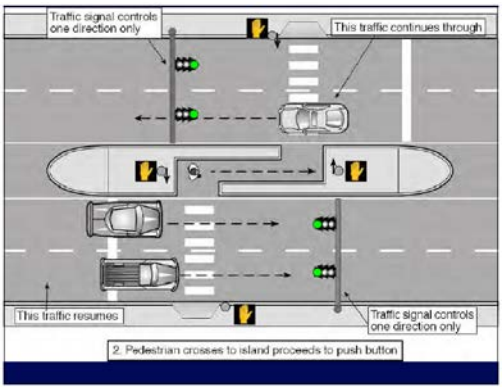


Figure 7.6 - Pedestrian crosses to island and proceeds to push button.

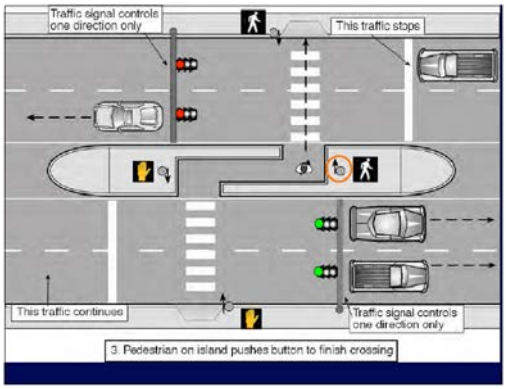


Figure 7.7 - Pedestrian on island pushes button to finish crossing.

The MUTCD provides that pushbuttons should be installed no higher than 3.5 feet from the ground to accommodate trail users in wheel chairs (MUTCD 2009). Each pushbutton assembly will be installed with an R10-3b pedestrian pushbutton regulatory sign and is meant to be an educational sign to trail users. It indicates the meaning of each interval as it is represented by the symbol.

The pedestrian signal indicators are recommended to be ITE compliant LED countdown pedestrian signals. The left side of the signal head will include a hand/man module with a countdown display on the right side of the pedestrian signal head. The MUTCD requires the pedestrian signal indicators be installed a minimum of 7 feet from the ground level.

7.1.5.4 Signage

Advance warning sign placement to indicate to drivers the presence of an upcoming crosswalk is, according to AASHTO, optional. The publication recommends against the overuse of signs due to decreased driver respect for signs the more they see them. Nevertheless, an advance warning sign is recommended for this rail trail crossing. Warning sign W11-15 and W11-15P (Combined Bicycle and Pedestrian Warning Sign and TRAIL XING supplementary sign) will be placed 100 feet in advance of the crosswalk. AASHTO recommends a minimum of 100 ft for a roadway with 35 mph speed limit. The signs will be placed 2 ft from the edge of the roadway.

In addition, a R10-3b (Pedestrian Crossing sign) will be installed at each pushbutton assembly. This sign is intended to be an educational sign, informing pedestrian on the correct use of the signals. It indicates when to cross and when not to cross.

7.2 Design of Section 2 – Route 15 to North Water Street

7.2.1 Route 15 to 5th Street

Between Route 15 and 5th Street the trail will have a similar design to the current rail trail. The preliminary design of this section of the trail was primarily completed by LDG. Input into the design process was given at initial meetings with stakeholders and LDG. The design of the small steel girder railroad bridge over Bull Run (Figure 7.8) followed a similar design to the existing bridge on the trail near Vicksburg between Beaver Run Rd. and Cook Lane over Beaver Run. The pavement width will be 10 feet and the cross section design will follow a similar design to the existing Buffalo Valley Rail Trail. The alignment of the trail from Route 15 to 5th Street through Green Alley including an extension to Market Street was designed by LDG under a separate preliminary design contract. Many considerations were taken into account in the design of the extension including access for Lewisburg users and the location of the 100-year floodplain. A trail extension to Market Street is proposed and includes a connection to an existing parking lot along Cherry Alley. This trail extension will be adjacent to and active railroad owned by the Lewisburg and Buffalo Creek Railroad. Extensive coordination with the railroad owner and operator will occur during final design.

Typical trail layout, bridge design and details/cross sections are included in this report Appendix B for convenience only. A separate design and documentation was issued for this portion of the trail. It should be noted that this segment of trail has been awarded PennDOT's Transportation Alternative Program funding for construction and has moved into final design stage with construction beginning in 2015.

Figure 7.8 - Small Steel Girder Bridge over Bull Run

7.2.2 St. John's Street Trail Alignment

In completing a conceptual design for St. John Street, the design team work extensively with the project design committee since this segment of trail must share right-of-way with a public street and since it traverses through a mixed commercial/residential neighborhood. Collectively six final options were developed and considered as configurations to the existing conditions of St. John Street. Many additional options were developed and considered but were determined not to be suitable for further consideration. As explained in the existing conditions, there are two different cross sections along St. John Street between 5th street and N. Water Street. For every option two different cross sections were designed depending on the existing width of roadway for that section. The two options available are labeled as either A for the 30 foot roadway or B for the 36 foot roadway. Appendix C illustrates all St. John Street options considered for this study. The advantages and disadvantages of each option will be discussed in the following sections. Figure 7.9 illustrates the existing conditions of St. John Street.

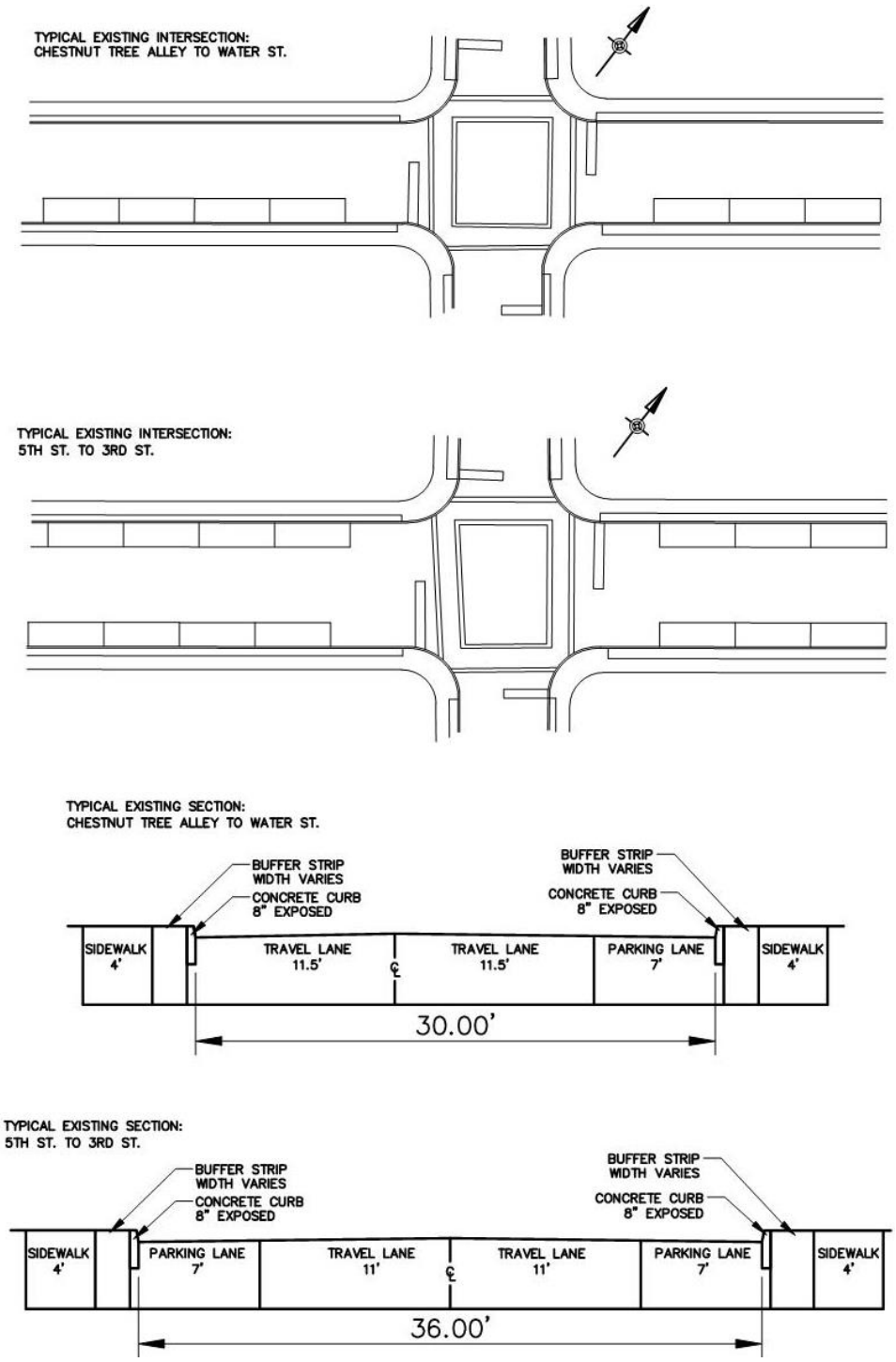


Figure 7.9 – Existing Conditions of St. John Street

7.2.2.1 Option 1

Option 1 is a two way street with no designed bike lane or cycle track. There are minimal changes to the existing conditions other than addition of signage and pavement markings. A cross section view of both option 1A and 1B are attached in Appendix C. Option 1 includes signage and markings were added based on specification by the MUTCD, chapter 9. As

suggested by the MUTCD in figure 9C-9, a share the road sign should be included at the beginning of every street section after an intersection. Furthermore, a shared lane marking should be placed at least 11 feet from the face of the curb and "should be placed immediately after an intersection and spaced at intervals not greater than 250 feet thereafter" (MUTCD, 2003).

Though not required, it is recommended that all curb cuts within the St. John Street corridor be upgraded to meet current accessibility standards since pedestrian trail users would utilize the existing sidewalks along this corridor.

Advantages:

- Least expensive since minimal changes are added to St. John Street.
- Least impact on downtown business and existing parking
- Two way traffic maintained
- Pedestrians separated from bicyclists
- Could be used as an interim option until further funding available for other Options.

Disadvantages:

- Option 1 is the least safe option since there is no designated bike lane or cycle track
- Bicyclists will affect traffic flow on St. John Street
- Does not encourage safe connection for all trail users

7.2.2.2 Option 2

Option 2 is a two way street with 5 foot bike lanes on each side and parking only provided in section B. The details of the cross sections are attached in Appendix C. Similarly to Option 1, signage and markings were added based on specification by the MUTCD, Chapter 9. As specified in the guidance of section 9B.04, "If used, Bike Lane signs and plaques should be used in advance of the upstream end of the bicycle lane, at the downstream end of the bicycle lane, and at periodic intervals along the bicycle lane as determined by engineering judgment based on prevailing speed of bicycle and other traffic, block length, distances from adjacent intersections, and other considerations" (MUTCD, 2003). Furthermore signage should include The Bike Lane (R3-17) sign and the R3-17aP and R3-17bP plaques (see Appendix 2.14) shall be used only in conjunction with marked bicycle lanes as described in Appendix 2.14.

Advantages:

- Marked, designated bike lanes
- Two-way traffic maintained
- Bicycle traffic in same direction as vehicle traffic
- Pedestrians separated from bicyclists

Disadvantages:

- Bike lanes less safe than a cycle track
- Bike lane on west bound do not align with rail trail
- Excessive loss of street parking on St. John Street

7.2.2.3 Option 3

Option 3 is a two-way street including a two-way cycle track and parking in section B. The drawings associated with option 3 are attached in Appendix C. The details for markings and signage were based on the National Association of City Transportation Officials guidance of two-way cycle tracks.

For those not familiar with a cycle track, cycle tracks are an exclusive bike facility separated form vehicular traffic and pedestrian traffic through the use of buffers and/or grade differentiation. Cycle tracks can be one-way or two-way and can be incorporated within the street/roadway or be physically separated. Figure 7.9 illustrates typical cycle tracks similar to those proposed in this study.

Figure 7.10 – Typical Cycle Tracks

Advantages:

- Cycle track along alignment of rail trail.
- Two-way traffic maintained
- Buffer and cycle track offer best safety for riders
- Pedestrians separated from bicyclists

Disadvantages:

- Excessive loss of street parking on St. John Street
- Increased risk for cyclists at vehicular intersections
- Narrow street lanes

7.2.2.4 Option 4

Option 4 is a one-way street with a two-way cycle track and parking maintained throughout the entire St. John Street section. The drawings associated with Option 4 are attached in Appendix C Similarly to option 3, this option followed the specifications detailed by the National Association of City Transportation Officials for two-way cycle tracks. An Option 4C was added as a possible alternative to Option 4 which includes angled parking between N. 3rd Street and Hazel Tree Alley. This option was recommended by stakeholders from meetings to maintain the parking count currently existing on St. John Street.

Advantages:

- Wider traffic lane and cycle track
- Parking lane maintained throughout St. John Street
- Safest of all the options
- Parking lane allows for extra buffer for trail users
- Traffic calming encourages safe usage for bikers / pedestrians

Disadvantages:

- One way traffic adds inconvenience to neighborhood traffic flow
- Increased risk for cyclists at vehicular intersections
- More expensive than options 1 and 2

7.2.2.5 Option 5

Option 5 is a two-way street with an extended sidewalk repurposed as a multi-use trail. The cross sectional views of Option 5 are attached in Appendix C. This option includes an 8-10' wide sidewalk utilized by both pedestrians and cyclists and would be located behind the street curb as a typical sidewalk does.

Advantages:

- Wider lanes improve safety of roadway
- Parking loss only occurs within 30' street section of St. John Street
- Rail trail users separated from car traffic to improve the safety of the trail

Disadvantages:

- Most expensive option do to reconstruction of existing curbing, storm drainage and lighting
- Eliminates separate, designated area between cyclists and pedestrians
- Cyclists traveling close to resident's homes and doorways.

7.2.2.6 Option 6

Options 6 is a one-way street with an extended sidewalk repurposed as a multi-use trail. This option is similar to Option 5, but maintains all existing parking on both sides of section B. The cross sectional views of Option 6 are attached in Appendix C. An Option 6C was also added similarly to option 4C, as a possible alternative to Option 6 which includes angled parking between N. 3rd Street and Hazel Tree Alley.

Advantages:

- Wider lanes improve safety of roadway
- Parking maintained throughout St. John Street
- Rail trail users separated from car traffic to improve the safety of the trail

Disadvantages:

- Most expensive cross section because removing the sidewalk is costly
- Eliminates a barrier between trail users / cyclists and pedestrians
- Cyclists traveling closer to residents front doors / sidewalks.
- One way traffic adds inconvenience to neighborhood traffic flow

7.2.3 LOS Calculations

Level of Service for bicyclists were calculated to analyze the different options for St. John Street based on capacity and comfort for bike users of the proposed section.

7.2.3.1 Urban Streets

In order to assess the performance of an urban street segment in terms of its service to bicyclists, the HCM 2020 Manual was utilized. Chapter 17, Urban Street Segments, was used for this application. Urban Street LOS was used to determine the LOS of Options 1, 2, 3, and 4. The following steps were used calculate the Link LOS:

1. Determine bicycle running speed
    a. Assumed to be 15 based on average running speeds detailed in the HCM
2. Determine bicycle delay at intersection
    a. Assumed to be zero because all intersection along St. John Street are two-way stop controlled
3. Determine bicycle travel speed
    a. The following equation was used to calculate the bicycle travel speed:

$$S_{Tb,seg} = \frac{3{,}600L}{5280(t_{RB} + d_{b)}}$$

    b. T_{RB} = segment running time of through bicycles = (3,600L)/(5280S_b) (s)
    c. For each section L, the length of the segment was determined using the Union County Aerial Map GIS.
4. Determine bicycle LOS score for intersection
    a. Assumed to be zero because all intersection along St. John Street are two-way stop controlled
5. Determine Bicycle LOS for the segment
    a. The following equation were used in calculating Bicycle LOS (HCM, 2010):

$$I_{b,link} = 0.760 + F_w + F_v + F_S + F_p$$

with

$$F_w = -0.005\ W_e^2$$

$$F_v = 0.507 \ln\left(\frac{v_{ma}}{4\ N_{th}}\right)$$

$$F_S = 0.199\ [1.1199 \ln(S_{Ra} - 20) + 0.8103]\ (1 + 0.1038\ P_{HVa})^2$$

$$F_p = \frac{7.066}{p^2}$$

Ex. 17-21

Condition	Variable When Condition Is Satisfied	Variable When Condition Is Not Satisfied
$p_{pk} = 0.0$	$W_t = W_{ot} + W_{bl} + W_{os}^*$	$W_t = W_{ot} + W_{bl}$
$v_m > 160$ veh/h or street is divided	$W_v = W_t$	$W_v = W_t (2 - 0.005\ v_m)$
$W_{bl} + W_{os}^* < 4.0$ ft	$W_e = W_v - 10\ p_{pk} \geq 0.0$	$W_e = W_v + W_{bl} + W_{os}^* - 20\ p_{pk} \geq 0.0$
$v_m (1 - 0.01\ P_{HV}) < 200$ veh/h and $P_{HV} > 50\%$	$P_{HVa} = 50\%$	$P_{HVa} = P_{HV}$
$S_R < 21$ mi/h	$S_{Ra} = 21$ mi/h	$S_{Ra} = S_R$
$v_m > 4\ N_{th}$	$v_{ma} = v_m$	$v_{ma} = 4\ N_{th}$

Notes: W_t = total width of the outside through lane, bicycle lane, and paved shoulder (ft);
W_{ot} = width of outside through lane (ft);
W_{os}^* = adjusted width of paved outside shoulder; if curb is present $W_{os}^* = W_{os} - 1.5 \geq 0.0$, otherwise $W_{os}^* = W_{os}$ (ft);
W_{os} = width of paved outside shoulder (ft);
W_{bl} = width of bicycle lane = 0.0 if bicycle lane not provided (ft);
W_v = effective total width of outside through lane, bicycle lane, and shoulder as a function of traffic volume (ft);
p_{pk} = proportion of on-street parking occupied (decimal);
v_m = midsegment demand flow rate (veh/h);
P_{HV} = percent heavy vehicles in the midsegment demand flow rate (%), and
S_R = motorized vehicle running speed (mi/h).

3. $$I_{b,seg} = 0.160\ I_{b,link} + 0.011\ F_{bi}\ e^{I_{b,int}} + 0.035 \frac{N_{ap,s}}{(L/5280)} + 2.85$$

b. The following assumptions were made:
   i. When a cycle track was used the motorized vehicle adjustment factor = 0 and the motorized vehicle speed adjustment factor = 0 since the cycle track is completely unaffected by traffic since it is separate
   ii. The motorized vehicle running speed = 25 (mi/h) for all options.
   iii. The adjustment percent for heavy vehicles in mid-segment demand flow rate was = 0 since St. John Street does not experience any truck traffic. '
   iv. A pavement condition rating of 4 was assumed since the pavement conditions were assumed to be of high quality. This was calculated using Exhibit 17-24 of the HCM.

6. Determine Link LOS
   a. Once the LOS score link was calculated, Exhibit 17-24 was utilized to determine the Link LOS:

Step 6 - Link LOS	
A	<2
B	>2-2.75
C	>2.275-3.5
D	>3.5-4.25
E	>4.25-5
F	>5

Table 7.7 Table showing Link LOS from step six of the calculations

It should be noted that St. John Street LOS was only analyzed based on segment because each of the segments act separately on the street since they are separated by intersections where the cyclist is assumed to dismount.

7.2.3.2 Off Street

The Highway Capacity Manual (2010) was used to analyze the Level of Service for Options 5 and 6 of St. John Street. The Off-Street Bicycle Facility calculation was used to determine the level of service ot the bridge. Input data was determined from the 2012 User Survey and Economic Impact Analysis and standard trail design values. Hourly demand was calculated from the user survey to be 17.5 bicyclists per hour, 6.25 pedestrians per hour, and 1.25 runners per hour. These values were used to calculate active passings per minute and meetings per minute. The trail was assumed to have 2 lanes. The probability of a delayed passing was determined from the active passings per minute and meetings per minute, and then used to determine the delayed passings per minute. This value was used in conjunction with other variables to calculate a LOS Score. A summary of the values used in this calculation can be seen below in Table 7.8.

		Bike	Ped	Run
hourly directional path flow rate for user group i	qi (modal users/hr)	9.5109	3.3967	0.6793
Expected Passings Per minute of mode I by average bicyclist	Ai	0.1423	0.2513	0.0276
total active passings per minute	At	0.4212		
directional path demand in minutes	Mi	0.1585	0.0566	0.0113
total meetings per minute	Mt	0.2264		
probability of delayed passing in subject direction	Pds	0.0107	0.0112	0.0014
probability of delayed passing in opposing direction	Pdo	0.0107	0.0112	0.0014
probability of blocked lane in opposing direction	Pno	0.0108	0.0113	0.0014
probability of blocked lane in subject direction	Pns	0.0108	0.0113	0.0014
probability of delayed passing	Pmds	0.0001	0.0001	0.0000

active passings per minute	At	0.421
total probability of delayed passing	PTds	0.000
Peak Hour Factor	PHF	0.920
Delayed Passings Per minute	DP	0.000
weighted events per minute	E	4.438
reciprocal of path width	RW	0.1
centerline		0.000
delayed passings per minute	DP	0.000
	LOS Score	3.82
	LOS	B

Table 7.8 - Values for LOS Calculation for St. John Street Options 5 and 6.

Options 5 and 6 were analyzed as Off Street because they are not affected by street traffic since they act as completely separate sections. The Off Street LOS calculation was also used in determining the LOS of the section between Route 15 and 5th street including the extension to 5th street which proved to be a LOS of A. The only changes that were made in calculating LOS for these sections in comparison to that used to calculate the LOS of the railroad bridge trail section were the changes to the following variables:

- Length of path segment which was calculated using the Union County Aerial Map tool.
- The reciprocal of path width.

The specific calculations made and assumptions associated are attached in Appendix 2.24. Ultimately calculating the LOS for each of these options allowed for an LOS comparison of these options which aided in creating a decision matrix for assessing which of the options to recommend for the reconfiguration of St. John Street.

7.2.4 BCI LOS Calculations

Another method to compare the different options associated with St. John Street was calculating the bicycle compatibility index (BCI) LOS of each option. The BCI LOS was developed by the Federal Highway Administration in order to assess the bikeability of a given section. It does not take into account capacity but rather purely characteristics of the roadway including:

- Bike lane
- Lane width
- Curb lane width
- Curb lane volume
- Speed
- Parking lane
- Area type
- Heavy vehicle percentages
- Parking turnover
- Right-turn volumes

The following equation and tables were used in determining the BCI LOS (FHWA, 1998):

BCI = 3.67 - 0.966**BL** - 0.410**BLW** - 0.498**CLW** + 0.002**CLV** + 0.0004**OLV** + 0.022**SPD** + 0.506**PKG** - 0.264**AREA** + **AF**

where:

BL = presence of a bicycle lane or paved shoulder ≥ 0.9 m
no = 0
yes = 1

BLW = bicycle lane (or paved shoulder) width
m (to the nearest tenth)

CLW = curb lane width
m (to the nearest tenth)

CLV = curb lane volume
vph in one direction

OLV = other lane(s) volume - same direction
vph

SPD = 85th percentile speed of traffic
km/h

PKG = presence of a parking lane with more than 30 percent occupancy
no = 0
yes = 1

AREA = type of roadside development
residential = 1
other type = 0

AF = $f_t + f_p + f_{rt}$

where:

f_t = adjustment factor for truck volumes *(see below)*

f_p = adjustment factor for parking turnover *(see below)*

f_{rt} = adjustment factor for right-turn volumes *(see below)*

Adjustment Factors

Hourly Curb Lane Large Truck Volume[1]	f_t	Parking Time Limit (min)	f_p
≥ 120	0.5	≤ 15	0.6
60 - 119	0.4	16 - 30	0.5
30 - 59	0.3	31 - 60	0.4
20 - 29	0.2	61 - 120	0.3
10 - 19	0.1	121 - 240	0.2
< 10	0.0	241 - 480	0.1
		> 480	0.0

Hourly Right-Turn Volume[2]	f_{rt}
≥ 270	0.1
< 270	0.0

Figure 7.11 - The equation used to calculate BCI LOS.

The following table was used to determine the LOS score (FHWA, 1998):

Table 2. Bicycle Compatibility Index (BCI) ranges associated with level of service (LOS) designations and compatibility level qualifiers.

LOS	BCI Range	Compatibility Level[1]
A	≤ 1.50	Extremely High
B	1.51 - 2.30	Very High
C	2.31 - 3.40	Moderately High
D	3.41 - 4.40	Moderately Low
E	4.41 - 5.30	Very Low
F	> 5.30	Extremely Low

Figure 7.12 - The table used to assess the BCI LOS.

Finally a LOS and BCI LOS comparison was made in order to help compare the different alternatives in terms of these measures. Table 7.9 includes the LOS and BCI LOS score given for each of the different options.

LOS / BCI Comparison		
Option	LOS Grade	BCI Grade
1A	C	C
2A	C	C
2A	B	A
2B	B	B
3A	A	A
3B	A	A
4A	A	A
4B	A	A
5A	C	A
5B	B	A
6A	B	A
6B	B	A

Table 7.9 - A comparison of the LOS and BCI scores calculated for each option.

7.2.5 Parking Analysis

A parking analysis was completed for each option on St. John Street since many of the reconfigurations effect the parking allocation on St. John Street. Furthermore, parking changes on St. John Street elicited many comments from residents and businesses in the neighborhood during the project public meeting. Parking was analyzed which was based on the data collected in the field. Table 7.10 offers a snap shot of the parking analysis completed under this study. Currently, a total of 70 parking spots exist between 5th street and N. Water Street on St. John Street. For each option, parking still available and lost was calculated. Based on the data collected, a maximum of 55 of the 70 parking spaces were used at any one time during the survey on St. John Street. In other words, 21% of the parking spots were unused and available. Finally, the percentage of spots lost for each section was calculated. Furthermore, the percentage of spots unused minus the percentage of spots lost was calculated to determine a net affect that the parking changes had on St. John Street. Additional calculations for the parking analysis for each trail option are attached in Appendix D.

Parking Analysis	1A/1B	2A/2B	3A/3B	4A/4B	4A/4C	5A/5B	6A/6B	6A/6C
Current Parking Available	70	70	70	70	70	70	70	70
Remaining Parking if Option Implemented	70	15	15	52	64	52	70	64
Parking Spaces Lost	0	55	55	18	6	18	0	6

Table 7.10 – Parking Analysis.

In analyzing the parking on St. John Street, one option to incorporate additional parking on St. John Street is by adding additional parking on the north side of the street between Peach Tree Alley and N. 3rd Street. In total it was calculated that six additional spots could be added to St. John Street in this option. This option is not represented in the parking analysis table presented above.

Since public input for the project indicated a concern for lost parking, it is recommended that further study of the parking availability in neighboring streets adjacent to St. John Street shown be completed.

7.2.6 Cost Comparison

The last consideration in choosing the reconfiguration of St. John Street was the probable construction cost for each option. The probable construction cost opinions for each of the different options are included in Appendix E. The highest costing option was Option 6 at $785,650 and the lowest cost option was Option 1 at $22,570 if accessible curb ramps within the street corridor are not upgraded to current standards. Table 7.11 lists the total probable cost for each of the options.

Construction Estimate	Option 1	Option 2	Options 3	Option 4	Option 5	Option 6
Total Cost	$22,570.00	$255,945.00	$281,060.00	$290,400.00	$727,800.00	$785,650.00

Table 7.11 - A cost comparison of the six different options for St. John Street.

7.2.7 Decision Matrix

In order to assess which of the options best meets the need of the project, a decision matrix was completed. Five different metrics were assessed in the matrix which included: LOS, BCI, parking availability, cost, and safety. Each of these metrics was ranked 1-10 based on the calculations and comparisons made for each metric. Each of these metrics were also weighted based on net effect on a complete street. Table 7.12 shows all of the different rankings given to each option.

		Options					
Metrics	Weight (1-10)	Option 1	Option 2	Options 3	Option 4	Option 5	Option 6
LOS	9	2	8	10	10	5	8
BCI	6	2	9	10	10	10	10
Parking Availability	7	10	1	1	9	8	9
Cost	7	10	9	8	8	2	2
Safety	10	1	3	10	10	8	8

Table 7.12 - Decision matrix used with the associated weights and values for each option.

With values identified above for each of the different metrics, the range index method was utilized to give a score to each option based on given values. The range index method takes into account the range another alternative option is better or worse than another. The following equation was used to compute the range index for each metric:

$$Factor\ RI(i) = \frac{x}{range}\ X\ 100$$

where RI_i is the range index, $x = f_i - f_{best}$, and range = $f_{worst} - f_{best}$.

The cumulative range index (CRI) was then determined by summing the weights * RI for each metric. (Fricker and Whitford). The decision matrix used to asses St. John Street is attached in Appendix 2.29. Finally the CRI's were ranked from lowest (best) to highest (worst) to determine the best option. Table 7.13 shows the six different options ordered and ranked based on CRI value.

Rank based on CRI	Option
1st	4
2nd	3
3rd	6
4th	5
5th	2
6th	1

Table 7.13 A comparison of the six different options based on CRI value as calculated using a decision matrix.

7.2.8 Final Recommendation for St. John Street

Based on all the comparisons and the decision matrix outcome, it is recommended that Option 4 is used in reconfiguring St. John Street. It is the safest of the options and also has the highest LOS and BCI grades. For section B of the section it is recommended that Option 4C it utilized. It is cost effective and also maintains parking for St. John Street. Based on design committee and public input, further traffic studies should be conducted to determine the effect a one-way St. John Street will have on adjacent neighborhood streets.

The public or borough may favor options other than Option 4. Moving forward, it is important to consider some of the other options that received high CRI scores. Option 3 also has merits if it is determined through traffic studies that a one-way configuration of St. John Street impacts Borough Streets negatively.

Funding will also have a major effect on whether or not specific options are truly viable for reconfiguring St. John Street. Therefore, Option 1 may be considered as an interim design solution if a trail connection between North 5th Street and North Water Street is needed before full funding is available.

7.3 Design of Section 3 – Railroad Bridge

A decking and railing system was designed for the abandoned railroad bridge over the West Branch Susquehanna River that will support pedestrian and bicycle loads. Loads for emergency vehicles were also considered. The decking and railing system will lay on top of the existing stringers and will be constructed out of glued laminated timber (glulam) and pressure treated lumber. The existing bridge truss structure is assumed to be sufficient to carry pedestrian loads due to the recommendation of John Conrad. Therefore, no detailed structural analysis was performed of the existing bridge structure itself. This section of the trail will also include the design of the trail from North Water Street to the west side of the bridge and the design of the trail from the east end of the bridge to Route 405.

7.3.1 Load Combinations

The design process was started by using AASHTO's LRFD Guide Specifications for the Design of Pedestrian Bridges (2009) to determine the appropriate design loads for the structure. This distributed load mainly accounts for the dead load of the decking itself and the live load of pedestrians and bicyclists on the bridge. Wind, rain, and snow loads were also considered and included in the load factor calculations. A pedestrian live load of 90 psf was assumed based on AASHTO recommendations. The self-weight of the deck was assumed to be 30 psf. Wind loads were determined using the wind load map in ASCE-7. (see Appendix). These loads were combined using load factors found in the AASHTO LRFD Bridge Design Specifications (2010). Based on recommendations from the Pedestrian Bridge Guidelines, only Strengths I and III, Service I and Fatigue I load combinations from the AASTHO LRFD Bridge Design Specifications (2010) were considered. A distributed combined load of 195 psf was calculated as the maximum combined distributed load from the Strength I combination.

A H10 design vehicle load was used for the structure as suggested in Table 3.2-1 the Pedestrian Bridge Guide Specifications (2009). This vehicle load was included so the structure could support maintenance and emergency vehicles. An H-10 vehicle accounts for point loads from truck wheels with 4 kips on the front axle and 16 kips on the rear axle. These loads were placed to produce the maximum load effects. Due to the infrequency of these loads, the AASHTO Pedestrian Bridge Guidelines (2009) states that dynamic loading does not need to be considered. The same strength, service, and fatigue load combinations were applied to this vehicle load. The maximum combination was once again Strength I, with 26.5 kips spaced 6 feet apart. Since the bridge is designed for primarily pedestrian loadings, the AASHTO Specifications for Pedestrian Bridges (2009) 3.7 – Combination of Loads states that a limited number of the load combinations in AASHTO LRFD Bridge Design Specifications (2010) are required for analysis. These distributed and point loads were used in later analysis to analyze the strength and serviceability of the selected deck material.

7.3.2 Material Selection

A list of possible decking materials was compiled based on case studies of other pedestrian bridges. Materials considered include glulaminated timber, precast concrete panels, lumber, pressure treated lumber, plastic composite, and metal grate. The materials were evaluated based on considerations including aesthetics, strength, maintenance, bike impact, environmental impacts, constructability, and durability. A weighted decision matrix was created to evaluate the considered materials on these evaluation criteria. The criteria were not all equally important, so certain criteria such as cost and aesthetics were weighted with more importance than other criteria. The decision matrices can be seen below in Table 7.13 and 7.14.

0=poor, 5=excellent	Wood	Pressure Treated Wood	Glu-Lam	Plastic	Concrete	Metal Grate
Cost	4	4	2	3	3	2
Aesthetics	5	4	4	3	2	2
Bike Impact	3	3	3	1	4	0
Maintenance	2	3	4	4	5	5
Environmental Impacts	2	1	1	3	2	3
Strength	2	2	4	2	4	5
Constructability	4	4	4	3	1	2
Durability	2	3	4	2	5	5
TOTAL	24	24	26	21	26	24

Table 7.13 - Unweighted Material Decision Matrix

	Weight (0=unimportant, 5= very important	Wood	Pressure Treated Wood	Glu-Lam	Plastic	Concrete	Metal Grate
Cost	5	20	20	10	15	15	10
Aesthetics	5	25	20	20	15	10	10
Bike Impact	4	12	12	12	4	16	0
Maintenance	3	6	9	12	12	15	15
Environmental Impacts	3	6	3	3	9	6	9
Strength	4	8	8	16	8	16	20
Constructability	5	20	20	20	15	5	10
Durability	3	6	9	12	6	15	15
TOTAL		103	101	105	84	98	89

Table 7.14 - Weighted Material Decision Matrix

As seen in the tables above, concrete, metal grate, and glulam were all highly rated if all of the evaluation factors were considered equally important. Metal grate was eliminated due to safety issues with bicycle riders because it can become very slippery. Concrete was not selected because of constructability issues that were likely imminent. When weighting factors were added to the evaluation factors, Glued-laminated timber was selected as the most appropriate material for the deck. There are limitations with using this decision matrix method to determine the appropriate deck material. Since some of the factors included are not easily quantifiable, the weights given to certain evaluation criteria are subjective to this design team's opinions.

7.3.3 Strength and Serviceability Evaluation

After selecting the glulam timber, the material was evaluated for strength and serviceability. Glulam decks on other pedestrian bridges were investigated. Since the orientation of the glulam is very important when calculating strength, significant research was done to determine how to install the glulam. The glulam will be installed in panels with the laminations oriented perpendicular to the longitudinal axis of the bridge and parallel to the applied loads as seen in Figure 7.12.

Figure 7.13 Glulam Deck Panel Orientation

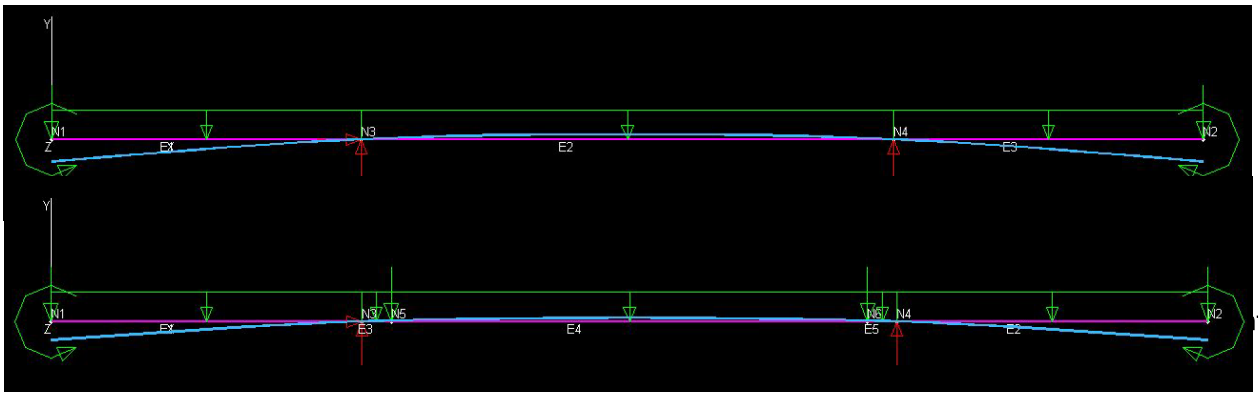
Initial sizes of the glulam planks were estimated based on construction documents from smaller bridges that were constructed along the existing length of the trail, including the Vicksburg Bridge. These bridges were designed using the AASHTO working stress method but calculations performed by GEM Consulting show that the same size decking is appropriate using the AASHTO LRFD method as well. Using the distributed and point loads determined from the load combinations, shear and moment diagrams were used to determine the shear stress and bending stress the deck must withstand for a one foot strip of deck. These values were compared to the nominal strength of deck. Resistance (φ) factor values were found in the Chapter 8: Wood Design of the AASHTO LRFD Bridge Design Specifications (2010). Values of nominal strength for glulam timber were found in the ASD/LRFD Manual for Engineered Wood Construction (2005) and double checked with the values used to design the Vicksburg Bridge. Full calculations can be found in the Appendix.

Adding additional steel members between floor beams was considered to support the load of the deck and railing, but it was determined that it would be unnecessary if the railing connection to the deck was designed appropriately. This additional steel would greatly increase the cost of construction and would not change the required size of the deck significantly.

7.3.3.1 Deflections

Deflections were calculated using MASTAN2 (2010). AASHTO Pedestrian Bridge Design Specifications states that deflections at the Service I limit state should be analyzed and deflections should not exceed 1/360. According to the load combinations, the Service I limit state requires a 120 psf distributed load and 18 kip point loads. These loads were placed on the structure created in MASTAN2 (2010) and the deck was evaluated with a first order elastic analysis. The deck was assumed to be a single member and simply supported on the existing bridge girders. Material properties were inputted into the program that was consistent with glulam timber descriptions found in the ASD/LRFD Manual for Engineered Wood Construction (2005). Point loads and moments representing the maximum expected railing load were also applied

to the end of the deck. The MASTAN structures that were created to analyze the deck can be seen below.



A first order elastic analysis was applied and the deflected shape was displayed. Due to the close proximity of the spacing of the vehicle load with the support from the existing steel stringers, the point loads did not have a major effect on deflections even though they were considerable higher than the distributed load. Table 7.15 details the deflections of the exterior portion of the deck under both loading conditions.

	Deflection (in)	L/360 (in)	Deflection less than L/360?
Distributed load only	-0.228	0.48333	Y
Distributed Load and Point Load	-0.0993	0.48333	Y

Table 7.15 - Deck Deflections from MASTAN2

As seen in the table above, the deflections of the deck with and without the vehicle point loads were less than the AAASHTO requirement of L/360. Therefore, the bridge deck is acceptable in regards to serviceability.

Fracture critical members and fatigue resistance for steel reinforcement were not analyzed since they referred to the existing truss structure, which was assumed to be sufficient based on John Conrad's inspection report.

7.3.4 Railing Design

The railing on the bridge was designed in accordance with and AASHTO LRFD Bridge Design Specifications (2010), Section 13 "Railings." These regulations require railing systems to be at least 42 inches high for pedestrian traffic and 54 inches high for bicycle traffic. A 6-inch sphere cannot pass through the lower 27 inches of the rail system and an 8 inch sphere cannot pass through the upper area of the rail system higher than 27 inches. A safety toe rail must be provided to prevent trail users from catching anything on the posts. In the design of this bridge, the safety toe rail will also be a structural member to support the moment created on the edge of the deck from the railing.

The design live load for railings is 50 pounds per linear foot transversely and vertically. A concentrated load of 200 pounds acting simultaneously with the above loads and any point

in any direction at the top of each rail. These loading configurations can be seen in Figure 7.13 below.

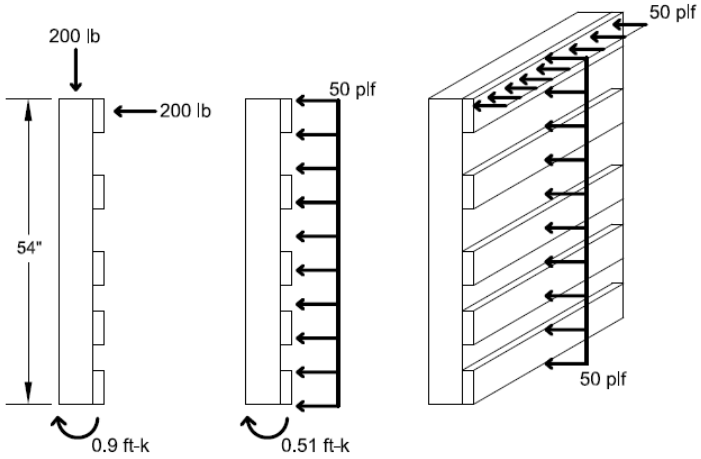


Figure 7.14 - Loading Configurations on Railing System

Based on the loading configurations seen above, the railing connection to the deck must withstand 0.9 foot-kips. A 8x8 inch nominal timber curb will be provided with ¾ inch diameter bolts to create a connection to withstand this moment. Calculations for this connection can be found in the appendix. The curb also helps meet the safety toe rail requirement from the AASHTO regulations. 2" x 6" nominal timber beams connected to 8"x8" nominal timber posts with ½" diameter dome head bolts will be used as the railing system. The strength of these bolted connections was investigated to determine their strength. Bolts were designed to be grade A36 steel and timber strengths were determined from the strengths listed in the National Design Specification Design Values for Wood Construction (2005) and verified with the plans for the existing Vicksburg Bridge. Shear through the shank of the bolt, crushing of the timber, and tearing of the timber were investigated. Full calculations can be found in the appendix. Tearing of the wood was the controlling variable in this design, so washers will be used in all connections to increase the bearing area and reduce the possibility of the wood crushing at the bearing points.

The timber rail will be spaced in the lower 27" of the railing system with 4 ½" separation between the beams. The upper portion of the railing system will have 7 ½" separation between the beams. Sleeper blocks of ½" thickness will be provided under the safety toe rail to allow for drainage. The deck will be constructed with a 1 % slope and these sleeper blocks will allow the deck to drain. The railing design can be seen in the Railing Details drawing in the appendix.

7.3.5 Integration with Existing Bridge

After the deck and railing system materials and sizes were determined, designs were developed to incorporate the system into the existing bridge. Drawings of the basic dimensions of the bridge and truss structure were provided by John Conrad early in the project. These drawings had approximate lengths of the members of the stringers, floor beams, and truss members, but the sizes of these members were not recorded. The approximate sizes of the steel members were necessary in order to develop a design to incorporate the deck and rail system into the existing structure. Team members went out to the site of the bridge and took measurements of the steel members that were easily accessible as seen in Figure 7.14. A sketch of the existing steel members

and approximate sizes can be found in the Existing and Proposed Sections drawing in the appendix.

Figure 7.15 - Team Members measuring size of steel members

Since the stringers of the bridge sit approximately 7 inches below the floor beams that are spaced approximately every 26 feet along the bridge, glulam sleeper blocks will be required to create a level surface that the deck can sit on. The deck will be installed with a 1% slope to facilitate drainage. The sleeper blocks on one side of the bridge will be approximately ½" higher in order to develop this slope or drainage.

Sleeper blocks will be connected to the existing steel stringer using a steel offset shoe. The offset shoe will hook around the flange of the stringer and a bolt will be driven up into the sleeper block as seen in the Stringer Connections drawing in the appendix. Figure 7.15 shows an example of an offset shoe used on the Vicksburg Bridge.

Figure 7.16 - Offset Shoe Example

The sleeper block will then be connected to the deck with clip angles with lad screws. The railing system will otherwise be freestanding of the existing steel members at all sections not at a floorbeam. The sections of the bridge that are at a floorbeam will provide additional stability to the railing system. Clip angles similar to the connections used to connect the deck to the sleeper block will be used to connect to the vertical members of the truss to the railing where applicable.

7.3.6 East Side of Bridge

BVRec's right-of-way for the trail ends on the east side of the bridge. BVRec formerly owned the right of way of the rail line to Montandon, however, this right-of-way was abandoned recently due to potential legal issues. For now, the trail is designed to carry users down to PA Route 405. The proposed path of the rail runs through PennDOT's right-of-way for Route 405, so further coordination would be required with PennDOT and a Highway Occupancy Permit would need to be granted to construct the trail there. As seen in Figure 7.16, there is a section of the trail that runs through private property. Further investigation is needed to determine the owner of the land on the west side of the right-of-way and if they would be supportive of granting an easement for construction of the trail.

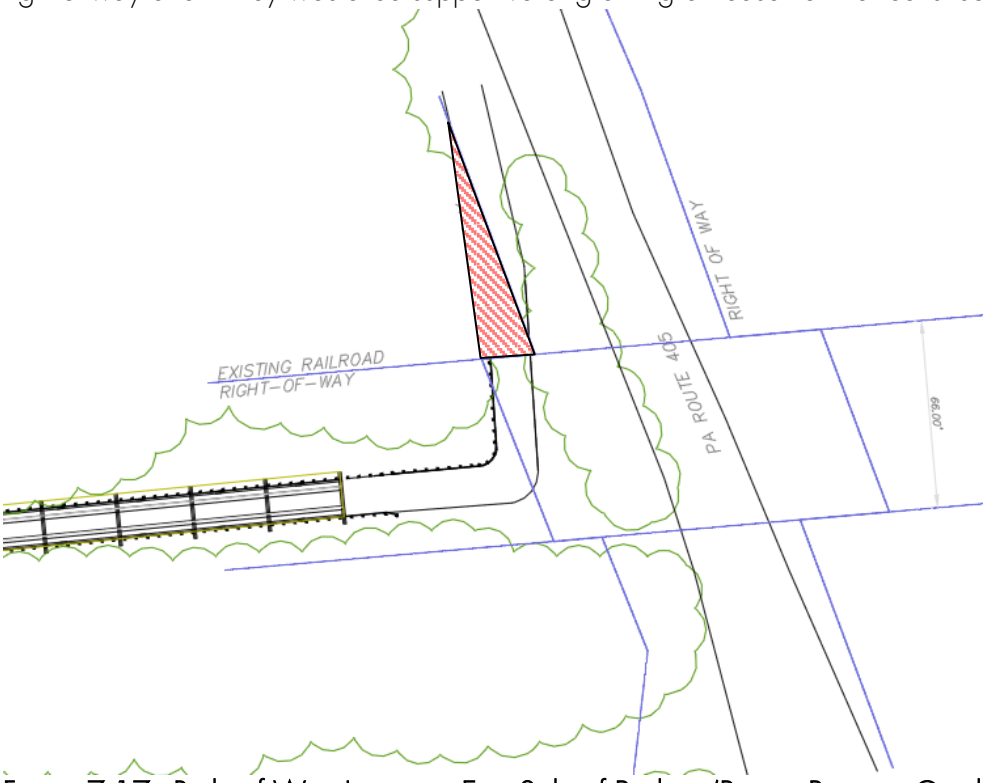


Figure 7.17 - Right of Way Issues on East Side of Bridge. (Private Property Overlap highlighted in red)

This segment of the trail from the end of the bridge down to Route 405 has a slope of approximately 7.33%. Currently, the difference in elevation between the bridge and Route 405 is 11 feet according to Google Earth. The length of the path is approximately 150 feet. According to the Access Board Trail Guidelines, the slope of a trail segment less than 200 feet long cannot be steeper than 1:12. The 7.33% slope is approximately 1:14, so the slope of this segment of the trail meets regulations. The design team verified field measurements of certain segments of this 150 foot path and found them to be slightly steeper than the overall slope. Therefore, grading will be required to create a constant slope of the path from the end of the bridge to Route 405. After

grading, this segment of the trail is recommended to be paved in a similar fashion as other asphalt paved sections of the trail.

7.3.7 LOS Calculation

The Highway Capacity Manual (2010) was used to analyze the Level of Service of the Bridge. The steps taken to determine the LOS are very similar to the steps taken to calculate the LOS of Options 5 and 6 of St. John Street. Based on this LOS Score, the segment of the trail over the bridge has a level of service of A. A summary of the values used in this calculation can be seen below in Table 7.16.

		Bike	Ped	Run
hourly directional path flow rate for user group i	qi (modal users/hr)	9.5109	3.3967	0.6793
Expected Passings Per minute of mode I by average bicyclist	Ai	0.1423	0.2513	0.0276
total active passings per minute	At	0.4212		
directional path demand in minutes	Mi	0.1585	0.0566	0.0113
total meetings per minute	Mt	0.2264		
probability of delayed passing in subject direction	Pds	0.0107	0.0112	0.0014
probability of delayed passing in opposing direction	Pdo	0.0107	0.0112	0.0014
probability of blocked lane in opposing direction	Pno	0.0108	0.0113	0.0014
probability of blocked lane in subject direction	Pns	0.0108	0.0113	0.0014
probability of delayed passing	Pmds	0.0001	0.0001	0.0000

active passings per minute	At	0.421
total probability of delayed passing	PTds	0.000
Peak Hour Factor	PHF	0.920
Delayed Passings Per minute	DP	0.000
weighted events per minute	E	4.438
reciprocal of path width	RW	0.071
centerline		0.000
delayed passings per minute	DP	0.000
	LOS Score	4.277
	LOS	A

Table 7.16 - Values for LOS Calculation

8.0 COST OPINION

A cost estimate opinion was compiled for each separate section of the project. Unit cost data was found from previous bids compiled by Larson Design Group or industry databases. It is likely that each of these sections of the trail will be constructed separately as funding becomes available, so the costs of each section are separated. Final cost estimates include the cost of material, equipment, and labor. Each opinion includes a contingency/engineering fee and inspection costs. The complete cost opinions for each trail segment are provided in Appendix E. These costs will vary based on the type of funding utilized to construct the proposed improvements and if more than one segment is constructed at a time. The cost opinions provided are in 2013 dollars; therefore, construction cost escalation should be factored with the cost shown to ensure accuracy going forward. Construction cost escalation can be determined from the *Engineering News Record* annual construction cost escalation report. Table 8.1 is the probable cost for each individual segment and total project cost:

12th Street to Route 15	$224,610.00
Route 15 Intersection	$228,840.00
Route 15 to 5th Street and Extension to Market St	$526,730.00
St. John Street Corridor – Option 4	$290,400.00
River Bridge Segment	$2,019,850.00
TOTAL PROJECT COST	$3,290,430.00

Table 8.1 – Opinion of Probable Cost

9.0 PUBLIC INPUT

This study included one stakeholders meeting, which occurred on May 1, 2013 at the Barnes and Noble Community Room. This was by invitation only and included members of the Borough Council and members of numerous Borough and Township committees and commissions considered stakeholders in this project.

Additionally, an advertised public meeting was held on May 23, 2013 at the William Cameron Engine Company Training Room. A copy of the PowerPoint presentation is provided in Appendix F. At the meeting, a comment form was distributed in order for attendees to offer comments, concerns and suggestions. The completed surveys received following the meeting are included in Appendix G. The meeting included mixed reactions and comments offered during the question and answer portion of the meeting. The following general sentiments were heard during the meeting.

- The attendees were pleased that a connection to Market Street is proposed.
- Residents are concerned with potential impacts of increased pedestrian traffic in the neighborhood adjacent to St. John Street.
- A safe connection across Route 15 is very important.
- Additional parking at Soldiers and Sailors Park on North Water Street should be considered since this would act as the beginning or end of the trail.
- Residents in the neighborhood adjacent to St. John Street value on-street parking above and beyond keeping the street two-way.
- The preference was to separate cyclists from pedestrians within the St. John Street corridor.

Following the public meeting, an informal survey was left at Fisher's Meat Market to further gather input. The results of that survey are presented in Table 9.1.

Fisher's Meat Market Public Opinion Survey - Summer 2013					
Questions	Responses				
Where do you live?	North of Market St in Lewisburg, between Route 15 and the river	In the borough, south of Market St	Outside of the borough		
	26	16	54		
Creating a pedestrian and a bike trail from 5th St to the river	Is a good idea	Is a good idea if doing so does not reduce the # of parking spaces available on St. John by >5%	Is a good idea if doing so does not reduce the # of parking spaces available on St.John at all	Is a good idea if doing so does not require St. John be made a one-way street	Is a bad idea
	26	7	19	10	41
How frequently would you expect to make use of a Rail Trail extension through Lewisburg, if it ran the river through to Mifflinburg with a spur that ran to Hufnagle Park?	Frequently	Sometimes	Rarely	Never	
	20	19	19	41	

Table 9.1 – Fisher's Meat Market Survey Results

Further input was sought during a Lewisburg Neighborhoods Corporation meeting held on June 11, 2013 in which neighbors and property owner's adjacent to the proposed trail alignment gathered to discuss the rail trail extension. That meeting included additional comments and identification of potential impacts related to the loss of parking, increased liability, loss of access with one-way street circulation, trespassing, increased litter, no provisions for additional trail parking and concern for a lack of actual need for the trail, among other minor concerns.

10.0 CONCLUSIONS

This feasibility study communicates the design team's design process to develop concept plans to extend the Buffalo Valley Rail Trail from its current location to the east side of the railroad bridge. Valuable feedback was provided throughout the design process through the collaboration with Bucknell University, design committee members, BVRec, and well attended public meetings. The extension is needed to connect Lewisburg Borough's commercial and residential areas with the existing trail. A previous economic impact study completed demonstrated the demand for the trail. Currently, the trail extends into downtown Mifflinburg and the economic impact study showed that the trail is used not only for recreational purposes, but also as a convenient means of accessing nearby businesses. An extension of the current trail into downtown Lewisburg will provide a safe, sustainable transportation option for local residents and will help sustain and improve the economy and quality of life of downtown Lewisburg.

The design has three major design elements: the intersection of the trail with Route 15, the alignment of the trail between 15th Street and the railroad bridge, and the decking and rehabilitation of the railroad bridge. These elements were conceptually designed to provide a guide that would aid in the future design and construction of the trail extension.

The design proposes an at-grade, signalized pedestrian crossing of Route 15 through the use of "hot-response" pedestrian signal with a raised pedestrian buffer in the highway median. This design increases safety and allows the trail to connect both sides of Route 15 without significantly impacting the vehicular traffic along the roadway and for a reasonable cost. The trail will be extended along St. John's Street by modifying the street and developing a cycle track separated from the vehicular travel way with a buffer. The railroad bridge will be decked with glued-laminated timber panels and timber railings and posts. The total cost of constructing all trail segments is estimated to be approximately $3.29 million

Moving forward it is recommended that BVRec continue seeking opportunities to develop the rail trail extension. This will require continued partnership with the Township and Borough, PennDOT and adjacent trail property owners. The following is a small list of recommendations to continue moving this exciting project to completion.

- Continue discussions with PennDOT through the newly formed Route 15 Corridor Committee to find funding streams and improve corridor traffic signals throughout the corridor in order to accommodate the trail corridor crossing.

- Continue discussions with the St. John Street neighborhood to refine the St. John Street trail segment options. This includes; (1) implementing Option 1 as a temporary option; (2) complete a traffic study to determine impacts of making St. John Street a one-way street and in which direction the one-way designation should be; and (3) further study of the parking impacts to adjacent residential and commercial areas.

- Explore areas for additional parking along the trail corridor including improvements to Municipal Parking Lot 4 and potential additional parking at the railroad bridge along North Water Street.

- Continue to seek funding opportunities from multiple public and private sources to further implement trail development within the corridor.

11.0 REFERENCES

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Other Resources

Other resources that will be helpful during the design process are listed below.

- FHWA Manual on Uniform Traffic Control Devices (MUTCD)
  - Determine signage, striping, and signalization
- AASHTO Design Guide for Pedestrian Bridges
  - Determine pedestrian loads and evaluate decking materials
- AASHTO LRFD Bridge Design Specifications
- AASHTO Guide for the Planning, Design, and Operation of Pedestrian Facilities
  - Identify appropriate designs for pedestrian facilities
- AASHTO Guide for the Development of Bicycle Facilities
  - Identify appropriate designs for bicycle facilities
- AASHTO Policy on Geometric Design of Highways and Streets (Green Book)
  - Reference for designing trail alignment
- Buffalo Valley Recreation Authority (BVRec)
  - Provide general input on design goals and objectives
- Data counters on the existing BVRT
  - Determine pedestrian traffic to warrant Route 15 crossing
- Data from the BVRT Rail Trail 2012 User Survey and Economic Impact Analysis
  - Determine trail demand to warrant Route 15 crossing and extension
- CENG 432 Preliminary Study
  - Provides background on the trail and user demand
- Greenroads / Envision rating system
  - applied to assess sustainability of project
- Route 15 Smart Transportation Corridor Study
  - Reference for design of Route 15 crossing
- Abandoned Railroad Bridge over the West Branch Susquehanna Inspection Report
  - Background on railroad bridge, recommendations for repair, affirmation of structural stability

APPENDIX A

BVRT Extension Kick-off Meeting Minutes
January 29, 2013, 2:00pm
Room 315, Dana Engineering Building, Bucknell University

Attendees:
Michelle Oswald, Professor, Bucknell University
Emily Gladstone, Bucknell University
Gil Erlich, Bucknell University
Matt Syzmanski, Bucknell University
Steven Beattie, Larson Design Group
Shawn McLaughlin, Union County Planning Director
Chad Smith, Lewisburg Borough Manager
Ted Strosser, Lewisburg Borough Councilmember
Jim Mathias, LARA Chairman
Katie Davis, LARA Director
Jim Buck, BVRT Committee
Sam Pearson, BVRT Committee
Judy Wagner, Mayor of Lewisburg

Introductions

Each meeting attendee introduced themselves and the role they play within the group and community at large.

Project Scope

- Scope includes designing extension from current trail terminus across Route 15, through the Borough along St. John's Street and over the abandoned railroad bridge. The students propose to break the scope into three parts, as such; Mr. Erlich's will focus on the section from the trailhead to and including the Route 15 crossing. Mr. Szymanski's will work on the section from 8th to Water Street including the bridge crossing at Bull Run and Ms. Gladstone's will concentrate on the river bridge.

- It was noted that case studies were removed from BU student scope. Mr. Beattie indicated that he or anyone else should forward information to the group that would be a good example of the type of improvements proposed for this project. Mr. Beattie mentioned the recently completed section through Jersey Shore as a potential similar project.

- Larson Design Group's (LDG) scope was noted. LDG is contracted to complete a preliminary engineering design from Route 15 to 5th Street with an extension to Market Street. LDG is also contracted to complete conceptual design from 5th Street to East side of Railroad bridge and assist students on their project.

- BU Project Website: https://sites.google.com/a/bucknell.edu/buffalo-valley-rail-trail-extension-2013/

Public Outreach

Sam Pearson suggested that the Rail Trail Committee could visit businesses and homes along the proposed extension along St. John Street to inform them of the planning process and progress. The RT Committee will assist in preparing a "common message" pamphlet to provide property owners. It was agreed that everyone involved on the project should have a "script" of what to tell the public about the extension. This "script" will be developed by RT Committee. It was also agreed that Katie Davis will be the official spokesperson for media requests.

Project Schedule

- January 29th, 2013: Authorization to proceed for LDG's Concept Planning.
- January –March 2013 Kick-off Meeting, Data Collection, design coordination meetings
- March, 2013: Develop Concept Alternatives and Review with Design Committee
- April, 2013: Key Stakeholder Meetings/interviews
- May 1, 2013: BU Students present final project at Barnes and Noble Community Room
- Late May 2013: LDG completes Draft Concept Plan and Feasibility Report
- Late July 2013: LDG completes Final Concept Plan and Feasibility Report and presents to LARA Board and Borough Council

BU students will present their design on May 1st at Barnes & Noble. It was discussed that a Stakeholder meeting could occur in April as one large meeting that invites all relevant committees, commissions in the Borough and Township. LDG will evaluate options with the students and LARA and recommend a preferred approach for stakeholder and public involvement.

Concrete Piers in Hufnagle Park North

The concrete piers are not included in the conceptual design of the BU student's scope. LDG currently intends to leave concrete piers out of its scope due to the cost of decking and technical issues that will complicate this phase of the design. Group concluded that the piers and a potential bridge atop the piers will be considered a secondary project in the future.

LDG Review of Project

LDG presented early sketch of potential alignment from 8th Street to Municipal Parking Lot 4 located in Hufnagle Park north. More discussion needed on how to incorporate gravel parking lot near piers and if this will be a trailhead or a secondary pathway to parking. Being mindful of potential costs, it was discussed that an accessible route to the gravel parking lot should occur adjacent to Cherry Alley. LDG noted that an area of the trail is located within the Floodway. LDG will review this further and determine what mitigation/permitting would be required if the trail project changes existing grades within the floodway. This will be a point of discussion at the next meeting.

Lewisburg and Buffalo Creek Railroad

It was discussed that special attention will be needed in the area of the Lewisburg and Buffalo Creek Railroad since the trail is proposed to cross the active rail line and also run adjacent to the active rail line for the trail connection to Market Street. The Borough owns a portion of the western side of the

railroad ROW three feet off the western rail. LDG and the Borough will set a meeting with the owner of the railroad, Will Sanders.

Student Data Collection

The following data will be developed and/or obtained by the Bucknell Students:

- Traffic counts on Route 15, pedestrian and bike counts too
- Data from Route 15 study will be incorporated
- Traffic counts on St. John's Street (special attention to westbound and eastbound traffic)
- Parking Spaces usage along St. John Street
- Water St. traffic counts (data from another BU student group), includes new stop sign
- Pedestrian counts on 45 bridge (depending on weather)

Action Items

1. **Rail Trail Committee to prepare a "Common Message" for everyone to utilize when speaking to others about project.**
2. **Union County Planning Department to provide traffic counts from Route 15 Corridor Study**
3. **LDG to set meeting with Mr. Will Sanders.**
4. **LDG to contact William Cameron concerning thoughts on Bridge Access, one-way street consideration, etc.**
5. **LDG to set next design meeting for end of February.**

MEETING MINUTES – DESIGN/SITE REVIEW

This confirms and records our interpretation of the discussions that occurred and our understanding reached during this meeting. Unless notified in writing within 48 hours of the date shown on the last page of these minutes, we will assume that the following interpretation or description is complete and accurate. Area of italic print notates additions or revisions made based on new information following the scheduled meeting.

Reference: Buffalo Valley Rail Trail Concept and Preliminary Design
LDG Project No. 7020-005 and 7020-006

Meeting Date: February 13, 2013

Attendees:

Chad Smith	csmith @lewisburgborough.org	Borough Manager
George Stump	gstump@lewisburgborough.org	Borough Foreman
Katie Davis	director@golara.org	LARA Exec. Director
Will Sanders	wsand101@hotmail.com	L&BC Railroad Owner
Pete Simcox	psimcox@nshr.com	North Shore Superintendent
Phil Hoffman	pgh@larsondesigngroup.com	Larson Design Group
Steven Beattie	smb@larsondesigngroup.com	Larson Design Group

Purpose: The purpose of this meeting was to meet with the Lewisburg and Buffalo Creek Railroad owner and operator (North Shore Railroad) to discuss LARA's proposed project, timelines and some impacts it may have on the railroad.

Schedule: Tentatively, if funding for construction is secured in a timely manner, it was discussed that construction of the BVRT segment from 8th Street to 5th Street could occur in Fall 2014. This would include a segment south to Market Street.

Discussion:

The project was introduced to the attendees. Generally, LARA is seeking to construct a rail trail extension across the active rail line in the area of St. John Street and N. 5th Street. Additionally, LARA desires a trail to run from the main rail trail alignment south to Market Street.

Mr. Beattie noted that the Borough of Lewisburg owns the area of the old railroad right-of-way located 3 feet from the western rail to the western right-of-way line from St. Mary Street to the northern abutment of the Bull Run railroad bridge below Kidsburg playground. The deed notes that the Borough need to provide access to the railroad for future maintenance and other operational purposes.

The group made some rough measurements along the track to understand where the trail would occur if the trail was placed 10 feet from the western rail. 10 feet is the minimum desired by Lewisburg and Buffalo Creek Railroad North Shore Railroad to allow for regular maintenance and provide a safe distance from the Railroad. The Railroad noted that the majority of work to replace ties can occur on the east side of the tracks, but some obstructions exist on the east side, thus the need for the access on the west side.

It was noted that in order for the trail to be 10 feet away from the western rail, embankment work would be necessary to allow construction of the trail at this location. This will also require the removal of trees. It was noted that most of the trees are Norway Maple.

It was discussed that a split rail fence between the railroad and the trail would be preferred by all since it can easily be removed and replaced based on railroad maintenance needs. Permanent fencing 9in concrete) or removable (sleeved-type) bollard/fencing would cost more upfront, have a higher cost for temporary removal and higher potential for vandalism.

It was mentioned that the Railroad would need 10 to 12 feet of clearance at times of tie replacement. It was agreed that during these instances, that the trail would be closed and the fence removed where necessary.

At the area where the main line trail crosses the active railroad, the railroad requested that the crossing include a 9-foot long concrete panel as the crossing type. This would require the replacement of the railroad ties with new 10' long wood supports under the panel. It may also require the replacement of rail if the concrete panel interferes with the rail splice bars. The Railroad also requested that the yellow offset gates also be installed at the railroad crossing for added safety.

It was noted that LDG is in preliminary design and we would remain in touch with the Railroad through the design and permitting process and seek further input and review. It was noted that an agreement would need to be drafted between LARA and the railroad to document maintenance of the trail crossing at the railroad.

Following the meeting with the Railroad representatives, the remaining group walked the area of the trail to Market Street and to Seventh Street. The following was observed:

- The adjacent restaurant/property owner at Market Street, which would be adjacent to the trail has encroached on the Borough's property with miscellaneous "stuff". The Borough should consider contacting the property owner since the restaurant is moving out. It was noted that a visual screen/ fence be considered to limit views toward the services area, walk-in cooler and garbage disposal/parking area.

- The area of Cherry Street was reviewed. It was noted that a pathway from the Market Street trail extension to the municipal parking lot was likely possible in this area and LDG will review further.

- The Borough requested that the wooded area between the concrete piers and main line trail be removed in order to improve site lines, increase safety and reduce vandalism in the area. Removal of the trees and brush should include reshaping the slope in order to allow monthly/seasonal mowing of the area.

- It was noted that a drain pipe that drains the North 5th Street area runs along the north side of the main line trail from the old recycling building to Bull Run. Mr. Stump noted this drain pipe is in poor shape and likely need replaced. LDG will review the potential cost for this work outside the trail project scope.

- The Seventh Street crossing was reviewed and discussed. The Borough had developed preliminary plans to lower the roadway at the trail crossing and improve the drainage system. The Borough should review if these improvements are still a priority and it need to be further discussed which improvements are part of the trail and which improvements would be part of the street improvement. It was also noted that a drainage channel along Green Alley needs further consideration since it presents a hazard to vehicles. Potentially, a pipe run with inlets at each end could be provided, which would improve drainage, remove the vehicle hazard and allow for ease of maintenance.

Prepared by: Steven Beattie, RLA Date: February 18, 2013

Copies: ☒ Participants ☒ Design Committee ☒ File

MEETING MINUTES – DESIGN DEVELOPMENT

This confirms and records our interpretation of the discussions that occurred and our understanding reached during this meeting. Unless notified in writing within 48 hours of the date shown on the last page of these minutes, we will assume that the following interpretation or description is complete and accurate. Area of italic print notates additions or revisions made based on new information following the scheduled meeting.

Reference: Buffalo Valley Rail Trail Concept and Preliminary Design
LDG Project No. 7020-005 and 7020-006

Meeting Date: February 27, 2013

Attendees:

Chad Smith	csmith @lewisburgborough.org	Borough Manager
Judy Wagner	jtw@dejazzd.com	Borough Mayor
Katie Davis	director@golara.org	LARA Exec. Director
Jim Buck	jimbuckperson@gmail.com	EBT Supervisor
Samantha Pearson	sam.z.pearson@gmail.com	Trails Committee Chair
Michele Oswald	mro003@bucknell.edu	BU Eng. Professor
Emily Gladstone	eag024@bucknell.edu	BU Eng. Student
Gil Erlich	gpe001@bucknell.edu	BU Eng. Student
Matthew Szymanski	mcs019@bucknell.edu	BU Eng. Student
Steven Beattie	smb@larsondesigngroup.com	Larson Design Group
Dan Greene	elmstreet@dejazzd.com	Elm Street Manager

Purpose: The purpose of this meeting was to update the committee on design progress since our January 29 meeting. Reminder: BU Project Website: https://sites.google.com/a/bucknell.edu/buffalo-valley-rail-trail-extension-2013/

Schedule: The project remains on schedule as outlined in LDG's scope of work and BU Student requirements.

Discussion:

Review of past meetings Action Items:

- Common message
  - Public relations will be determined by BVRT Committee. It was concluded that outreach will occur to adjoiners within both projects.
  - It was noted that the May 1st public meeting would not be advertised publicly, but will include invitations to the various Borough and Township committees, commissions and partnerships.
- Traffic Counts at Route 15 were provided by Union County Planning. The BU Students conducted additional data collection.
- Will Sanders Meeting
  - Public Utilities Commission approval will be needed for final design at trail/rail crossing.

- Regulations require that nothing be above the height of the rail for 12' from the centerline of the railroad (see attached sketch presented during meeting).
- Two 9' precast concrete panels were requested to be used for trail crossing over railroad.
- It was suggested to use a split rail fence to separate the trail from active rail line in order to make it easily removable for RR maintenance
- The semantics of the meeting minutes with the Railroad were discussed. It was determined that nothing has actually "cast in stone" for final decisions, but more that this was the common ground found during the meeting. The meeting minutes should be interpreted to not be "absolute" where the phrase "it was agreed" was used.

- William Cameron has responded that Steve Leauber will be our direct contact.

Review of BU Student Data Gathering:

Traffic Counts conducted at Route 15

- Route 15 has high traffic volumes as expected (Max ~1650 vehicles peak hour).
- With this high volume of traffic, in order to warrant pedestrian signal according to PennDOT, 133 pedestrians will need to cross Route 15 in one hour.
- Pedestrian counts will be taken later in spring (Wednesday farm market, school, weather will be taken into account).
- Queuing over trail alignment occurs – project will eventually have to be expanded to include Route 15 corridor as a whole.

Traffic Counts conducted on St. John's Street

- Low volume was observed, as expected.

Parking along St. John's Street Evaluated

- Spaces approximately half filled on weekdays at 4pm.
- Spaces approximately 75% filled weekdays at 6:30am.
- More data collection will be taken on weekdays other than Wednesday, and Saturday mornings.
- Street Cleaning schedule, Fisher's schedule will be taken into account with further counts.
- It was noted that the number of parking spaces lost under each Concept option should be indicated.

Example projects within Streets - Jersey Shore and Watkins Glen NY

- Share the Road signage and new accessible curb ramps.
- Trail on low volume street.
- These were least impact, least cost options.

Review of Concept Alternatives along St. John Street

It was noted that there are two different cross section types along St. John Street. Each of the alternatives indicate A or B. The A alternatives include a 30' wide curb to curb existing condition. The existing street includes 2 – 11.5' wide lanes and a 7' wide parking lane occurring on the south side of the roadway. The B alternatives include a 36' wide curb to curb existing condition. The existing street includes 2 – 11' wide lanes and 2 - 7' wide parking lane occurring on both sides of the street.

It was noted that the south side of St. John Street is the preferred side for cycle tracks and shared use sidewalks since there are less residences and no private driveways.

It was noted that additional parking (6 spaces) could be constructed on the north side of St. John Street between Third Street and Peach Tree Alley, if determined to be necessary.

All options are provided as attachments to these minutes. Some minor corrections have been made to the options per meeting feedback and discussions.

Option 1A & B

- Bike lanes on both sides of street, travel in direction of vehicles
- 2-way traffic maintained
- Includes loss of all parking on south side of St. John Street
- Pedestrians remain on existing sidewalks

Option 2 A & B

- Cycle track on south side of St. John Street
- 2-way traffic maintained
- Buffer improves safety
- Loss of all parking on south side of St. John Street
- Pedestrians remain on existing sidewalks

Option 3 A & B

- One way traffic circulation proposed with cycle track on south side of roadway
- Loss of parking on south side of street at 36' wide
- Wider traffic lanes and cycle track
- Pedestrians remain on existing sidewalks

Option 4A & B

This option was presented as a widened street curb line with the elimination of the existing tree lawn (where occurs) and sidewalk. Upon discussion it was preferred that this option be modified to reduce the curb to curb width and construct a widened sidewalk. It was noted that bicycles are allowed on sidewalks in the Borough (except for Market Street).

- Two way street with widened sidewalk for shared use of pedestrians and cyclists
- Parking remains south side of St. John Street, but narrower travel lanes
- Requires construction of new curb line and drainage facilities on south side of Street
- May create some conflict points with existing residential stoops and doorways.

Review of Trail alignments between 8th Street and Market Street

- It was asked if the trail is being preliminary designed from Route 15 to 8th Street *(Upon review of LDG's scope of work, this area will be designed).*
- Old Recycling Center Building Area
    - The Borough requested that the trail accommodate equipment movements.
    - Likely, trail delineations will utilize pavement markings.
- Two typically sections were presented along the "rails with trail" section. One section illustrates compliance with the PUC height requirement and the other section sought an exemption form the PUC height requirement in order to limit fill in the floodplain and tree removal.
- The plan includes a path to the proposed municipal lot off Cherry Alley. LDG needs to obtain further basemap in this area and then will provide a centerline profile of this segment to show the grade of the trail.

- It was noted that a sweeping curve from the east-west alignment to the south alignment toward Market Street was not desired. It was preferred that an intersection occur at this turn in order to slow bicyclists.

Review of Floodway and Floodplain

The floodplain and floodway locations were illustrated and discussed (see attachments). It was noted that the existing bridge may be located within the floodway. LDG will review further to determine if the improvements to the bridge will be an obstruction to the floodway. LDG will discuss the project particulars with the PADEP to determine what permitting would be necessary. Potentially, this project will not to show a “no rise” in the flood elevation if changes to the ground elevations are proposed within the floodway. Further it needs to be determined if work within a railbanked corridor is exempt from state and/or local regulation.

Miscellaneous Discussion/New Topics

Discussion occurred on how to create a "node" or place of interest at the intersection of the east-west trail and southern segment trail. This area can be further developed during final design. Ideas for the space include interpretive signage, trail map, landscaping, picnic tables and/or benches.

Prepared by: Steven Beattie, RLA Date: February 27, 2013

Copies: ☒ Participants ☒ Design Committee ☒ File

MEETING AGENDA – DESIGN DEVELOPMENT

This confirms and records our interpretation of the discussions that occurred and our understanding reached during this meeting. Unless notified in writing within 48 hours of the date shown on the last page of these minutes, we will assume that the following interpretation or description is complete and accurate. Area of italic print notates additions or revisions made based on new information following the scheduled meeting.

Reference: Buffalo Valley Rail Trail Concept and Preliminary Design
LDG Project No. 7020-005 and 7020-006

Meeting Date: March 22, 2013

Attendees:

Chad Smith	csmith @lewisburgborough.org	Borough Manager
Judy Wagner	jtw@dejazzd.com	Borough Mayor
Katie Davis	director@golara.org	LARA Exec. Director
Jim Buck	jimbuckperson@gmail.com	EBT Supervisor
Samantha Pearson	sam.z.pearson@gmail.com	Trails Committee Chair
Ted Strosser	ted@strosserarchitecture.com	Borough Councilman
Michele Oswald	mro003@bucknell.edu	BU Eng. Professor
Emily Gladstone	eag024@bucknell.edu	BU Eng. Student
Gil Erlich	gpe001@bucknell.edu	BU Eng. Student
Matthew Szymanski	mcs019@bucknell.edu	BU Eng. Student
Shawn McLaughlin	smclaughlin@unionco.org	Union County Planning Dir
Phil Hoffman	pgh@larsondesigngroup.com	Larson Design Group
Steven Beattie	smb@larsondesigngroup.com	Larson Design Group
Linda Sterling	lsterling@lewisburgpa.com	Downtown Partnership
Jen Coughlin	jencough@ptd.net	Trails Committee

Purpose: The purpose of this meeting was to update the committee on design progress since our February 27 meeting.

Schedule: The project remains on schedule as outlined in LDG's scope of work and BU Student requirements.

Discussion:

Review of past meeting Action Items:

- Floodway and Floodplain issues
  - Meeting with DEP (LDG and Katie Davis to attend) scheduled for April 15th for permitting in floodway and floodway fringe.
    - LDG will ask about permit requirements for fill placement in floodway fringe on trail extension to Market Street.
- Update to Options
  - 4A / 4B – Two-way street with shared sidewalk widened to 10 feet. It was noted this is a potentially expensive option because of curb and drainage reconstruction. It was also

noted that conflict may occur with adjacent residences.
    - It was agreed that a "share the road" option will be developed as a baseline. This will only include accessible curb cut upgrades, signage and pavement markings.
    - One additional option will be prepared which will consider one-way travel, two sided parking (or angled parking) with a widened share-use sidewalk
    - Next Step is for BU students and LDG to prepare a plan view of St. John Street options and cost opinion.
- Public meeting needs and possible dates
    - May 1st, 7pm– BU students present at Barnes & Noble, attendees by invite only, including:
        - BVRec Board
        - EBT Board of Supervisors
        - Lewisburg Borough Council
        - Borough Planning Commission
        - EBT Ped/Bike Committee
        - Borough Traffic Committee
        - BVRT Committee
        - Shade Tree Commission
        - Lewisburg Neighborhood Corporation
        - Lewisburg Downtown Partnership
    - May 23rd, 7pm – Public meeting
        - Working on potential nearby locations; Heiter Center first choice but other options are WCEC training room, County Board Room or Barnes and Noble Community Room.
- Flyers to public
    - BVRec (LARA) is primary contact
    - Distribute flyers in beginning of April
    - Outreach will be by people who can't answer questions (BU students, fraternity?)
    - If people call for information after receiving flyer – becomes informal interview
    - Informal interviews with business owners and other key parties will also occur

Review of BU Student Updates

- Cycle track visual examples
- Additional Parking between N 3rd St and Peach Tree Alley
- Parking allocation calculations and spreadsheet
- Route 15 crossing design updates
    - Two crossing options presented.
    - Need to maintain large enough island to accommodate as many peds as possible.
    - Jersey barriers used as buffer may hinder site lines of adjacent driveways, curbing better option.
- Railroad bridge design updates
    - Slope on opposite side of bride determined to be too steep for ADA compliance.
    - Concrete and timber decking options presented.

Update on Trail alignments between 8th Street and Market Street

- Old Recycling Center Building Area
    - Revised plans showing with "T" intersection and 90° turn. Large paved area to be shown in this area as resting point.
    - One Gate will be provided on east side of Railroad and one gate provided on west side. West side gate depends on final centerline location of trail based on permitting and PUC to cross railroad are necessary.

- Segment of trail along existing railroad to Market Street
    - Adding fill may be economical option since waste fill can be used and thus require less hauling of material off-site.
    - Split rail fence is the basis of design for cost estimating to separate trail from railroad
    - A screen fence will be used to screen adjacent restaurant property near Market Street
    - Bench and shelter area will be demolition or removed by the Borough prior to construction. Borough will determine if it wants to move the shelter to other side of Market Street.
    - Path to proposed lot off of Cherry Alley was shown. LDG believes this trail segment will be +\- 8% slope. This meets accessibility guidelines for shared-use trails.
    - At this point in the design, a sidewalk to the Borough's gravel parking lot is not part of this project and can be considered if the parking lot is furthered developed and expanded.
    - Trailhead signage will be determined during final design.

Action Items

1. **Shawn McLaughlin to schedule May 23rd meeting with Katie Davis assisting**
2. **BU Students and LDG to finalize options in plan view and prepare cost opinion**
3. **LDG to meet with PADEP to discuss permitting requirements**
4. **LDG to provide 7th Street Crossing prelim. design to Chad Smith for use/review**
5. **LDG to set next design meeting to occur prior to public meeting on May 1 presentation.**

Prepared by: Steven Beattie, Emily Gladstone Date: April 1, 2013

MEETING MINUTES – DESIGN DEVELOPMENT

This confirms and records our interpretation of the discussions that occurred and our understanding reached during this meeting. Unless notified in writing within 48 hours of the date shown on the last page of these minutes, we will assume that the following interpretation or description is complete and accurate. Area of italic print notates additions or revisions made based on new information following the scheduled meeting.

Reference: Buffalo Valley Rail Trail Concept and Preliminary Design
LDG Project No. 7020-005 and 7020-006

Meeting Date: April 26, 2013

Attendees:

Chad Smith	csmith@lewisburgborough.org	Borough Manager
Judy Wagner	jtw@dejazzd.com	Borough Mayor
Katie Davis	director@golara.org	LARA Exec. Director
Jim Buck	jimbuckperson@gmail.com	EBT Supervisor
Samantha Pearson	sam.z.pearson@gmail.com	BVRT Committee Chair
Michele Oswald	mro003@bucknell.edu	BU Eng. Professor
Emily Gladstone	eag024@bucknell.edu	BU Eng. Student
Gil Erlich	gpe001@bucknell.edu	BU Eng. Student
Matthew Szymanski	mcs019@bucknell.edu	BU Eng. Student
Shawn McLaughlin	smclaughlin@unionco.org	Union Co Planning Director
Ted Strosser	ted@strosserarchitecture.com	Borough Council
Steven Beattie	smb@larsondesigngroup.com	Larson Design Group

Purpose: The purpose of this meeting was to update the committee on design progress since our March 22nd meeting.

Schedule: The project remains on schedule as outlined in LDG's scope of work and BU Student requirements.

Stakeholder Meeting scheduled for May 1, 2013 at 7:00pm, Barnes and Noble Community Room

Public Meeting scheduled for May 23, 2013 at 7:00pm, William Cameron Training Room

Discussion:

Review of past meeting Action Items:

- Meeting discussion with DEP occurred on April 15th for permitting in floodway and floodway fringe.
    - LDG was able to prove (with assist from UCPC) that original FEMA study had the trail 8" higher. Therefore, construction of the bridge improvements can proceed with GP-11.
    - If fill is proposed on the Market Street Trail extension section then a joint permit will be required.

- Update to St. John Street Options
    - Options were renumbered 1 through 6. Also created Option "C" that allows for diagonal parking option (Options are attached).

- Review of Project Costs
    - Current cost estimate for St. John Street options do not include design fees and inspection costs; this will be revised.
    - Cost of all St. John's Street Options include upgrading curb ramps to ensure all improvements include accessibility upgrades.

Review and Discussion of final presentation for May 1st meeting

- Route 15 Intersection
    - May limit access to businesses with median installation – study needed to investigate further.
    - Coordinate with Route 15 Corridor Study to fully understand concerns.
    - Many outside influences exist that could affect the Route 15 intersection; including the CSVT, new integrated signals along the corridor, relocation of the high school for example.
    - Bridge and tunnel eliminated from consideration as intersection crossing. This can be mentioned verbally if asked.

- DCNR funding applied for 12th Street to Route 15 segment and for preliminary design of Route 15 intersection.

- St. John's Street
    - Cycle Track buffer for Options 3&4 indicated as raised by students, but LDG does not intend for it to be raised. Buffer will be pavement markings or delineators.
    - Option C with angled parking can be an alternate to B options (36' width).
    - Direction of one-way streets is in historic direction of street (west to east). Further studies are needed to determine if this is appropriate.
    - Cost of all St. John's Street Options include upgrading curb ramps to ensure all improvements include accessibility upgrades.
    - Students used decision matrix to select recommended alternative. The only variable to the decision matrix is the weighted value for each criteria.
    - Upon recommendation and discussion with the group, changes will be made to presentation to clarify the amount of parking lost for each option.

- St. John's Street Options Decision Matrix
    - Weights of metrics can be changed to signify importance.
    - Matrix that is presented is representation of student's opinion.
    - One way and two-way street options will be separately evaluated.
    - Final matrix will have weights decided by stakeholders.
    - Consider including time range as another metric for evaluation.
    - Options 4 & 6 will be subdivided into A&B and A&C (angled or parallel parking).

- Railroad Bridge
    - Cost does not take into account repointing of stone piers and other preventative maintenance work items. Cost opinion will be revised to include these items.
    - Discussion of why glulam deck material was chosen. Students also reviewed concrete

slab. It was noted that glulam matches other bridge decks on the trail and glulam can be topped with non-slip surface.

- Public Meeting – May 23rd
  - Discussion of how to record comments – provide comment sheet at presentation and collection box, provide option for an email response after the meeting.
  - For meeting on May 23rd focus will be mainly on St. John's Street.
  - Presentation will mention Route 15 crossing and river bridge trail portions with basic background information.
  - Bridge and tunnel eliminated from consideration as intersection crossing.

Prepared by: Steven Beattie, Emily Gladstone Date: May 1, 2013

APPENDIX B

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
3-0	UNION	XXX	XXX	

REVISION NUMBER	REVISIONS	DATE	BY

℄ OF ROAD
(RTE 15 NORTH)

GUY WIRE

30.0'

22.4'

TT 101

11.4'

NORTH EAST
CORNER OF BRIDGE

TT 101, RABAR WITH CAP
STA 703+75.30, OFFSET 292.02' LT

CHISELED "///"
IN GUIDERAIL POST
WEST SIDE OF BRIDGE

CHISELED "///"
IN WEST GATE POST

10.3'

11.1'

TT 102

54.1'

TACK IN NORTH
SIDE OF EPL C252

TT 102, RABAR WITH CAP
STA 707+28.31, OFFSET 71.72' LT

TT 101

℄

KELLER WARD D &
MARILYN R
008-018-110

EPL C171

6" TREE

GUY POLE C17S
LIGHT STANDARD
SIGN CROSS WALK

N 81h ST

EPL 23705N29117

TT 102

100 YR

BEYER & FORTNER, INC.
008-018-096

EPL C 25 3

EPL C252

N 71h ST

TT 102

BM

EPL C

PC
706+80.02

PT
706+27.13

STATE

702

703

704

705

706

707

708

100 YR

100 YR

460

460

12" TREE

18" TREE

12" TREE

12" TREE

12" TREE

30" TREE

535 INC
008-018-109

CURRANT ALY

N 81h ST

SIGN CROSS WALK

EPL 23716N29115

CONCERN
PROFESSIONAL
SERVICES
008-018-095

EPL 23723N29122

SIGN SMITH ALLEY

SMITH ALY

HARRIS RICHARD C &
JULIE C
008-018-079

EPL C 42

N 71h ST

EDWARDS DONALD G JR
& BRENDA J
008-018-052

SEE SHEET 9

SCALE

HORIZONTAL 0 25 50FT

DES: RLS	OPR: RLS	CKD: PGH	JOB: 7020-005	FILE:	DATE:

5/1/2013
L:\Williamsport\Highway\7020-005 BVRT Ext (East of SR15)\DGN\SHTS-PLAN\PL-SH-01.dgn

DISTRICT	COUNTY	ROUTE	SECTION	SHEET
3-0	UNION	XXX	XXX	

REVISION NUMBER	REVISIONS	DATE	BY

SEE SHEET 8

SEE SHEET 10

N 7th ST

BOROUGH OF LEWISBURG
008-018-053

008-018-ROW

CONER OF CONCRETE CATWALK

CORNER OF BUILDING

34.9' 54.0' 68.9'

TT 103

END OF SOUTH RR TRACK

TT 103, RABAR WITH CAP
STA 712+32.62, OFFSET 38.73' LT

BENNETT CRAIG A
008-018-198

SANDERS RICHARD
008-018-198.1

SANDERS RICHARD
008-018-236

BOROUGH OF LEWISBURG
008-018-004

N 5th ST

SIGN NO TRESPASS

EPL C

BM

EPL NOT IN USE

TT 1341

24" CMP

12" TREE

12" TREE

12" TREE

18" TREE

CONC SLAB

TT 103

100 YR

BUILDING

18" TREE

MH

BM

100 YR

PC 713+54.94

PT 714+09.54

CONC SLABS

GUY SIGNAL POST

ABUTMENT WALL

BUILDING

ELEC BOXES ON CONC SLABS

EDWARDS DONALD G JR & BRENDA J
008-018-052

LINN ALY

SIGN LINN/GREEN
EPL 23754N29146

36" TREE

TT 1342

CONC SLAB W/ STAND PIPE

BOROUGH OF LEWISBURG
008-018-017

CONC PIERS

30" TREE

12" TREE

30" TREE

18" TREE

15" TREE

18" TREE

12" TREE

BOROUGH OF LEWISBURG
008-018-017

TT 1413

12" TREE

12" TREE

18" TREE

GINSBURG J & CATHERINE
008-018-003

SANDERS RICHARD
008-018-236

GINSBURG J & CATHERINE
008-018-002

SIGN NO LEFT TURN
SIGN DO NOT ENTER
EPL 23796N29177

N 5th ST

BOROUGH OF LEWISBURG
008-018-017

008-018-ROW

BM

TREE

ABUTMENT WALL

15" TREE

15" TREE

SCALE

HORIZONTAL 0 25 50FT

DES: RLS	OPR: RLS	CKD: PGH	JOB: 7020-005	FILE:	DATE:

5/1/2013
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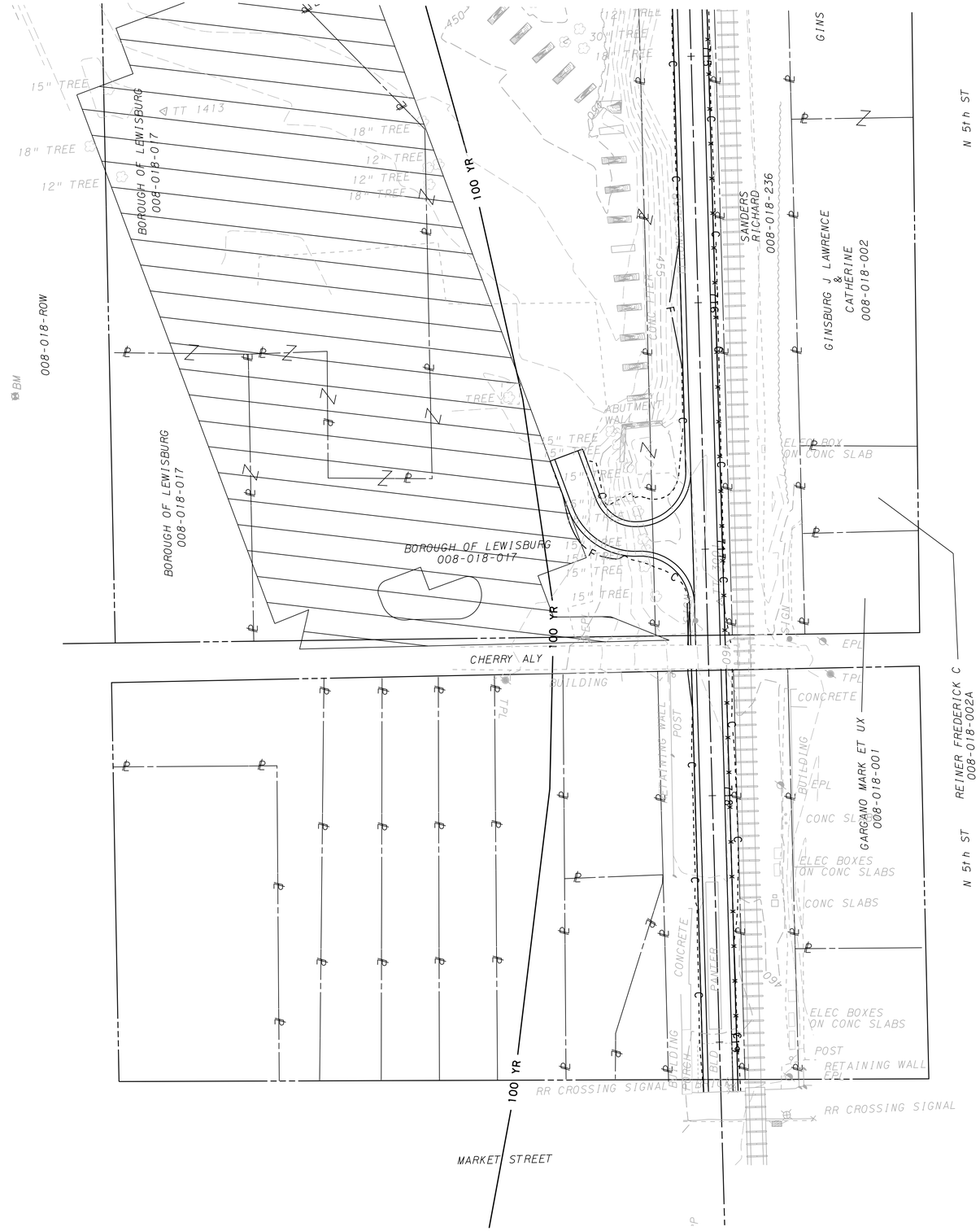
DISTRICT	COUNTY	ROUTE	SECTION	SHEET
3-0	UNION	XXX	XXX	

REVISION NUMBER	REVISIONS	DATE	BY



SCALE

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5/1/2013
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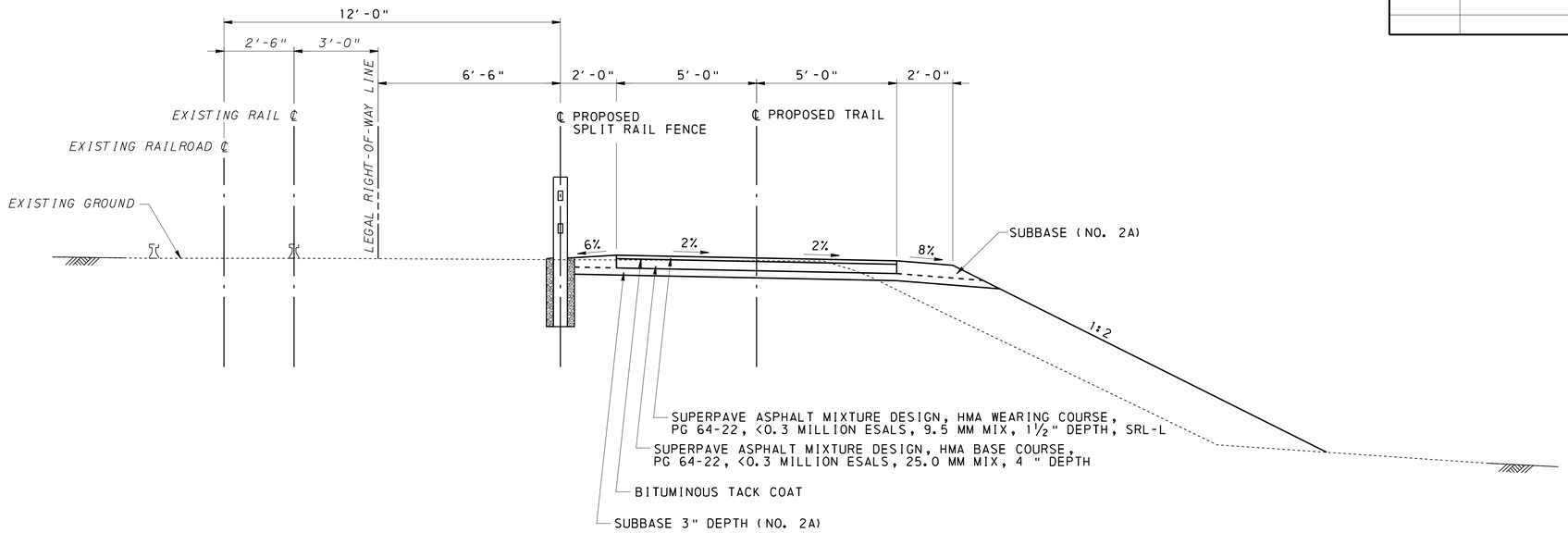
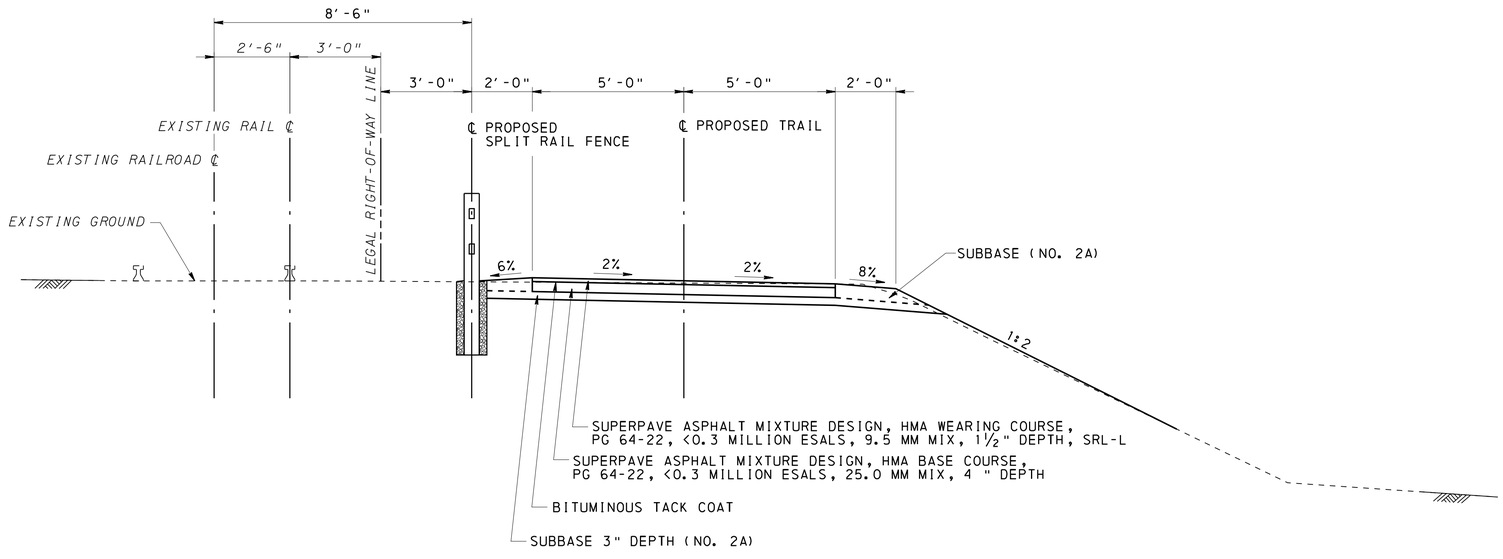
DISTRICT	COUNTY	ROUTE	SECTION	SHEET
3-0	UNION	XXX	XXX	

REVISION NUMBER	REVISIONS	DATE	BY



TYPICAL SECTION REQUIRING DEP COORDINATION AND/OR PERMIT



TYPICAL SECTION REQUIRING EXEMPTION FROM THE RAILIOAD

5/1/2013
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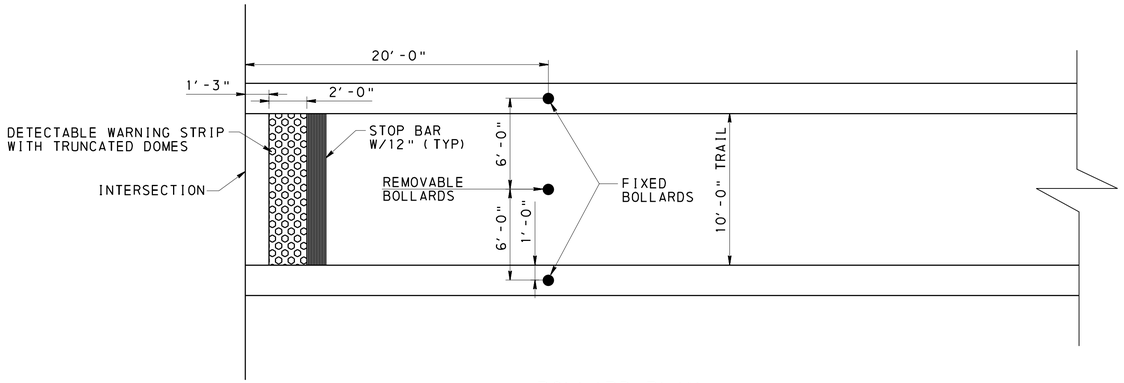
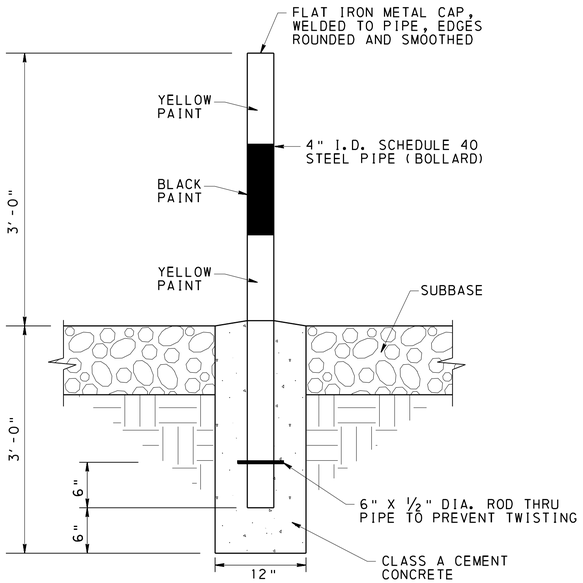
DISTRICT	COUNTY	ROUTE	SECTION	SHEET
3-0	UNION	XXX	XXX	

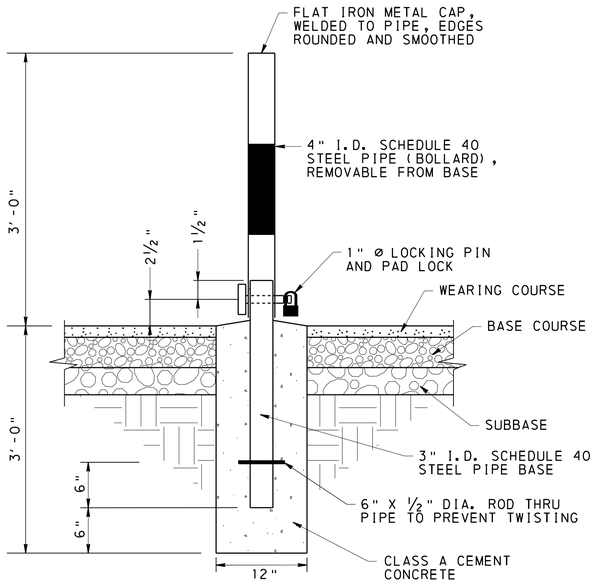
REVISION NUMBER	REVISIONS	DATE	BY



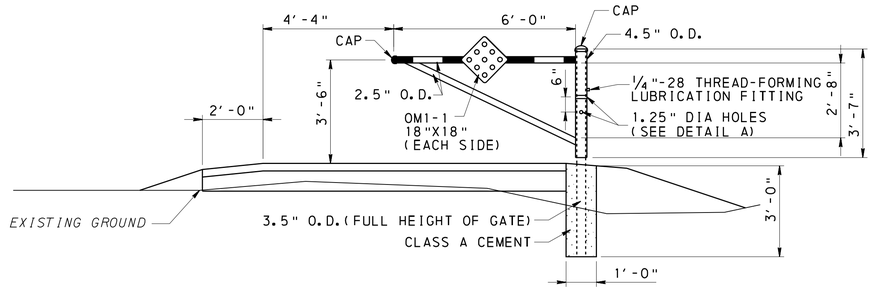
BOLLARD PLAN
NO SCALE



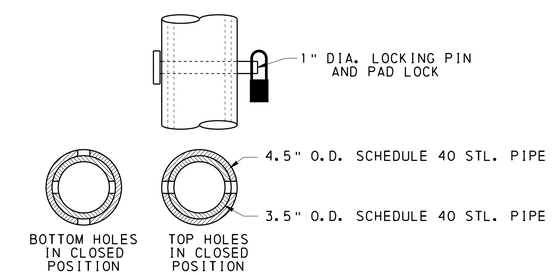
FIXED BOLLARD
NO SCALE
(ITEM NO. 9016-0101)



REMOVABLE BOLLARD
NO SCALE
(ITEM NO. 9016-0100)



SWING GATE DETAIL
(ITEM NO. 9624-0610)



DETAIL A

5/1/2013
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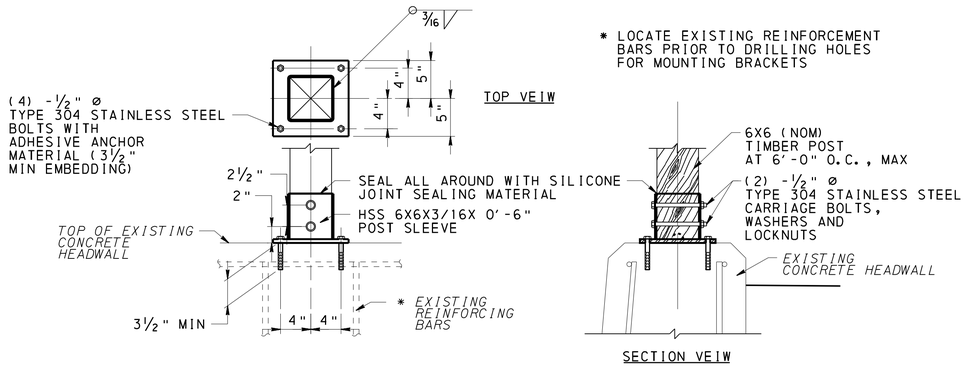
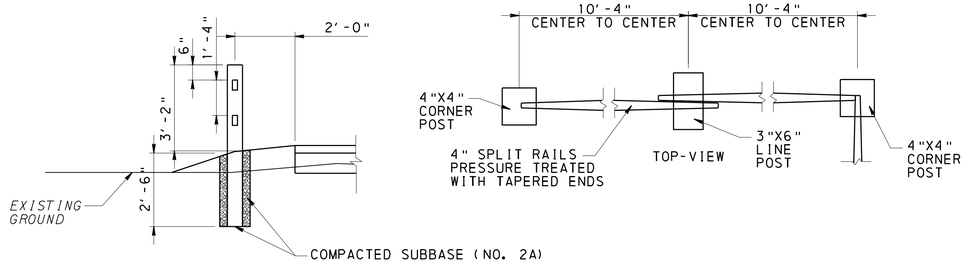
DISTRICT	COUNTY	ROUTE	SECTION	SHEET
3-0	UNION	XXX	XXX	

REVISION NUMBER	REVISIONS	DATE	BY



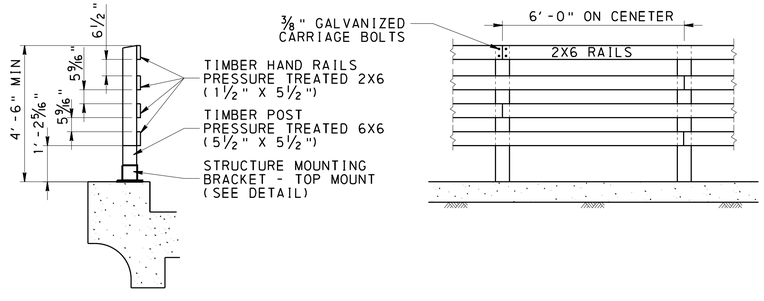
STRUCTURE MOUNTED BRACKET - TOP MOUNT

NOTE: ALL MOUNTING BRACKET STEEL
SHALL BE GALVANIZED



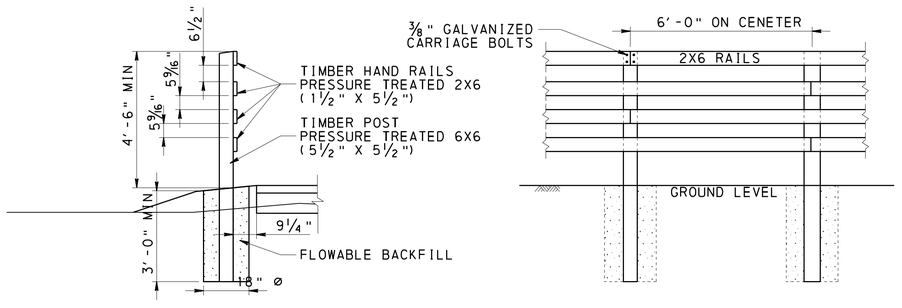
2-RAIL (SPLIT RAIL) FENCE DETAIL

(ITEM NO. 9000-0002)



STRUCTURE MOUNTED PRESSURE TREATED WOOD FENCING DETAIL

(ITEM NO. 9000-0001)

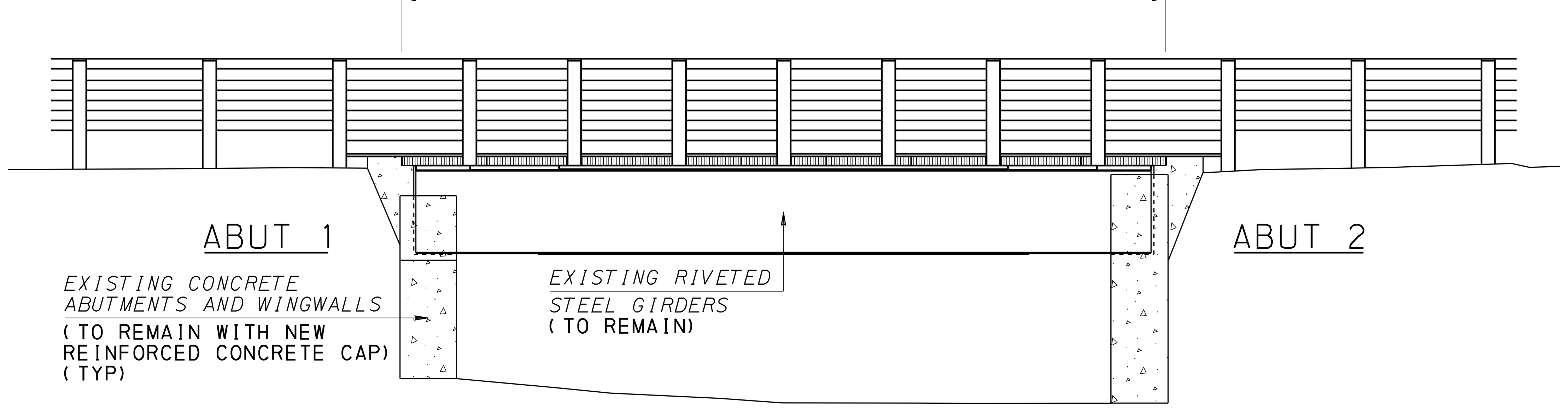


PRESSURE TREATED WOOD FENCING DETAIL

(ITEM NO. 9000-0000)

5/1/2013
L:\Williamsport\Highway\7020-005 BVRT Ext (East of SR15)\DGN\SHTS-PLAN\DETAILS-02.dgn

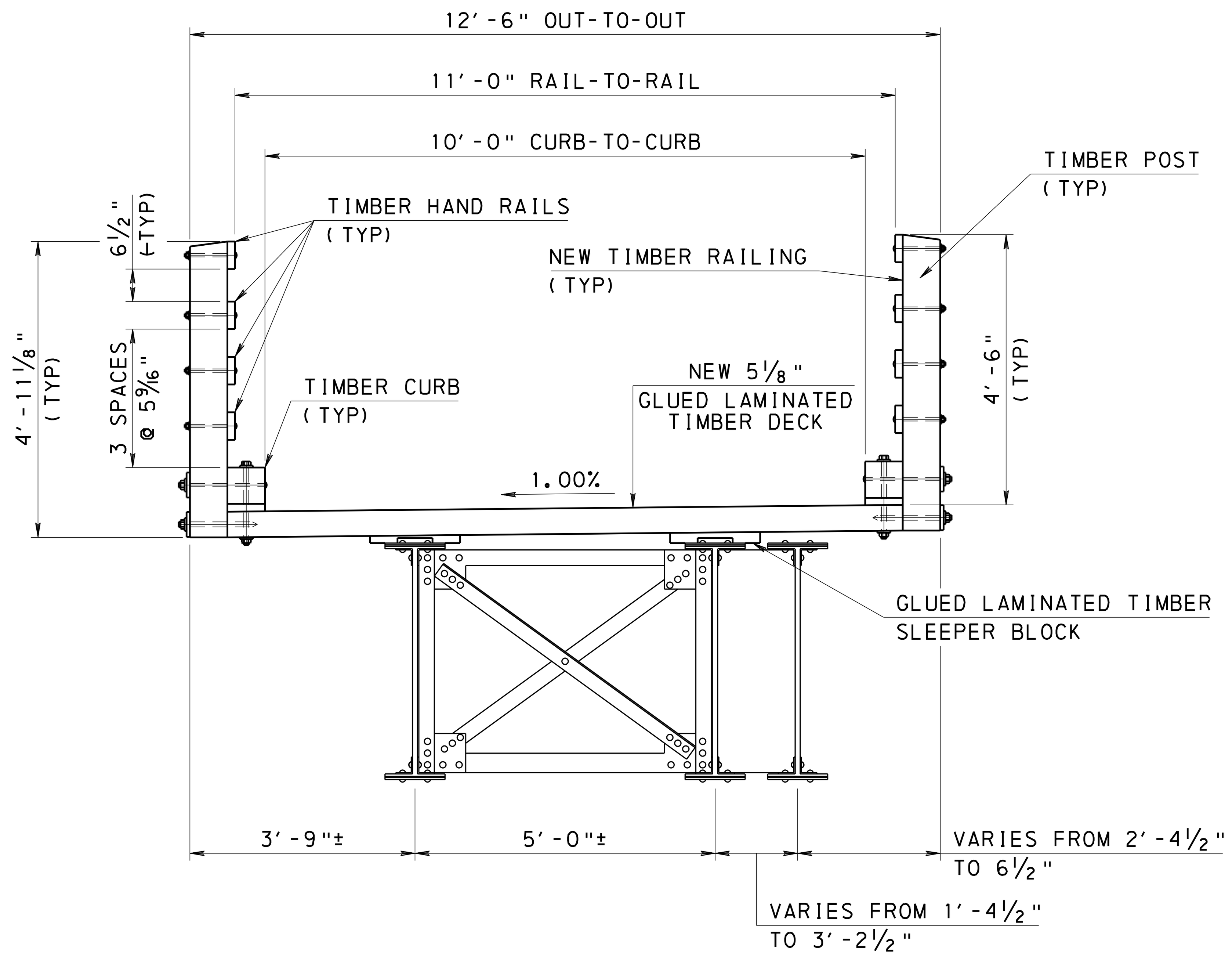
DES: RLS	OPR: RLS	CKD: PGH	JOB: 7020-005	FILE:	DATE:



ELEVATION

2 0 2 4 6 FEET

SCALE: 3/16" = 1'-0

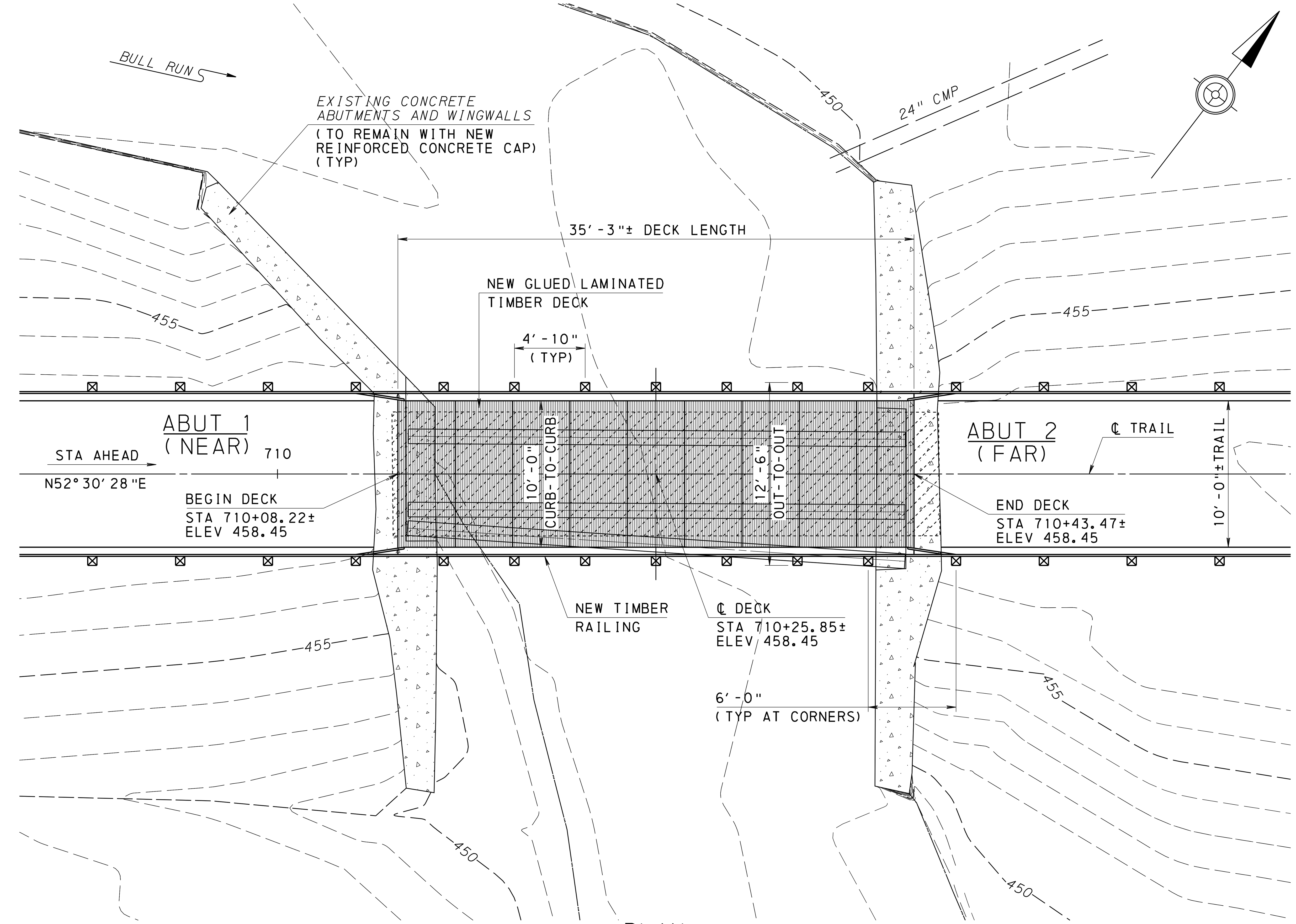


TYPICAL SECTION

(LOOKING STATIONS AHEAD)

1 0 1 2 FEET

SCALE: ½" = 1'-0



PLAN

2 0 2 4 6 FEET

SCALE: 3/16" = 1'-0

Mark	Description	By	Chk'd.	Recm'd	Date
REVISIONS					

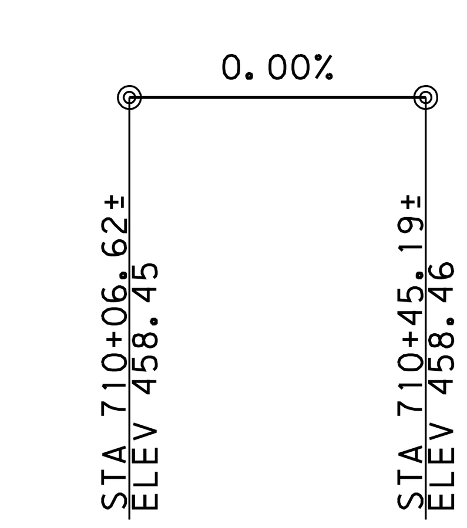
INDEX OF STRUCTURE DRAWINGS

SHEET NO.	TITLE
1	PLAN, ELEVATION & TYP SECTION
2	-
3	-
4	-
5	-
6	-
7	-
8	-

HORIZONTAL CURVE DATA

CONST ℄ LARA TRAIL
PI STA 713+88.43
Δ = 89°12'06" RT
D = 154°51'13"
T = 36.49'
L = 57.60'
R = 37.00'
E = 14.97'
PC STA 713+51.94
PT STA 714+09.54

VERTICAL CURVE DATA



LEGEND

- NEW GLUED LAMINATED TIMBER DECK
- EXISTING DECK OR TIMBER TIES (TO BE REMOVED)
- NEW REINFORCED CONCRETE CAP
- EXISTING WATER EDGE
- EXISTING CONTOUR

SUPPLEMENTAL DRAWINGS

DESCRIPTION	DWG NO.	APP DATE
CLASSIFICATION OF EARTHWORK FOR STRUCTURES	RC-11M	6-1-2010
BACKFILL AT STRUCTURES	RC-12M	6-1-2010
ANCHOR SYSTEMS	BC-734M	10-26-2010
REINFORCEMENT BAR FABRICATION DETAILS	BC-736M	5-18-2012
TYPICAL WATERPROOFING AND EXPANSION DETAILS	BC-788M	5-18-2012

PREPARED BY:

LARSON DESIGN GROUP
1000 COMMERCE PARK DRIVE
WILLIAMSPORT, PA 17703-0487

Signature and Date:

PRELIMINARY DRAWING OR INFORMATION

This drawing and/or information shall be used for reference purposes only, as details and content are subject to change.

SEAL

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF TRANSPORTATION

UNION COUNTY
LEWISBURG BOROUGH
BUFFALO VALLEY RAIL TRAIL STA 710+25.85±
OVER BULL RUN
GLUED LAMINATED TIMBER DECK

PLAN, ELEVATION & TYPICAL SECTION

RECOMMENDED ____________

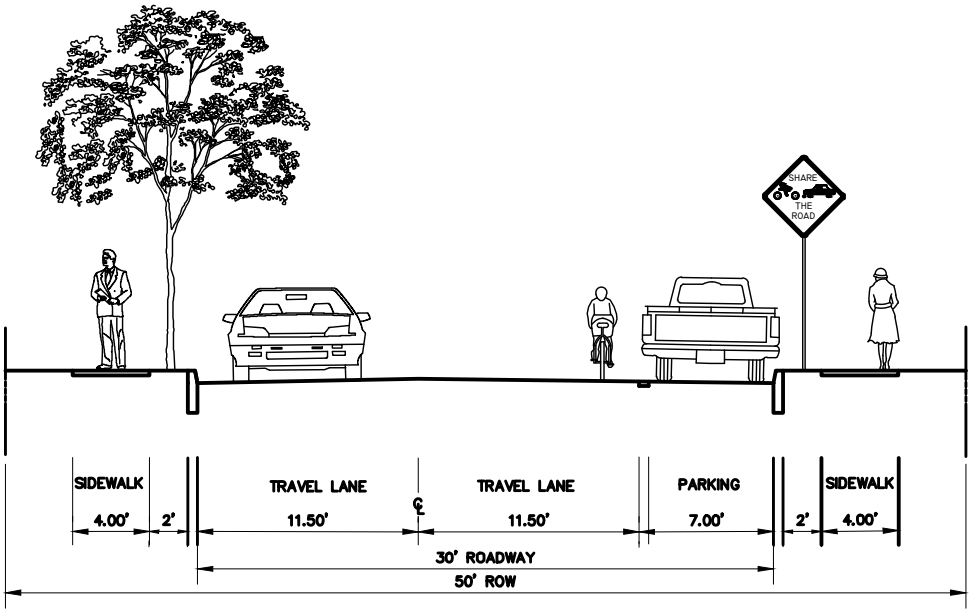
SHEET 1 OF -
& SUPPLEMENTAL DRAWINGS

S-XXXXX

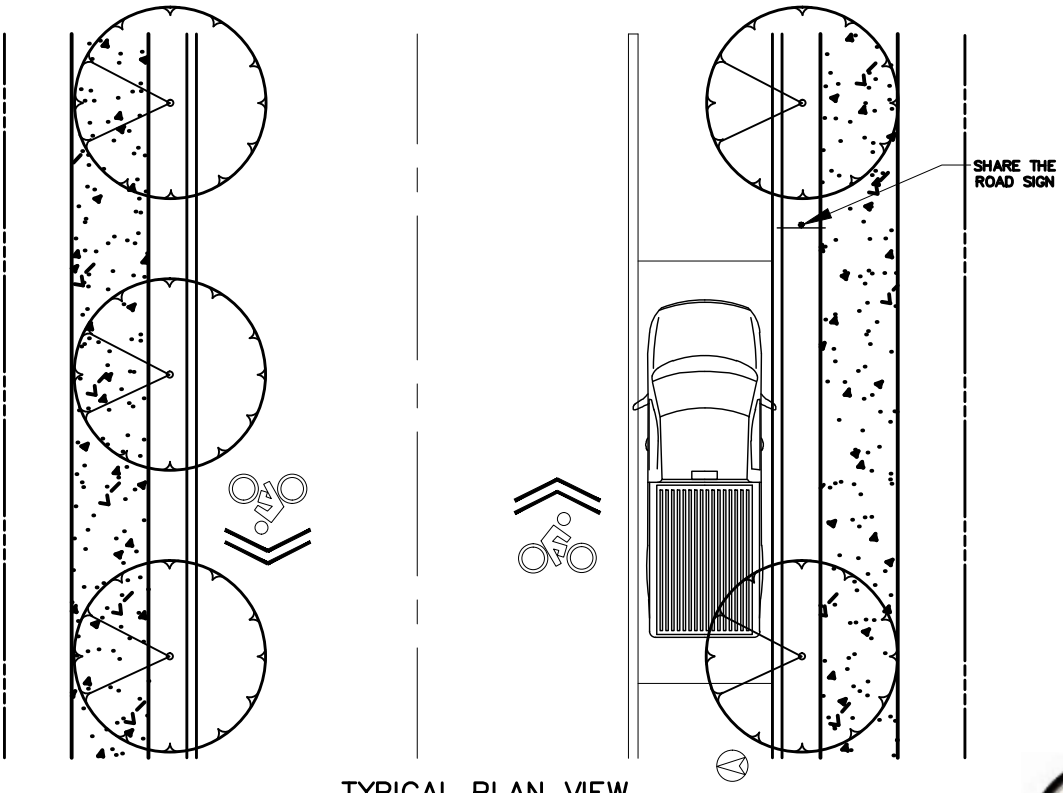
DES: CAU	OPR: JMG	CKD: DG	JOB: 7020-005	FILE: BVRT-TSL	DATE: 4/9/13

APPENDIX C

OPTION 1A: TWO-WAY STREET WITH SIGNAGE AND PAVEMENT MARKINGS



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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FAX 570.323.9902
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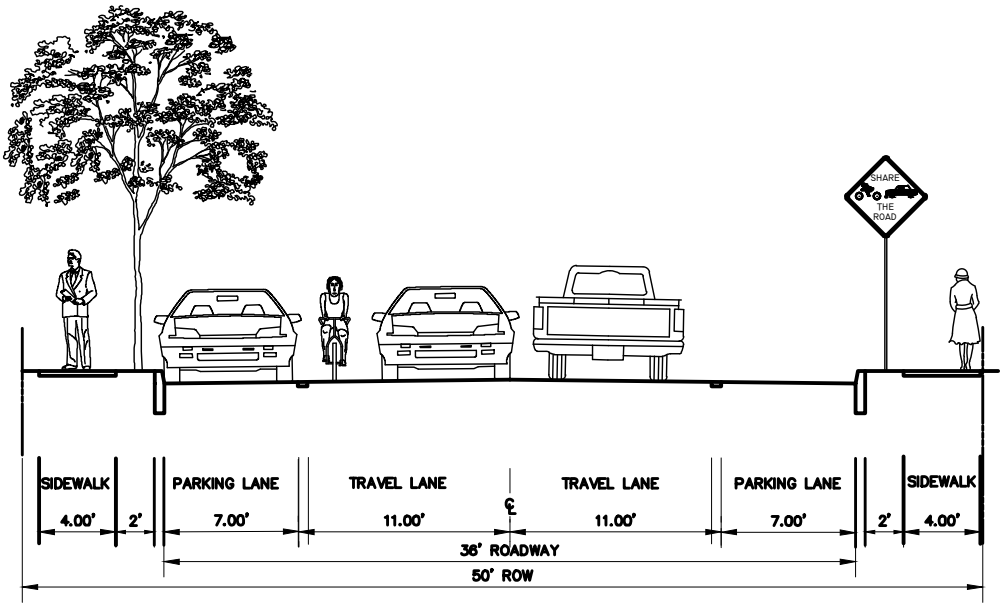
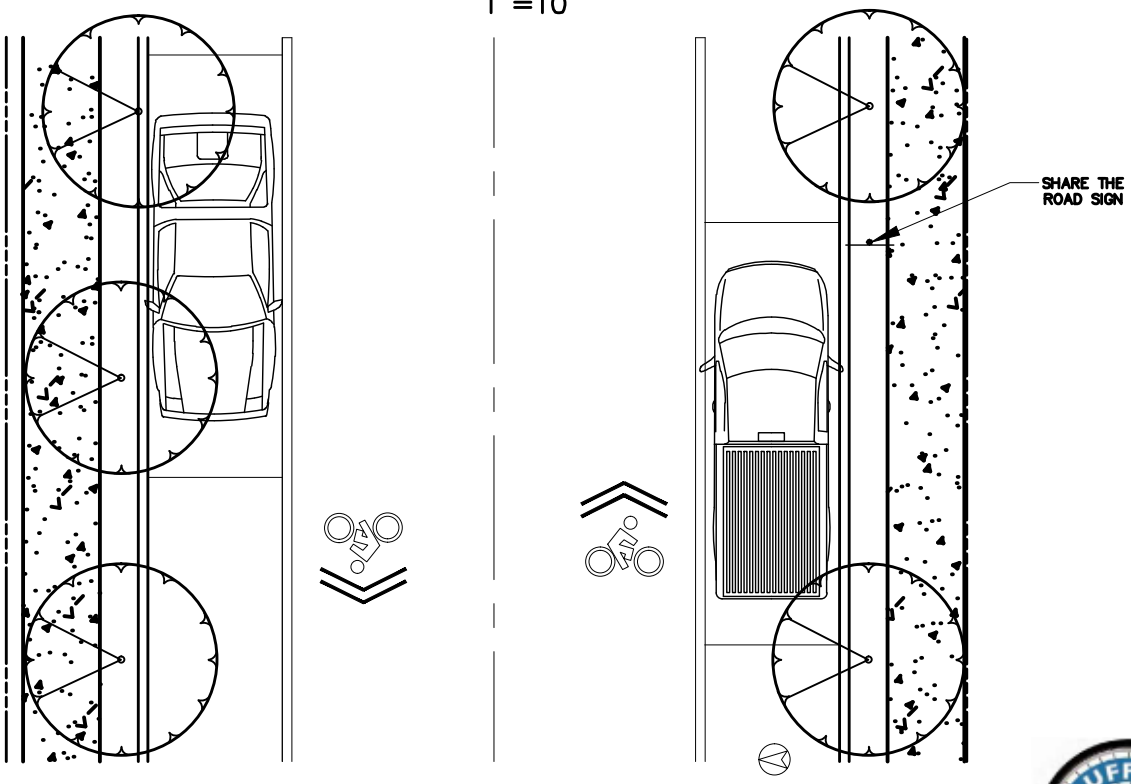
OPTION 1A
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-1A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 1B: TWO-WAY STREET WITH SIGNAGE AND PAVEMENT MARKINGS



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 1B
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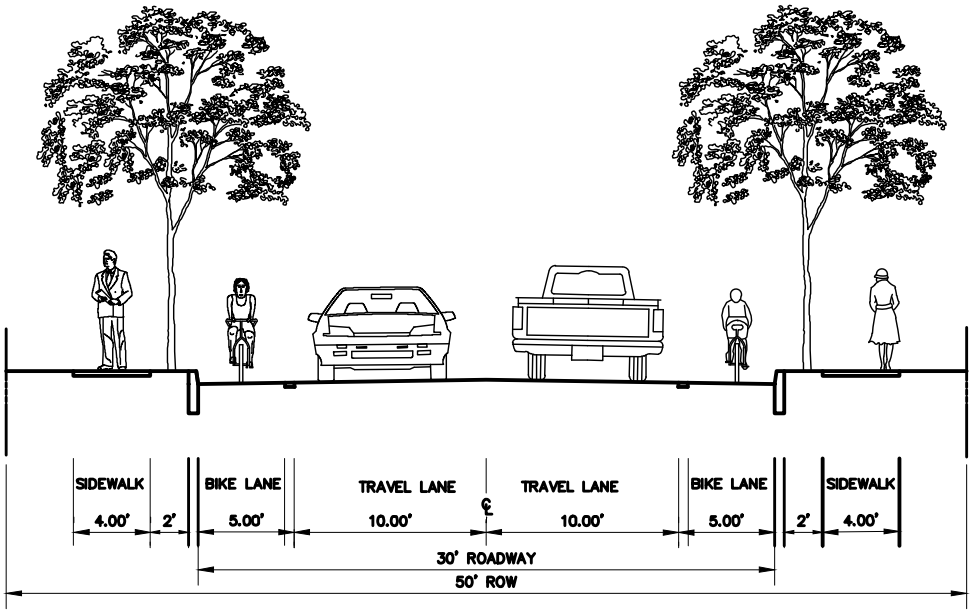
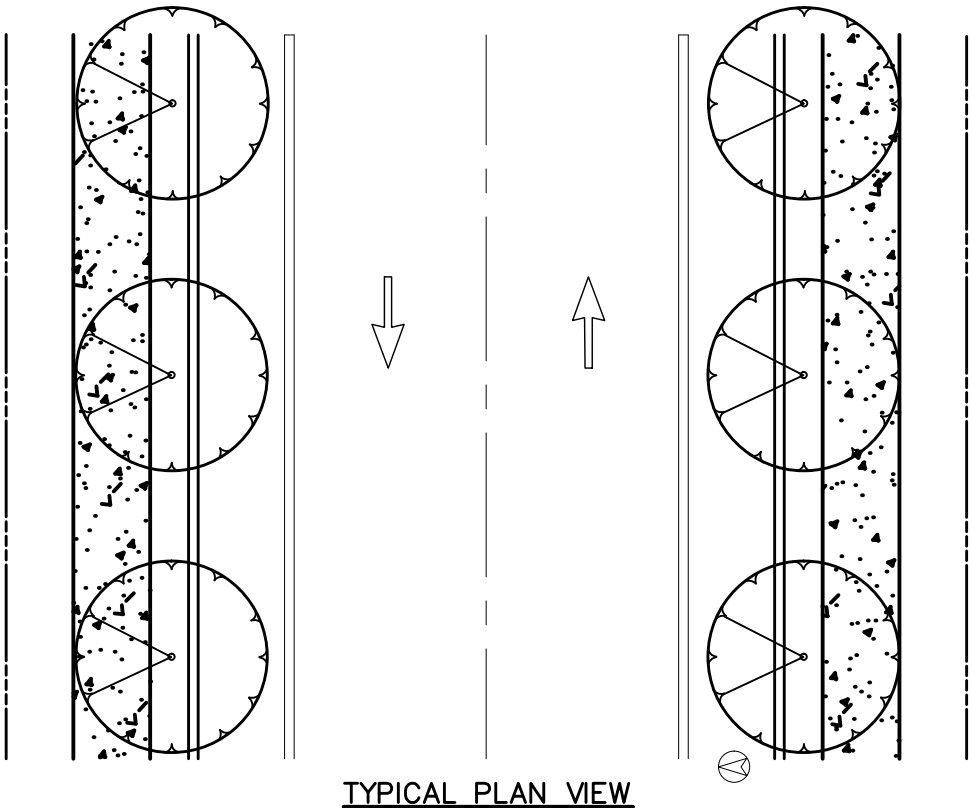
DATE: 4/16/2013
SHEET NO.: OPT-1B
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 2A: TWO-WAY STREET WITH BIKE LANES



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 2A
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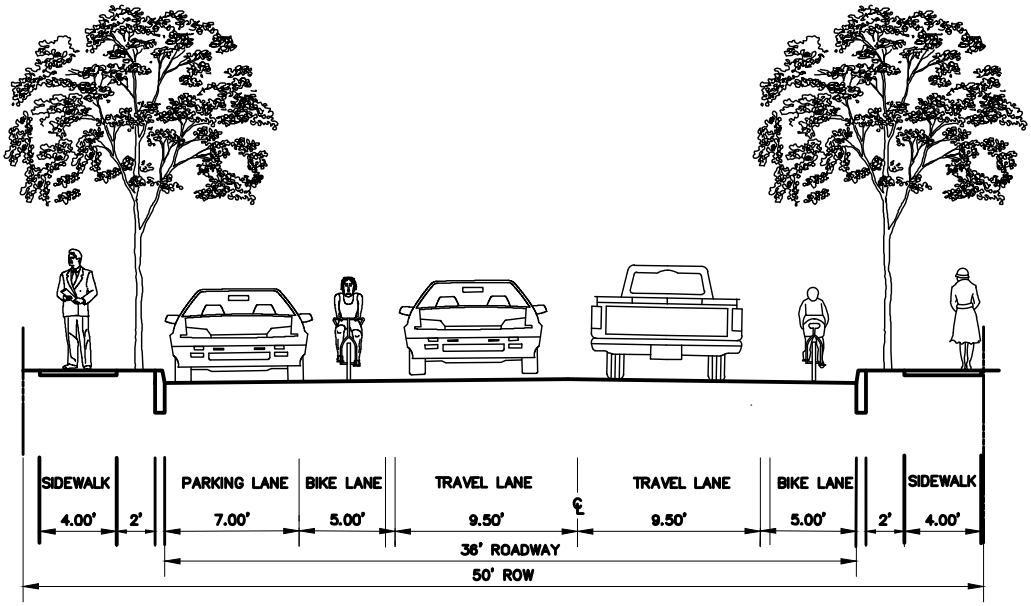
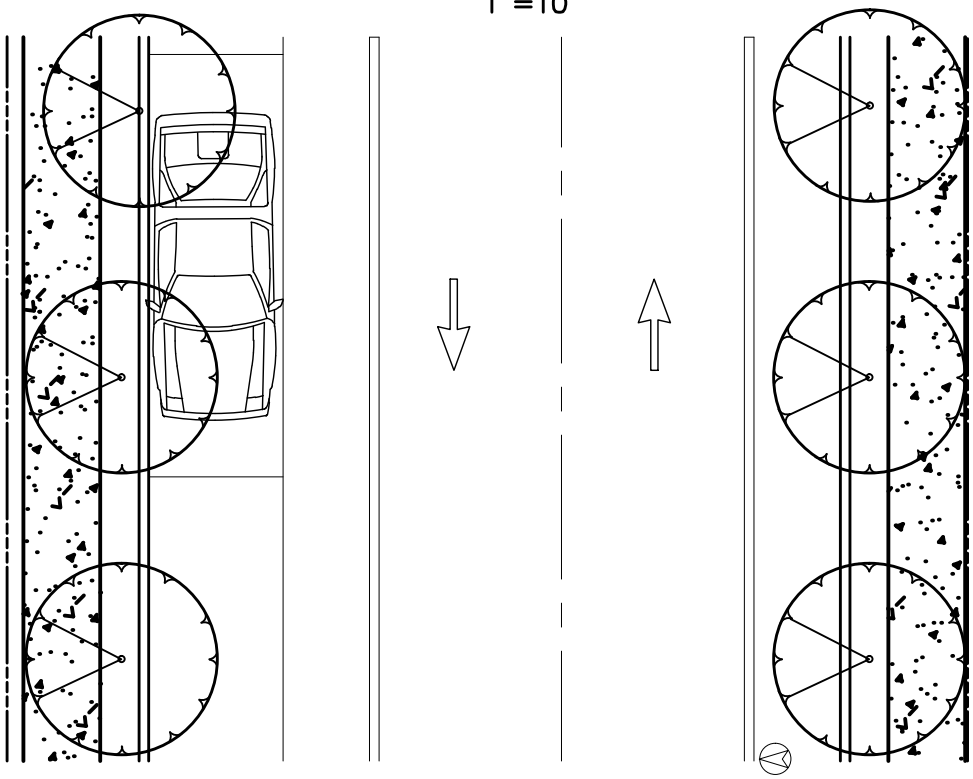
DATE: 4/16/2013
SHEET NO.: OPT-2A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 2B: TWO-WAY STREET WITH PARKING AND BIKE LANES



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
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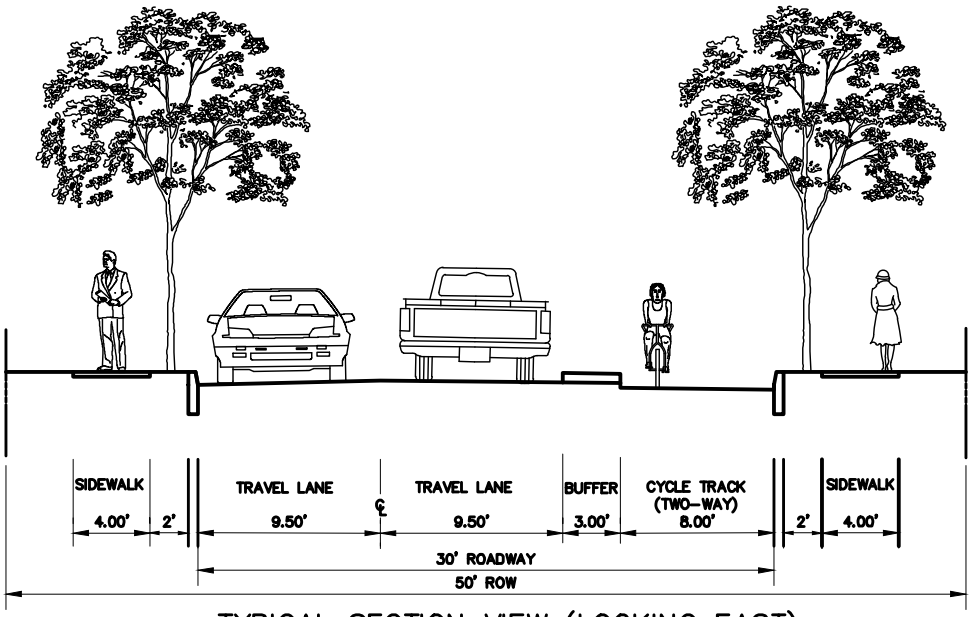
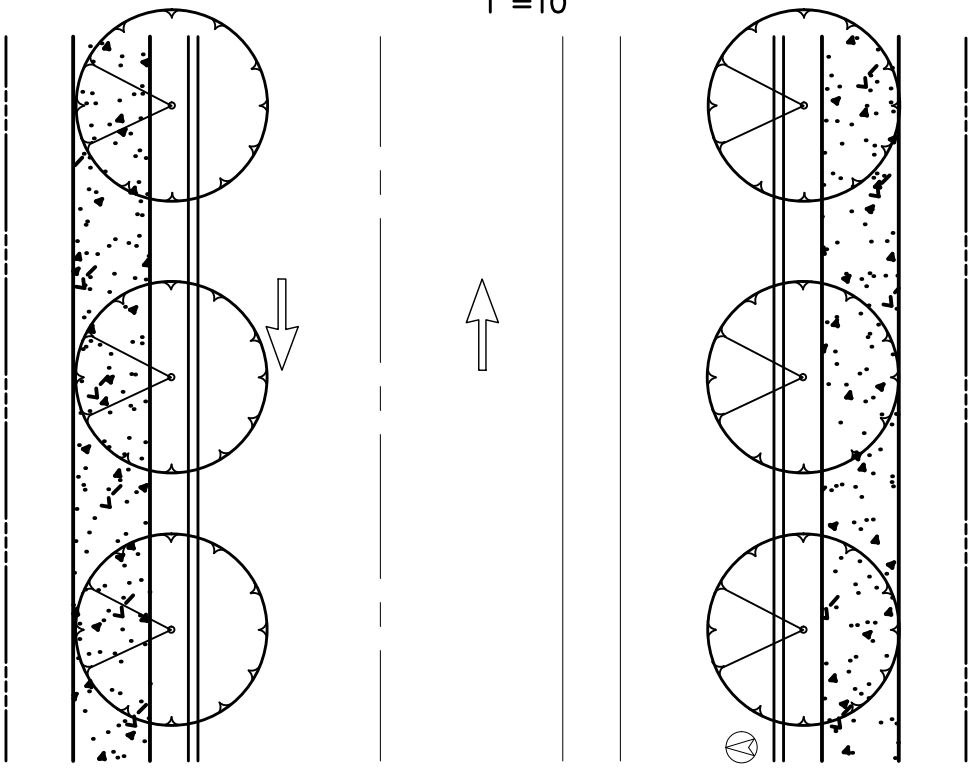
DATE: 4/16/2013
SHEET NO.: OPT-2B
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 3A: TWO-WAY STREET WITH CYCLE TRACK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
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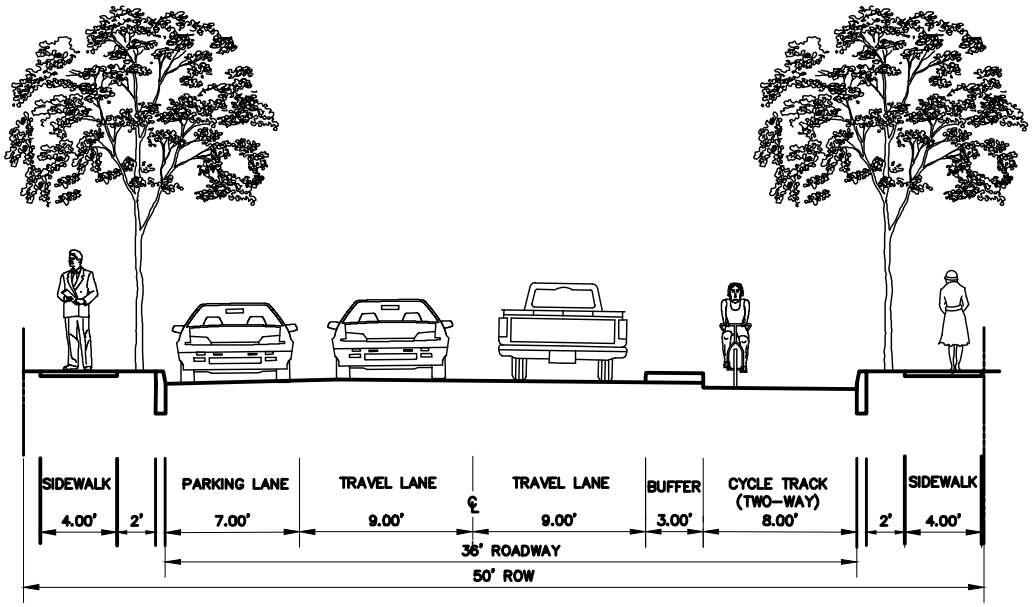
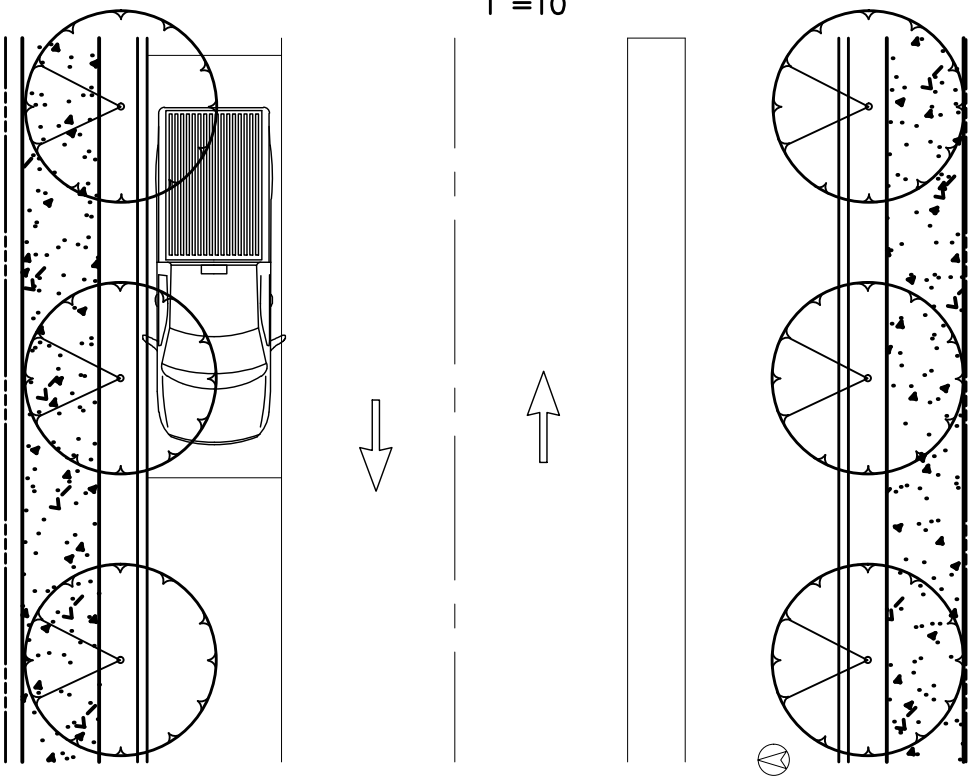
DATE: 4/16/2013
SHEET NO.: OPT-3A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 3B: TWO-WAY STREET WITH PARKING AND CYCLE TRACK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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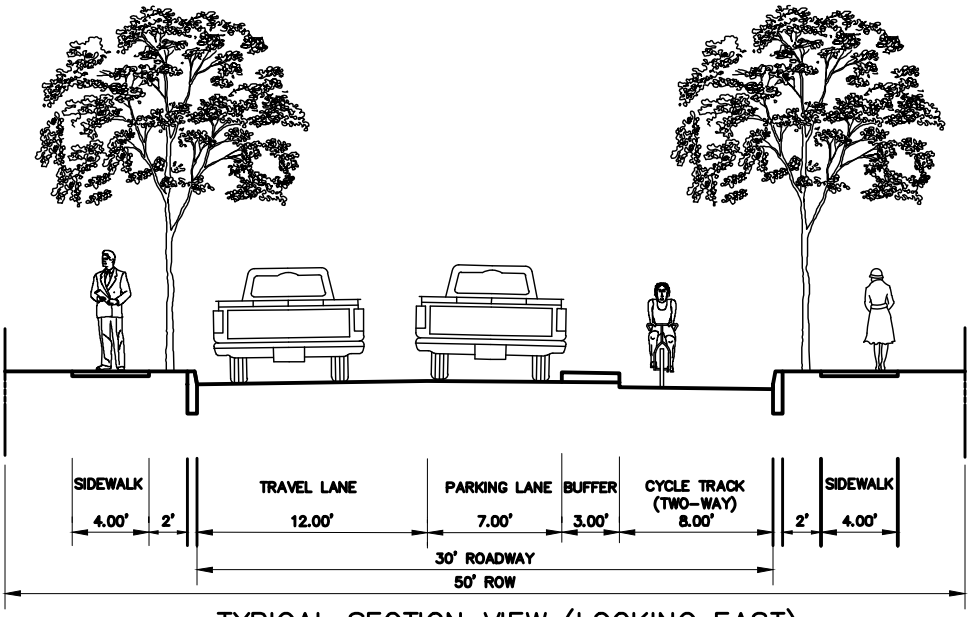
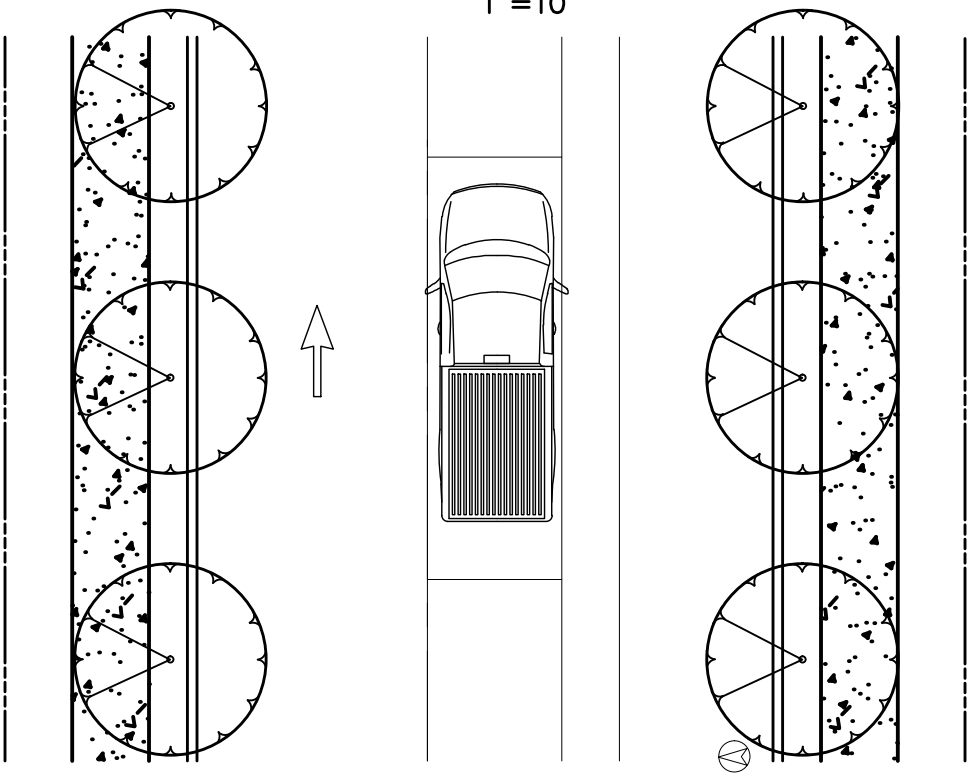
DATE: 4/16/2013
SHEET NO.: OPT-3B
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 4A: ONE-WAY STREET WITH PARKING AND CYCLE TRACK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 4A
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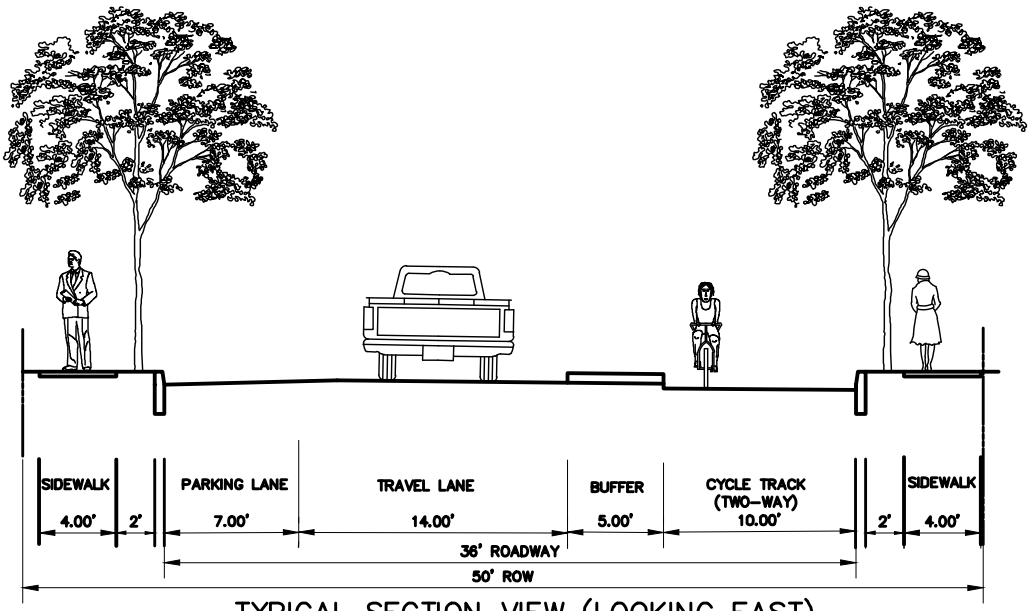
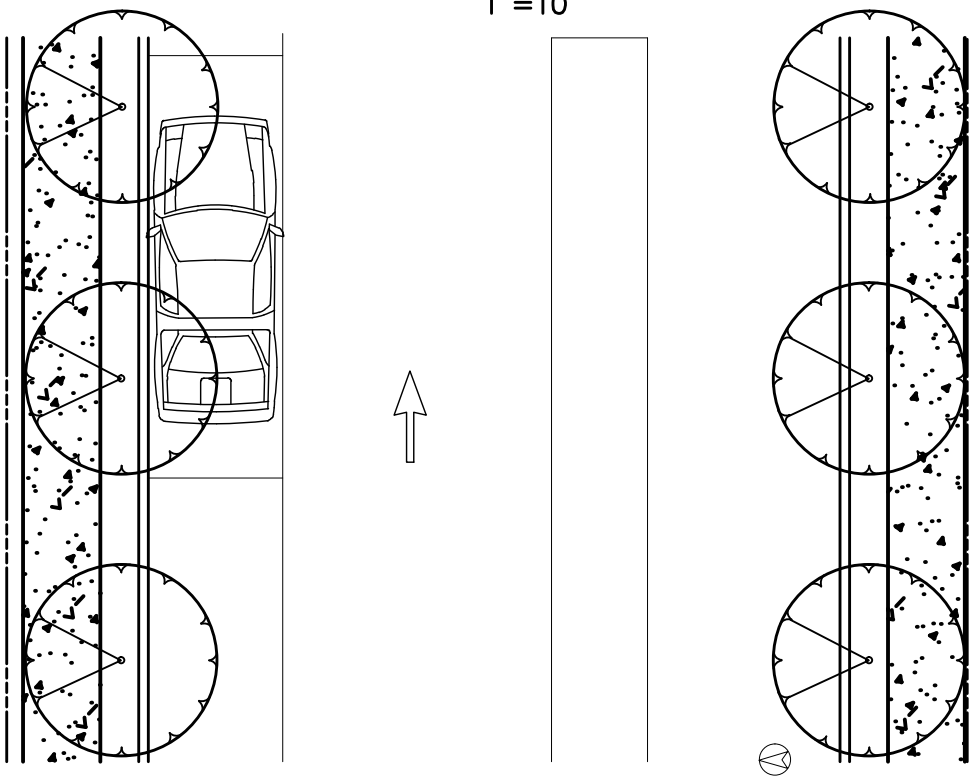
DATE: 4/16/2013
SHEET NO.: OPT-4A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 4B: ONE-WAY STREET WITH PARKING AND CYCLE TRACK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 4B
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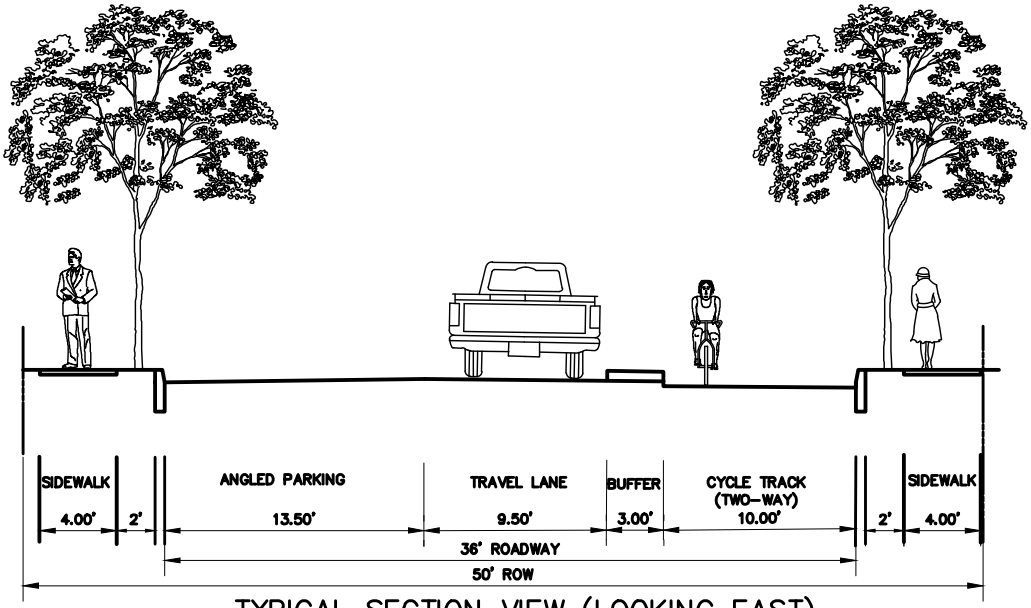
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-4B
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 4C: ONE-WAY STREET WITH ANGLED PARKING AND CYCLE TRACK (BETWEEN NORTH 3RD STREET AND HAZEL TREE ALLEY)



TYPICAL SECTION VIEW (LOOKING EAST)
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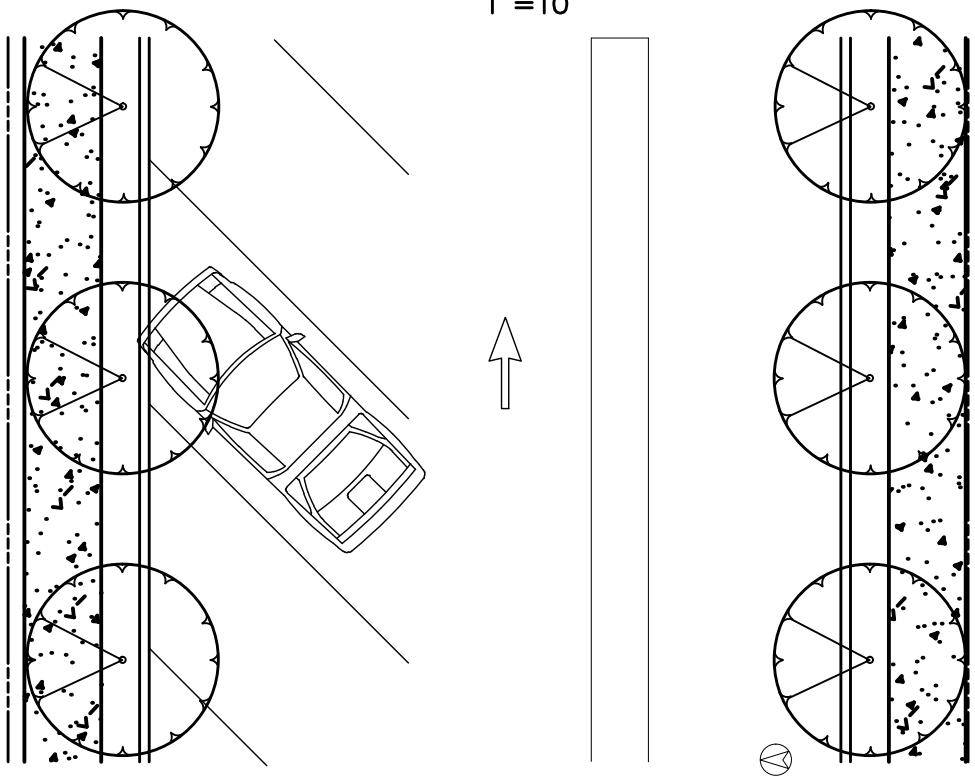

TYPICAL PLAN VIEW
1"=10'

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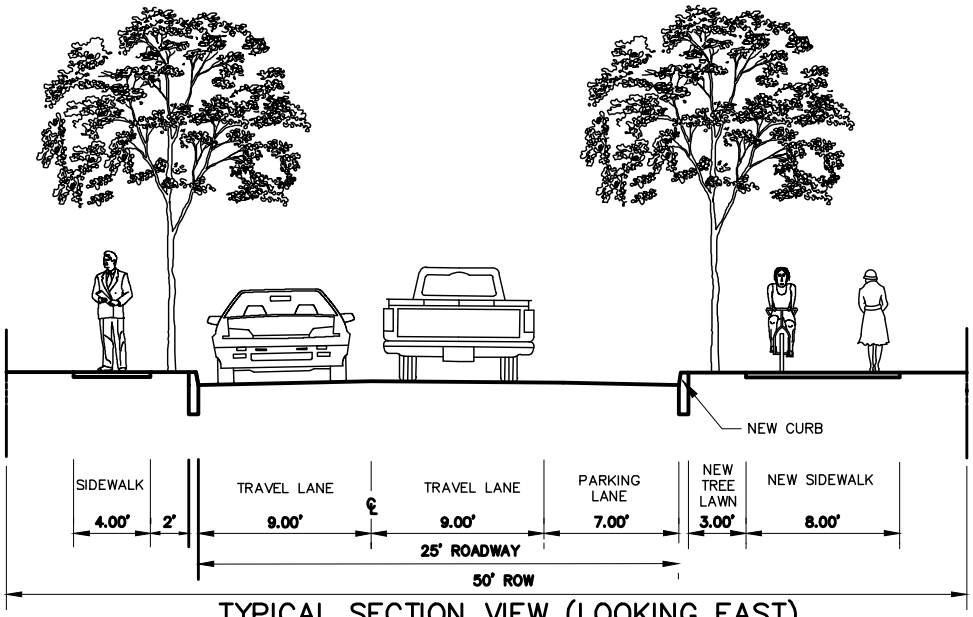
OPTION 4C
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-4C
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 5A: TWO-WAY STREET WITH WIDENED SIDEWALK



TYPICAL SECTION VIEW (LOOKING EAST)
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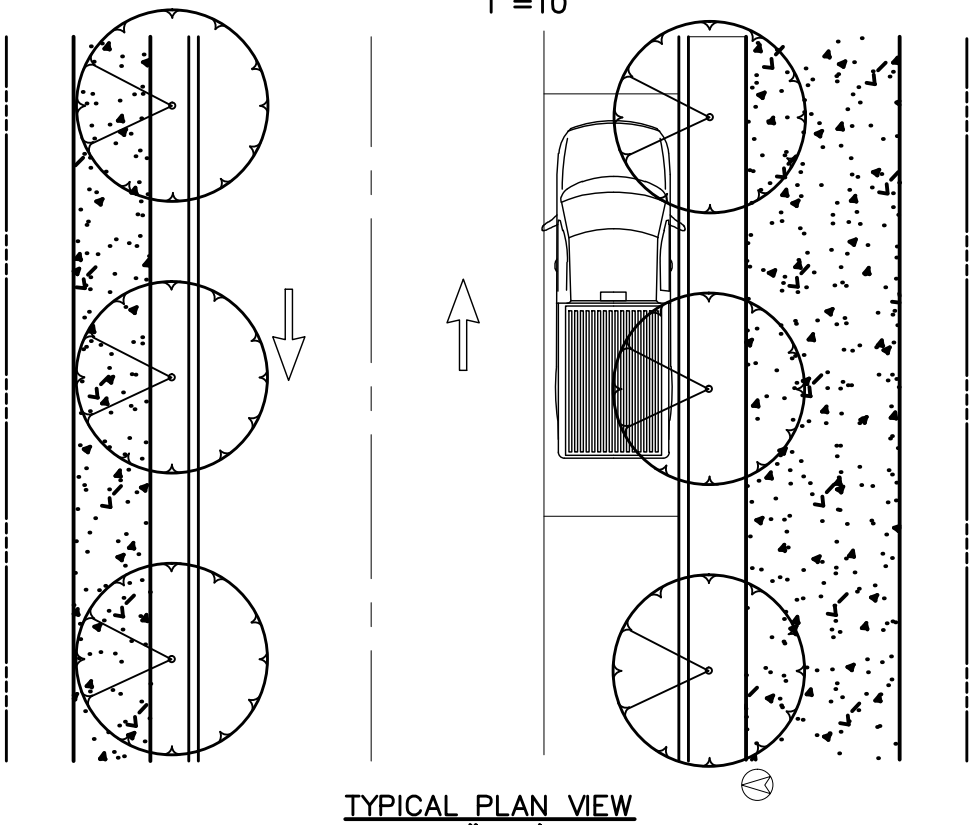

TYPICAL PLAN VIEW
1"=10'

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OPTION 5A
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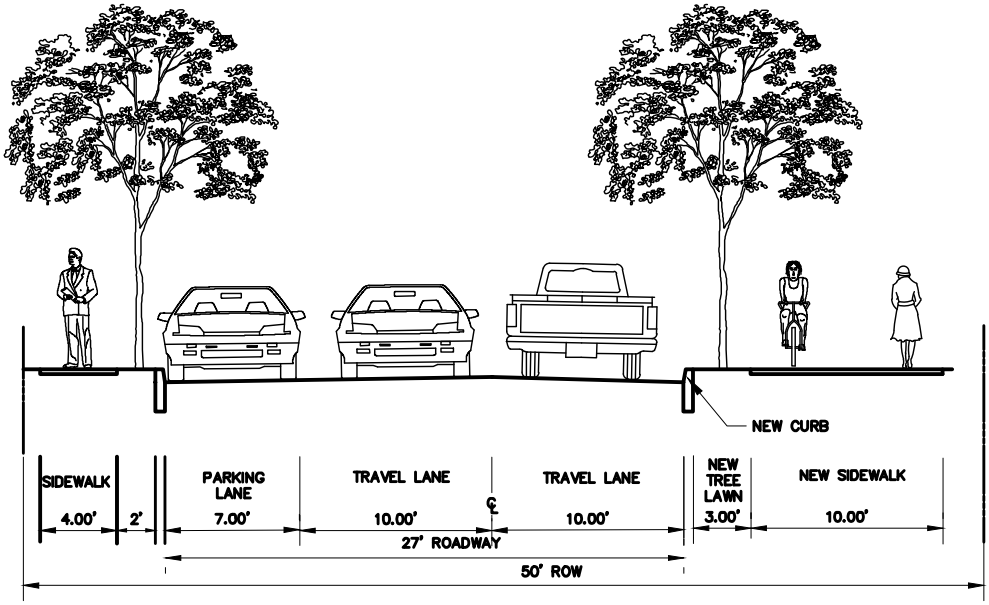
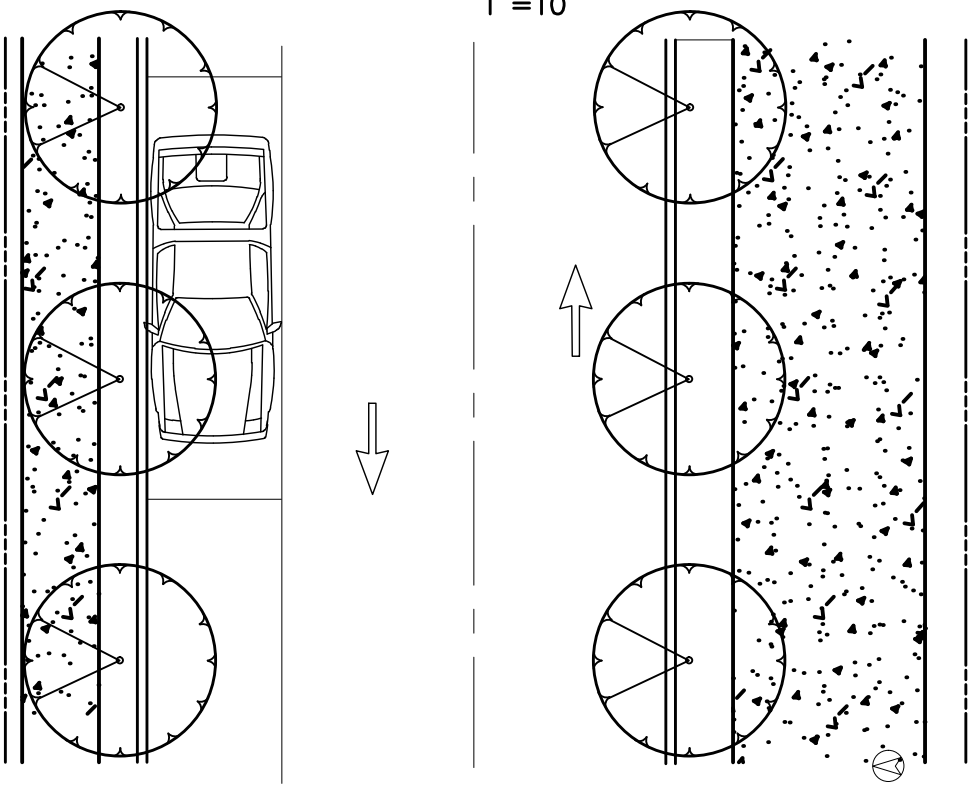
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-5A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 5B: TWO-WAY STREET WITH WIDENED SIDEWALK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

LDG
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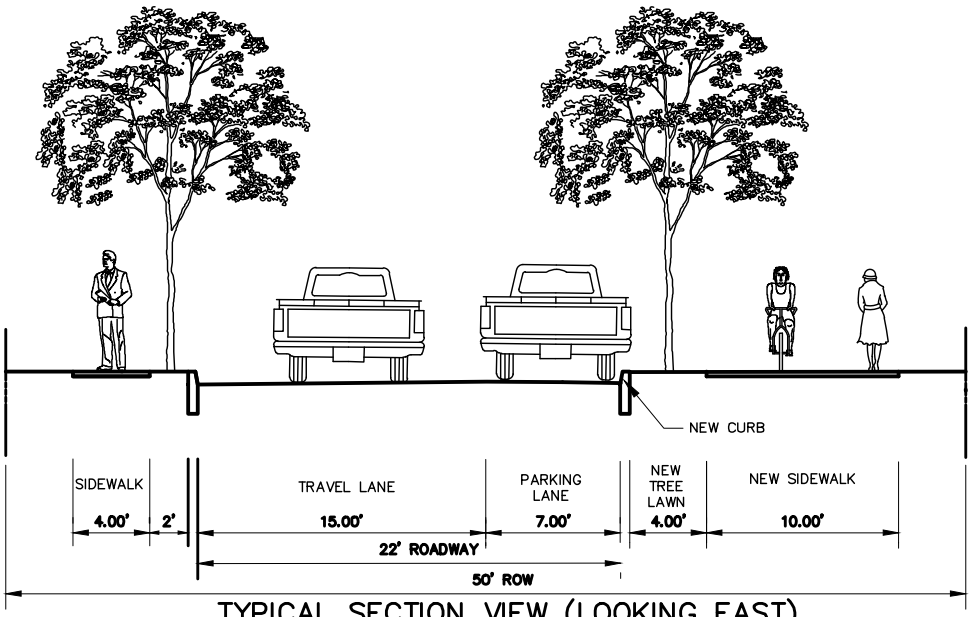
OPTION 5B
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-5B
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 6A: ONE-WAY STREET WITH WIDENED SIDEWALK



TYPICAL SECTION VIEW (LOOKING EAST)
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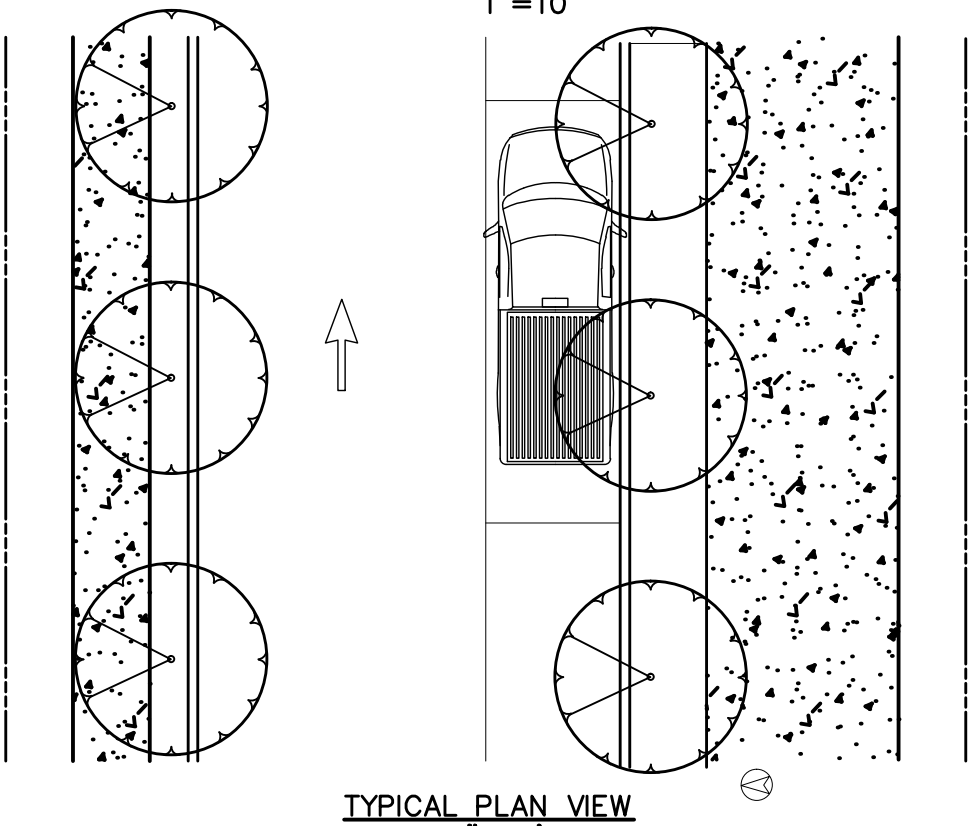

TYPICAL PLAN VIEW
1"=10'

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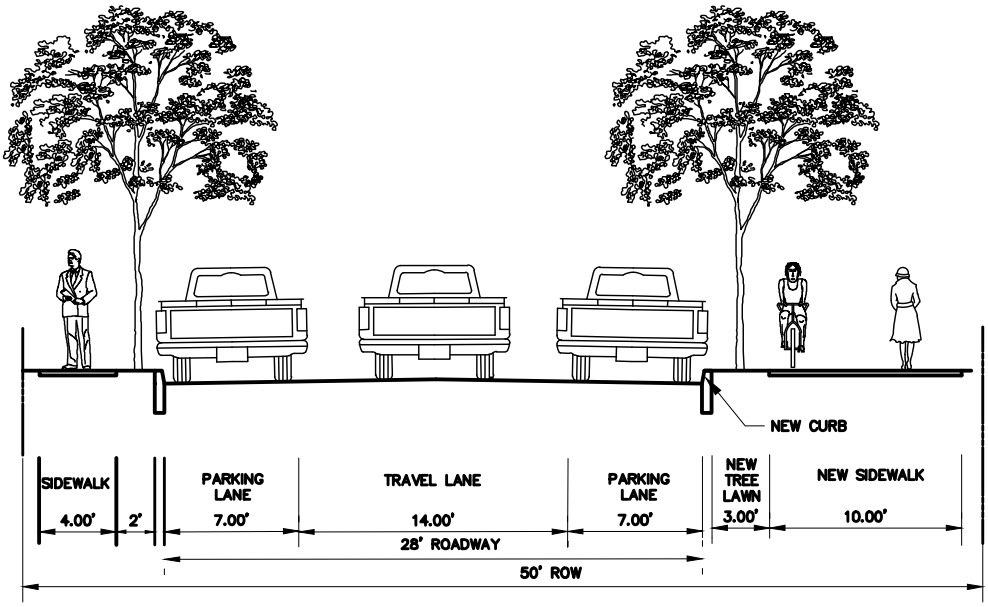
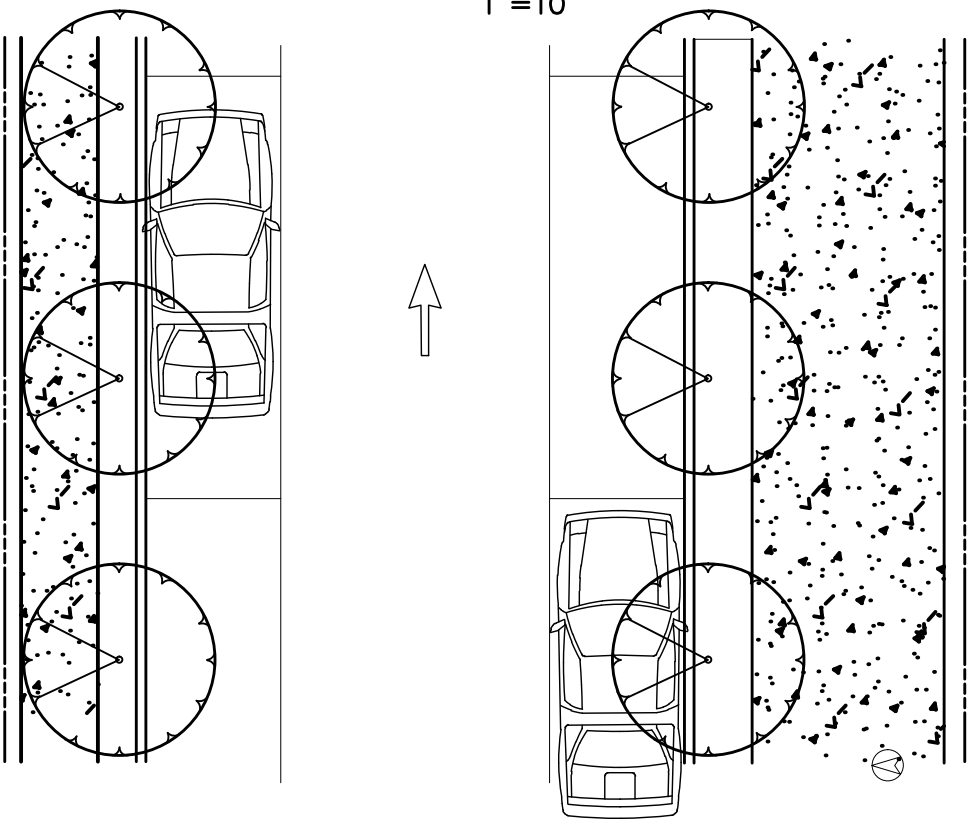
OPTION 6A
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-6A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 6B: ONE-WAY STREET WITH WIDENED SIDEWALK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 6B
BVRT FEASIBILTY
CONCEPT PLANNING
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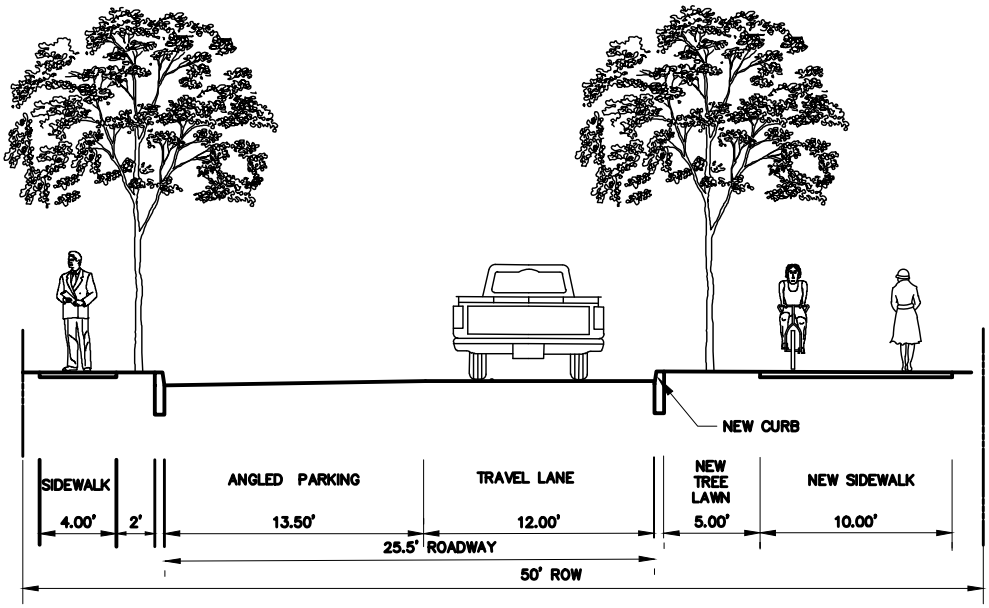
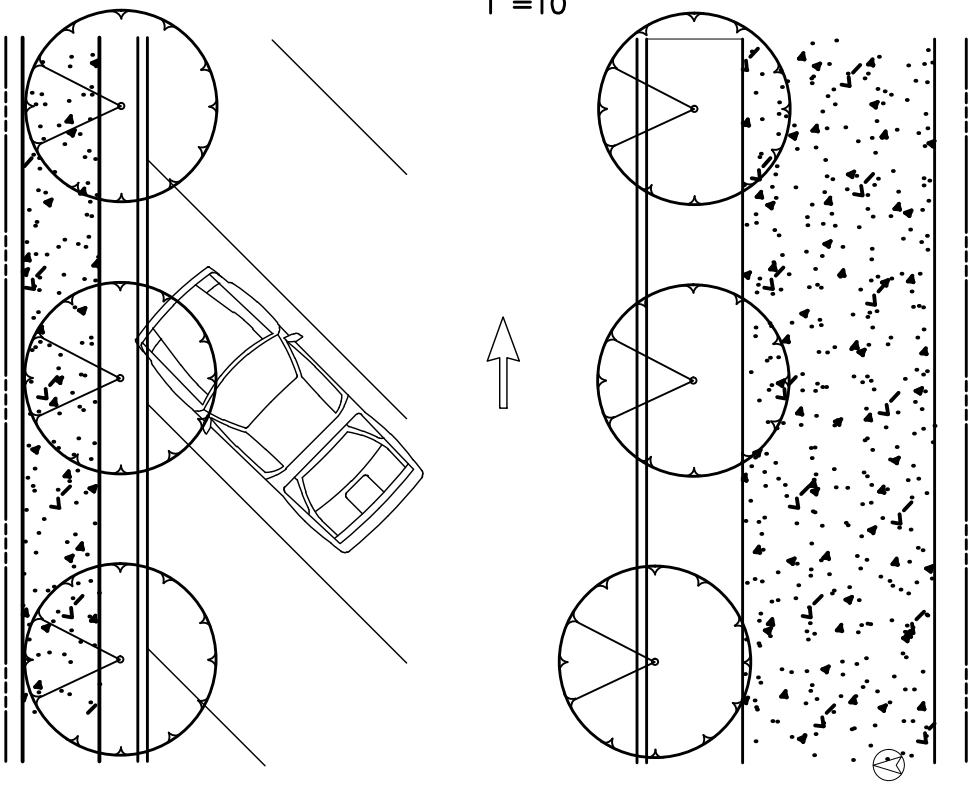
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-6B
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 6C: ONE-WAY STREET WITH WIDENED SIDEWALK AND ANGLED PARKING (BETWEEN NORTH 3RD STREET AND HAZEL TREE ALLEY)



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 6C
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-6C
PROJECT NO.: 7020-006
SCALE: VARIES

APPENDIX D

Option 1A/1B	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	15
Parking Spots Lost	55
%Spots Lost	79%
%Spots Unused - %Spots Lost (Net effect)	-57%
Option 1A/1B with addition of spots between N 3rd and Peach Tree Alley	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	21
Parking Spots Lost	49
%Spots Lost	70%
%Spots Unused - %Spots Lost (Net effect)	-49%

Option 3A/3B	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	52
Parking Spots Lost	18
%Spots Lost	26%
%Spots Unused - %Spots Lost (Net effect)	-4%
Option 3A/3B with addition of spots between N 3rd and Peach Tree Alley	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	58
Parking Spots Lost	12
%Spots Lost	17%
%Spots Unused - %Spots Lost (Net effect)	4%

Option 3A/3B (Switch Parking Side on 3B)	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	55
Parking Spots Lost	15
%Spots Lost	21%
%Spots Unused - %Spots Lost (Net effect)	0%
Option 3A/3B with addition of spots between N 3rd and Peach Tree Alley	
Current Parking Available	70
Max Parking Used (Data)	55

% of Spots Unused	21%
Parking Still Avaiable	61
Parking Spots Lost	9
%Spots Lost	13%
%Spots Unused - %Spots Lost (Net effect)	9%

Option 2A/2B	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	15
Parking Spots Lost	55
%Spots Lost	79%
%Spots Unused - %Spots Lost (Net effect)	-57%
Option 2A/2B with addition of spots between N 3rd and Peach Tree Alley	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	21
Parking Spots Lost	49
%Spots Lost	70%
%Spots Unused - %Spots Lost (Net effect)	-49%

Option 4A/4B	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	52
Parking Spots Lost	18
%Spots Lost	26%
%Spots Unused - %Spots Lost (Net effect)	-4%
Option 4A/4B with addition of spots between N 3rd and Peach Tree Alley	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	58
Parking Spots Lost	12
%Spots Lost	17%
%Spots Unused - %Spots Lost (Net effect)	4%

Option 4A/4B (Swith Parking Side on 4B)	
Current Parking Available	70
Max Parking Used (Data)	55
% of Spots Unused	21%
Parking Still Avaiable	55
Parking Spots Lost	15
%Spots Lost	21%
%Spots Unused - %Spots Lost (Net effect)	0%
Option 4A/4B with addition of spots between N 3rd and Peach Tree Alley	
Current Parking Available	70
Max Parking Used (Data)	55

% of Spots Unused	21%
Parking Still Avaiable	61
Parking Spots Lost	9
%Spots Lost	13%
%Spots Unused - %Spots Lost (Net effect)	9%

APPENDIX E

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	10/25/2013
Location:	BVrec	Prepared By:	EDD
Contact:	Katie Davis	Reviewed By:	SMB

ST. JOHN STREET OPTION 1: TWO-WAY STREET WITH SIGNAGE AND PAVEMENT MARKINGS

This cost estimate is for the Concept Design of a trail segment from North Fifth Street to North Water Street, located in the Borough of Lewisburg. This option is generally defined as the "share the road" option and improvements include additional signage and pavement markings.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Survey Layout	1	LS	$1,200.00	$1,200.00
2	Mobilization	1	LS	$10,000.00	$10,000.00
3	Signage	10	EA	$150.00	$1,500.00
4	Pavement Markings (sharrows)	10	EA	$300.00	$3,000.00
	Subtotal				**$15,700.00**
	Contingency and Engineering	**25**	**%**		**$3,925.00**
	Subtotal				**$19,625.00**
	Construction Inspection	**15**	**%**		**$2,943.75**
	TOTAL PROJECT COST				**$22,568.75**
Note: Curb ramp reconstruction along the St. John Street corridor is approximately $165,000 additional					

Please Note:

Engineer's opinion of probable Construction Cost is made on the basis of Engineer's experience and level of design detail and represents the Engineer's judgment as an experienced and qualified professional generally familiar with the construction industry. However, since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractor's methods of determining price, or over competitive bidding or market conditions, Engineer cannot and does not guarantee that proposals, bids, or actual Construction Costs will not vary from opinion of probable Construction Cost prepared by the Engineer.

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	10/25/2013
Location:	BVrec	Prepared By:	EDD
Contact:	Katie Davis	Reviewed By:	SMB

ST. JOHN STREET OPTION 2: TWO-WAY STREET WITH BIKE LANES

This cost estimate is for the Concept Design of a trail segment from North Fifth Street to North Water Street, located in the Borough of Lewisburg. This option is generally defined as the "Bike Lanes" option and improvements include accessibility improvements, signage and pavement markings.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Survey Layout	1	LS	$1,200.00	$1,200.00
2	Mobilization	1	LS	$10,000.00	$10,000.00
3	Signage	22	EA	$150.00	$3,300.00
4	Pavement Markings (bike symbol)	10	EA	$300.00	$3,000.00
5	Pavement Markings (white lines)	1	LS	$2,500.00	$2,500.00
6	Curb Cut Ramps (streets)	21	EA	$4,800.00	$100,800.00
7	Curb Cut Ramps (alleys)	18	EA	$2,800.00	$50,400.00
	Subtotal				**$171,200.00**
	Contingency and Engineering	**30**	**%**		**$51,360.00**
	Subtotal				**$222,560.00**
	Construction Inspection	**15**	**%**		**$33,384.00**
	TOTAL PROJECT COST				**$255,944.00**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	10/25/2013
Location:	BVrec	Prepared By:	EDD
Contact:	Katie Davis	Reviewed By:	SMB

ST. JOHN STREET OPTION 3: TWO-WAY STREET WITH CYCLE TRACK

This cost estimate is for the Concept Design of a trail segment from North Fifth Street to North Water Street, located in the Borough of Lewisburg. This option is generally defined as the "Cycle Track" option and improvements include accessibility improvements, signage and pavement markings.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Survey Layout	1	LS	$1,800.00	$1,800.00
2	Mobilization	1	LS	$12,000.00	$12,000.00
3	Signage	40	EA	$150.00	$6,000.00
4	Pavement Markings (bike symbol)	1	LS	$4,500.00	$4,500.00
5	Pavement Markings (white buffer between parking/travel lane)	1	LS	$12,500.00	$12,500.00
6	Curb Cut Ramps (streets)	21	EA	$4,800.00	$100,800.00
7	Curb Cut Ramps (alleys)	18	EA	$2,800.00	$50,400.00
	Subtotal				**$188,000.00**
	Contingency and Engineering	**30**	**%**		**$56,400.00**
	Subtotal				**$244,400.00**
	Construction Inspection	**15**	**%**		**$36,660.00**
	TOTAL PROJECT COST				**$281,060.00**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	5/25/2013
Location:	BVrec	Prepared By:	EDD
Contact:	Katie Davis	Reviewed By:	SMB

ST. JOHN STREET OPTION 4: ONE-WAY STREET WITH CYCLE TRACK

This cost estimate is for the Concept Design of a trail segment from North Fifth Street to North Water Street, located in the Borough of Lewisburg. This option is generally defined as the "One-Way Street and Cycle Track" option and improvements include accessibility improvements, signage and pavement markings.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Survey Layout	1	LS	$1,800.00	$1,800.00
2	Mobilization	1	LS	$12,000.00	$12,000.00
3	Signage	75	EA	$150.00	$11,250.00
4	Pavement Markings (symbols and directional)	1	LS	$5,500.00	$5,500.00
5	Pavement Markings (white buffer between parking/travel lane)	1	LS	$12,500.00	$12,500.00
6	Curb Cut Ramps (streets)	21	EA	$4,800.00	$100,800.00
7	Curb Cut Ramps (alleys)	18	EA	$2,800.00	$50,400.00
	Subtotal				**$194,250.00**
	Contingency and Engineering	**30**	**%**		**$58,275.00**
	Subtotal				**$252,525.00**
	Construction Inspection	**15**	**%**		**$37,878.75**
	TOTAL PROJECT COST				**$290,403.75**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	5/25/2013
Location:	BVrec	Prepared By:	EDD
Contact:	Katie Davis	Reviewed By:	SMB

ST. JOHN STREET OPTION 5: TWO-WAY STREET WITH WIDENED SIDEWALK

This cost estimate is for the Concept Design of a trail segment from North Fifth Street to North Water Street, located in the Borough of Lewisburg. This option is generally defined as the "Two-Way Street and Widened Sidewalk" option and improvements include accessibility improvements, narrowed street, street trees, stormwater alterations, signage and pavement markings.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Survey Layout	1	LS	$3,500.00	$3,500.00
2	Mobilization	1	LS	$18,500.00	$18,500.00
3	Erosion and Sediment Pollution Control	1	LS	$5,500.00	$5,500.00
4	Signage	40	EA	$150.00	$6,000.00
5	Pavement Markings (misc.)	1	LS	$3,500.00	$3,500.00
6	6" Concrete Curb, including removal	2,100	LF	$60.00	$126,000.00
7	4" Concrete Sidewalk, including removal	1,520	SY	$85.00	$129,200.00
8	Relocate Lewisburg Lamppost	7	EA	$2,500.00	$17,500.00
9	Type C Inlet	12	EA	$1,500.00	$18,000.00
10	18" HDPE Storm Drain Pipe	45	LF	$42.00	$1,890.00
11	Shade Tree	32	EA	$350.00	$11,200.00
12	Lawn Restoration	1	LS	$6,500.00	$6,500.00
13	Curb Cut Ramps (streets)	21	EA	$5,000.00	$105,000.00
14	Curb Cut Ramps (alleys)	18	EA	$3,000.00	$54,000.00
	Subtotal				**$506,290.00**
	Contingency and Engineering	**25**	**%**		**$126,572.50**
	Subtotal				**$632,862.50**
	Construction Inspection	**15**	**%**		**$94,929.38**
	TOTAL PROJECT COST				**$727,791.88**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	5/25/2013
Location:	BVrec	Prepared By:	EDD
Contact:	Katie Davis	Reviewed By:	SMB

ST. JOHN STREET OPTION 6: ONE-WAY STREET WITH WIDENED SIDEWALK

This cost estimate is for the Concept Design of a trail segment from North Fifth Street to North Water Street, located in the Borough of Lewisburg. This option is generally defined as the "One-Way Street and Widened Sidewalk" option and improvements include accessibility improvements, narrowed street, street trees, stormwater alterations, signage and pavement markings.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Survey Layout	1	LS	$3,500.00	$3,500.00
2	Mobilization	1	LS	$18,500.00	$18,500.00
3	Erosion and Sediment Pollution Control	1	LS	$5,500.00	$5,500.00
4	Signage	75	EA	$150.00	$11,250.00
5	Pavement Markings (misc.)	1	LS	$3,500.00	$3,500.00
6	6" Concrete Curb, including removal	2,100	LF	$60.00	$126,000.00
7	4" Concrete Sidewalk, including removal	1,920	SY	$85.00	$163,200.00
8	Relocate Lewisburg Lamppost	7	EA	$2,500.00	$17,500.00
9	Type C Inlet	12	EA	$1,500.00	$18,000.00
10	18" HDPE Storm Drain Pipe	45	LF	$42.00	$1,890.00
11	Shade Tree	32	EA	$350.00	$11,200.00
12	Lawn Restoration	1	LS	$7,500.00	$7,500.00
13	Curb Cut Ramps (streets)	21	EA	$5,000.00	$105,000.00
14	Curb Cut Ramps (alleys)	18	EA	$3,000.00	$54,000.00
	Subtotal				**$546,540.00**
	Contingency and Engineering	**25**	**%**		**$136,635.00**
	Subtotal				**$683,175.00**
	Construction Inspection	**15**	**%**		**$102,476.25**
	TOTAL PROJECT COST				**$785,651.25**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	10/25/2013
Location:	BVrec	Prepared By:	PGH
Contact:	Katie Davis	Reviewed By:	SMB

ROUTE 15 TO FIFTH STREET WITH EXTENSION TO MARKET STREET

This cost estimate is for the Concept Design of a trail segment from Route 15 to Fifth Street, located in the Borough of Lewisburg. This option is generally defined as a paved trail along the existing railroad right-of-way alignment with an extension south to Market Street. Construction Inspection is included in cost since this segment of trail will be constructed using Transportation Alternative Program funding from PennDOT.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
2	Mobilization	1	LS	$17,450.00	$17,450.00
1	Clearing and Grubbing	0.8	ACRE	$5,000.00	$4,000.00
2	Class 1 Excavation	450	CY	$16.00	$7,200.00
3	Geotextile, Class 2, Type B	110	SY	$2.50	$275.00
4	Superpave Asphalt Mixture Design, HMA Base Course PG 64-22, <0.3 Million ESALS, 25 MM Mix	1,900	SY	$20.00	$38,000.00
5	Subbase 3" Depth (No. 2A)	2,300	SY	$6.00	$13,800.00
6	Subbase (No. 2A) (Back-up)	45	TON	$32.00	$1,440.00
7	Superpave Asphalt Mixture Design, HMA Wearing Course, PG 64-22, <0.3 Million ESALS, 9.5 MM Mix, 1 1/2" Depth, SRL-L	1,900	SY	$10.00	$19,000.00
8	Bituminous Tack Coat	1,900	SY	$0.20	$380.00
9	18" Reinforced Concrete Pipe, Type A, 15' - 2' Fill	200	LF	$80.00	$16,000.00
10	Type M Concrete Top Unit and Bicycle Safe Grate	2	SET	$520.00	$1,040.00
11	Standard Inlet Box, Height < / = 10'	2	EACH	$2,000.00	$4,000.00
12	Inspector's Field Office, Type C	1	LS	$7,000.00	$7,000.00
13	Equipment Package	1	LS	$2,000.00	$2,000.00
14	Construction Surveying, Type B, Modified	1	LS	$6,000.00	$6,000.00
15	Narrative Schedule	1	LS	$500.00	$500.00
16	Unforeseen Water Pollution Control	500	DOLLAR	$1.00	$500.00
17	Compost Filter Sock, 12" Diameter	1,500	LF	$5.00	$7,500.00
18	Maintenance and Protection of Traffic	1	LS	$8,000.00	$8,000.00
19	Post Mounted Signs, Type B	100	SF	$35.00	$3,500.00
20	Post Mounted Signs, Type F	200	SF	$21.00	$4,200.00
21	6" White Preformed Thermoplastic Pavement Marking	300	LF	$4.00	$1,200.00
22	12" White Preformed Thermoplastic Pavement Marking	70	LF	$8.00	$560.00
23	2 Rail Fence	716	LF	$15.00	$10,740.00
24	Wood Railing	200	LF	$45.00	$9,000.00
25	Wood Railing, Structure Mounted	75	LF	$200.00	$15,000.00
26	Swing Gate	4	EACH	$2,200.00	$8,800.00
27	Removable Bollard	3	EACH	$675.00	$2,025.00
28	Fixed Bollard	6	EACH	$610.00	$3,660.00
29	Selected Borrow Excavation Rock, Class R-3 Special	75	CY	$80.00	$6,000.00
30	6" Depth Cement Concrete	50	SY	$125.00	$6,250.00
31	Sidewalk Detectable Warning Surface	100	SF	$60.00	$6,000.00
32	Concrete RR Crossing	1	LS	$25,000.00	$25,000.00
33	Trees	10	EACH	$315.00	$3,150.00
34	Fence	30	LF	$75.00	$2,250.00
35	Miscellaneous E&S Control	1	LS	$20,000.00	$20,000.00
36	Bridge Rehab	1	LS	$85,000.00	$85,000.00
	Subtotal				**$366,420.00**
	Contingency and Engineering	**25**	**%**		**$91,605.00**
	Subtotal				**$458,025.00**
	Construction Inspection	**15**	**%**		**$68,703.75**
	TOTAL PROJECT COST				**$526,728.75**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	4/22/2013
Location:	BVrec	Prepared By:	MCS
Contact:	Katie Davis	Reviewed By:	SMB

TWELFTH STREET TO ROUTE 15

This cost estimate is for the Concept Design of a trail segment from 12th Street to Route 15, located in East Buffalo Township. This option is generally defined as a paved trail along the existing railroad right-of-way alignment.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Mobilization	1	LS	$15,000.00	$12,000.00
2	Construction Surveying and Layout	1	LS	$4,500.00	$4,500.00
3	Clearing and Grubbing	1.8	ACRE	$5,000.00	$9,000.00
4	Class 1 Excavation	1,577	CY	$20.00	$31,540.00
5	Topsoil Stripping, 8" Depth	2,310	CY	$6.00	$13,860.00
6	Topsoil Placement, 4" Depth	2,310	CY	$6.00	$13,860.00
7	Seeding and Soil Supplements - Formula B	324	LB	$20.00	$6,480.00
8	Mulching - Straw	5.4	TON	$400.00	$2,160.00
9	Paved Surface - Superpave Asphalt Mixture Design, HMA Binding Course, PG 64-22, <0.3 Million ESALS, 19.0 MM Mix,	1,380	SY	$13.00	$17,940.00
10	Paved Surface - Superpave Asphalt Mixture Design, HMA Wearing Course, PG 58-28, <0.3 Million ESALS, 9.5 MM Mix, 1" Depth, SRL-L	1,380	SY	$7.00	$9,660.00
11	Paved Surface - Shoulder - Subbase 9" Depth (No. 2A)	828	SY	$12.00	$9,936.00
12	Paved Surface - Subbase 6" Depth (No. 2A)	1,380	SY	$10.00	$13,800.00
13	Class 2 Type B Geotextile Fabric	2,208	SY	$2.00	$4,416.00
14	Trash Cans	1	EACH	$200.00	$200.00
15	Security Camera with Feed	1	EACH	$500.00	$500.00
16	Landscape Trees - Evergreens	8	EACH	$400.00	$3,200.00
18	Gates	4	EACH	$800.00	$3,200.00
	Subtotal				**$156,252.00**
	Contingency and Engineering	**25**	**%**		**$39,063.00**
	Subtotal				**$195,315.00**
	Construction Inspection	**15**	**%**		**$29,297.25**
	TOTAL PROJECT COST				**$224,612.25**

Please Note:

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	10/25/2013
Location:	BVrec	Prepared By:	MCS
Contact:	Katie Davis	Reviewed By:	SMB

ROUTE 15 SIGNALIZED TRAIL INTERSECTION

This cost estimate is for the Concept Design of a signalized crossing at Route 15, located along the current intersection with the railroad alignment. This option is generally defined as a signalized intersection with refuge island located in the center of the highway. Construction Inspection is included in cost opinion since this segment of trail will be constructed within the PennDOT right-of-way.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Mobilization	1	LS	$15,000.00	$18,500.00
2	Construction Surveying and Layout	1	LS	$4,500.00	$4,500.00
3	Paved Surface - Superpave Asphalt Mixture Design, HMA Wearing Course, PG 58-28, <0.3 Million ESALS, 9.5 MM Mix, 1 1/2" Depth, SRL-L	94	SY	$15.00	$1,410.00
4	Superpave Asphalt Mixture Design HMA Base Course, PG 58-28, 0.3 to <3 Million ESALS, 25 MM Mix, 4" Depth	94	SY	$25.00	$2,350.00
5	Subbase 10" Depth (No. 2A)	94	SY	$20.00	$1,880.00
6	Stabilized Wearing Course - Subbase 4" Depth (No. 10)	94	SY	$10.00	$940.00
7	Maintenance and Protection of Traffic	1	LS	$3,500.00	$3,500.00
8	4" Concrete Sidewalk, including removal	42	SY	$110.00	$4,620.00
9	Plain Cement Concrete Curb, 6" Reveal	170	LF	$60.00	$10,200.00
10	Maintenance and Protection of Traffic	1	LS	$8,500.00	$8,500.00
11	12" White Hot Thermoplastic Pavement Markings	96	LF	$6.00	$576.00
12	24" White Hot Thermoplastic Pavement Markings	170	LF	$10.00	$1,700.00
13	Electric Service, Type A	1	LS	$3,500.00	$3,500.00
14	Pole Foundation	2	EACH	$3,500.00	$7,000.00
15	Post Mounted Sign - Type B	2	EACH	$150.00	$300.00
16	Traffic Signal Support, 24' Arm Mast	2	EACH	$4,900.00	$9,800.00
17	Traffic Signal Support, 20' Strain Pole	2	EACH	$3,900.00	$7,800.00
18	Traffic Signal Support, 10' Pedestal	4	EACH	$2,100.00	$8,400.00
19	Controller Assembly	1	EACH	$6,800.00	$6,800.00
20	Signal Cable, 12 AWG, 5 Conductor	1,500	LF	$3.00	$4,500.00
21	Signal Cable, 14 AWG, 3 Conductor	1,500	LF	$3.00	$4,500.00
22	Junction Box	2	EACH	$1,600.00	$3,200.00
23	Trench and Backfill, Type 1	1,500	LF	$8.00	$12,000.00
24	2" Conduit	1,500	LF	$5.00	$7,500.00
25	Vehicular Signal Head, Three 12" Sections	4	EACH	$740.00	$2,960.00
26	Pedestrian Signal Head	4	EACH	$1,100.00	$4,400.00
27	Pedestrian Pushbutton	4	EACH	$200.00	$800.00
	Subtotal				**$142,136.00**
	Contingency and Engineering	**40**	**%**		**$56,854.40**
	Subtotal				**$198,990.40**
	Construction Inspection	**15**	**%**		**$29,848.56**
	PROJECT TOTAL				**$228,838.96**

Please Note:

Engineer's opinion of probable Construction Cost is made on the basis of Engineer's experience and level of design detail and represents the Engineer's judgment as an experienced and qualified professional generally familiar with the construction industry. However, since the Engineer has no control over the cost of labor, materials, equipment, or services furnished by others, or over contractor's methods of determining price, or over competitive bidding or market conditions, Engineer cannot and does not guarantee that proposals, bids, or actual Construction Costs will not vary from opinion of probable Construction Cost prepared by the Engineer.

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Opinion of Probable Construction Cost

Project Information		Report Information	
Name:	Buffalo Valley Recreation Authority		
Number:	7020-006	Date:	10/25/2013
Location:	BVrec	Prepared By:	EAG
Contact:	Katie Davis	Reviewed By:	SMB

RAILROAD BRIDGE OVER WEST BRANCH SUSQUEHANNA RIVER

This cost estimate is for the Concept Design of the railroad bridge over the West Branch of the Susquehanna River. It includes the cost of the decking that will be installed on the existing steel truss structure and the 315 ft segment from Water Street to the west side of the bridge and the 150 foot segment from the east end of the bridge to Route 405.

Item Number	Description	Quantity	Unit	Unit Cost	Total Cost
1	Mobilization	1	LS	25,000	$25,000.00
2	Clearing and Grubbing	0.6	ACRE	$15,000.00	$9,000.00
3	Geotextile, Class 2, Type B	638	SY	$2.50	$1,594.44
4	Superpave Asphalt Mixture Design, HMA Base Course PG 64-22, <0.3 Million ESALS, 25 MM Mix	547	SY	$20.00	$10,933.33
5	Subbase 3" Depth (No. 2A)	547	SY	$6.00	$3,280.00
6	Superpave Asphalt Mixture Design, HMA Wearing Course, PG 64-22, <0.3 Million ESALS, 9.5 MM Mix, 1 1/2" Depth, SRL-L	547	SY	$10.00	$5,466.67
7	Wood Railing	2,642	LF	$45.00	$118,890.00
8	Glulam Deck	88,480	BFM	$12.50	$1,106,000.00
9	Fixed Bollard	2	EACH	$610.00	$1,220.00
10	Swing Gate	4	EACH	$220.00	$880.00
11	Repoint Masonry Joints on Stone Piers	2,940	LF	$16.00	$47,040.00
12	R-7 Rip-Rap Stabilization with R-4 Choke Stone	1,100	TON	$38.00	$41,800.00
13	Water Pollution Control	1	LS	$9,000.00	$9,000.00
14	Temporary River Access and Protection	1	LS	$25,000.00	$25,000.00
	Subtotal				**$1,405,104.44**
	Contingency and Engineering	**25**	**%**		**$351,276.11**
	Subtotal				**$1,756,380.56**
	Construction Inspection	**15**	**%**		**$263,457.08**
	PROJECT TOTAL				**$2,019,837.64**

Please Note:

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APPENDIX F

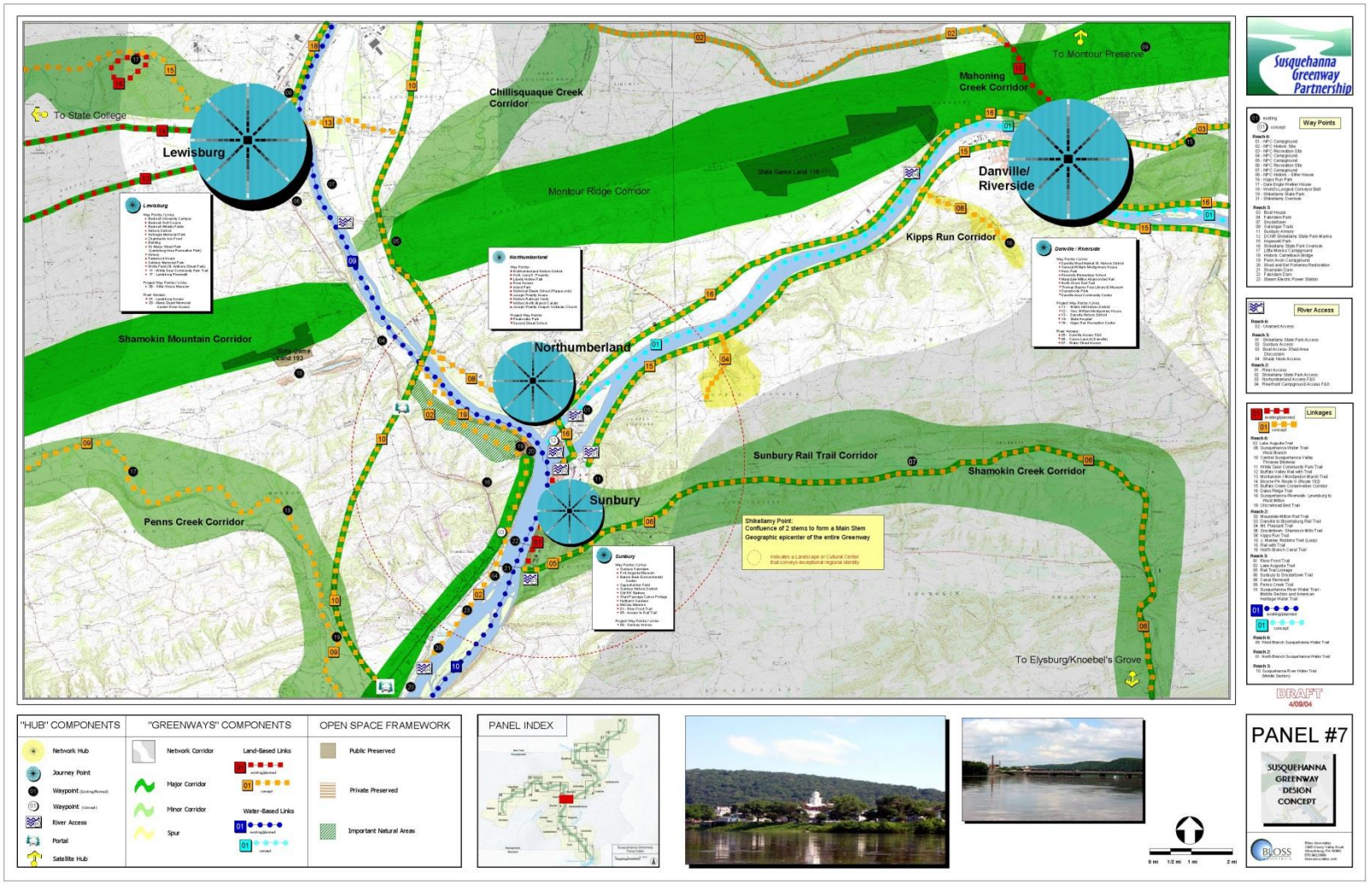
Concept Design Presentation

Proposed Buffalo valley rail trail extension

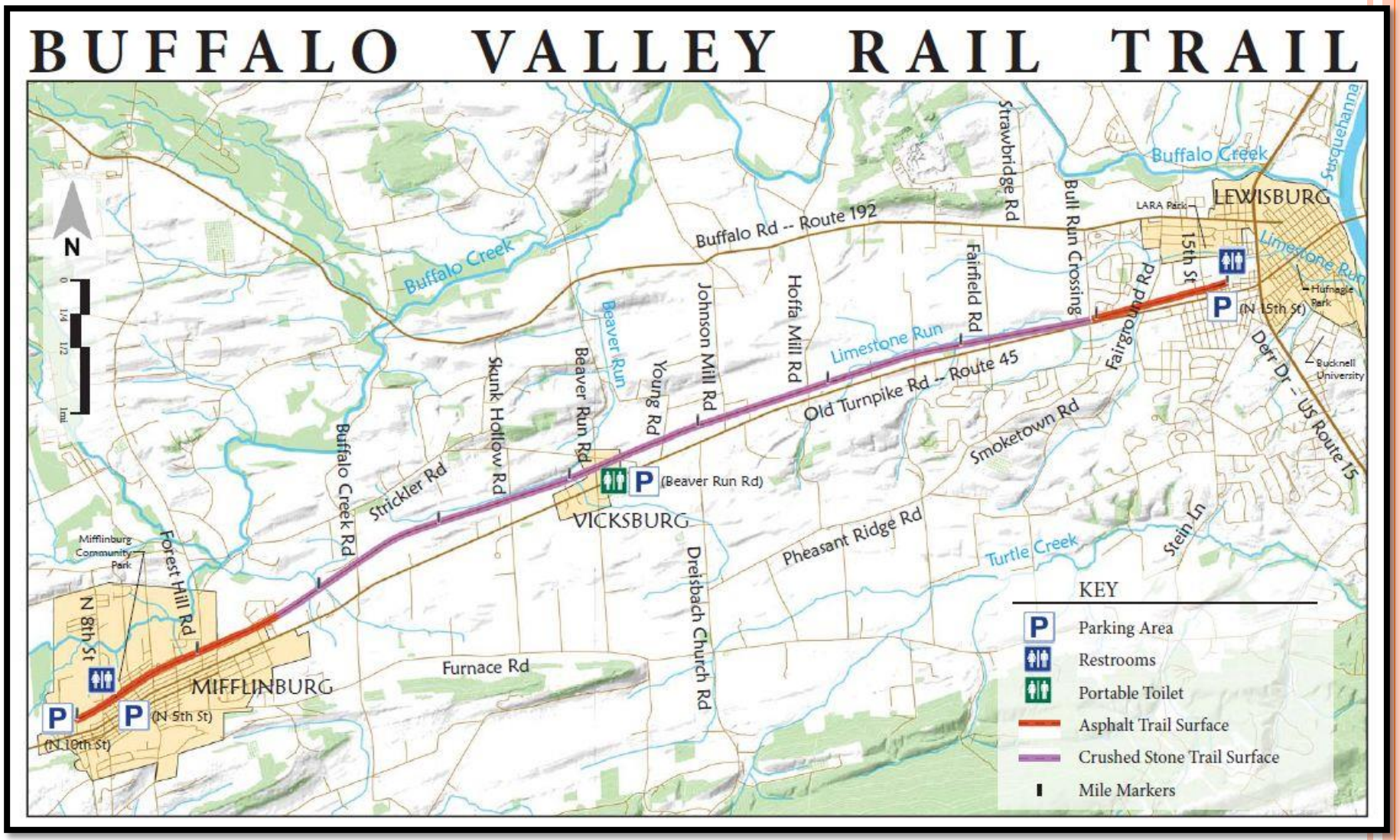
Resources / Stakeholders

- Jim Buck – EBT Board of Supervisors
- Jim Mathias – BVRec Board Chairman
- Katie Davis – BVRec Executive Director
- Shawn McLaughlin – Union County Planning Director
- Samantha Pearson –BVRT Committee, Elm Street Manager
- Chad Smith – Borough Manager
- Judy Wagner – Borough Mayor
- Linda Sterling – Downtown Partnership
- Ted Strosser – Borough Council
- Emily Gladstone – Bucknell Engineering Student
- Matt Szymanski – Bucknell Engineering Student
- Gil Erlich – Bucknell Engineering Student
- Steven Beattie – Larson Design Group
- Phil Hoffman – Larson Design Group
- Michelle Oswald – Bucknell Engineering Professor

Regional Context Map/Vision of Susquehanna Greenway

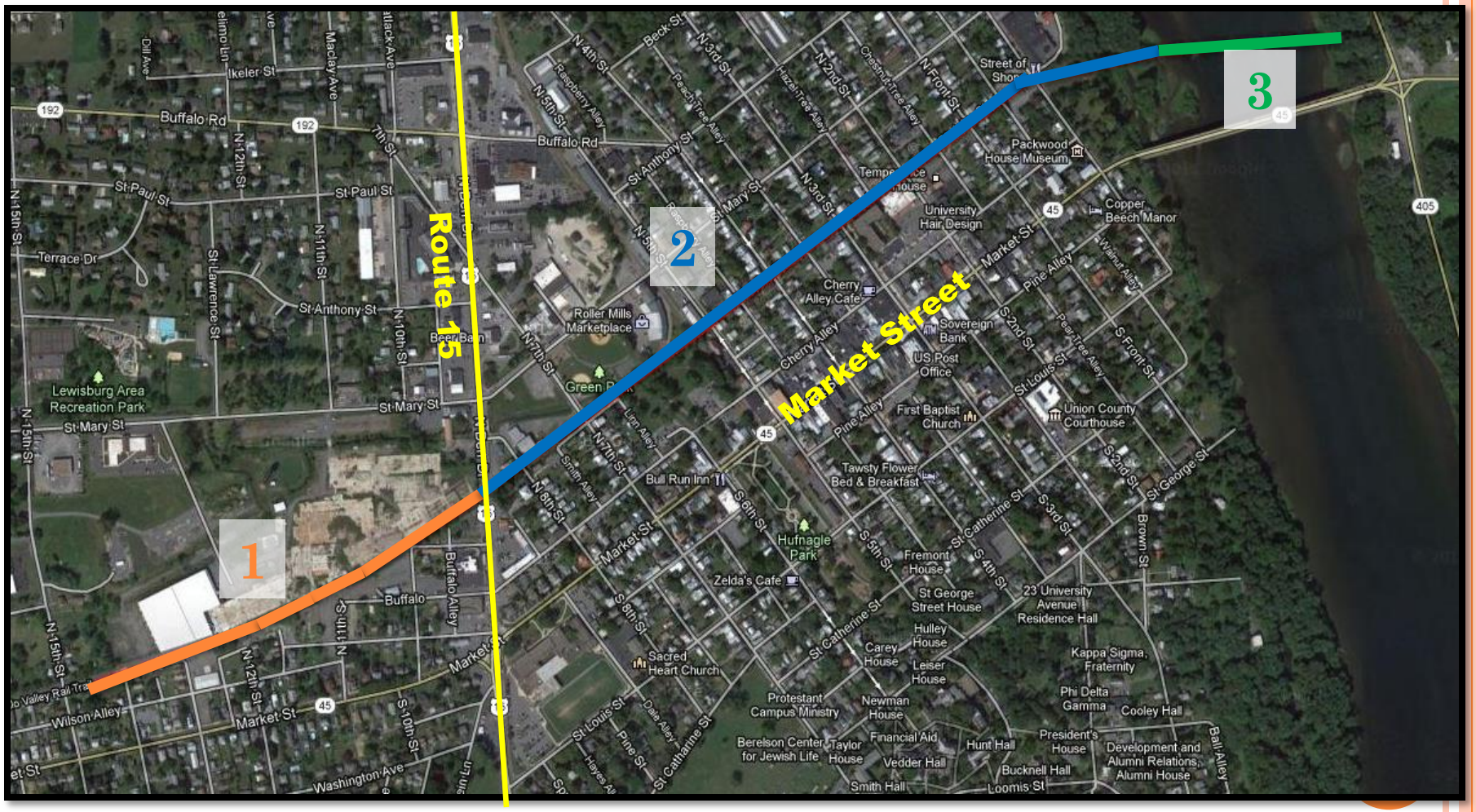


Project Overview



Design Process

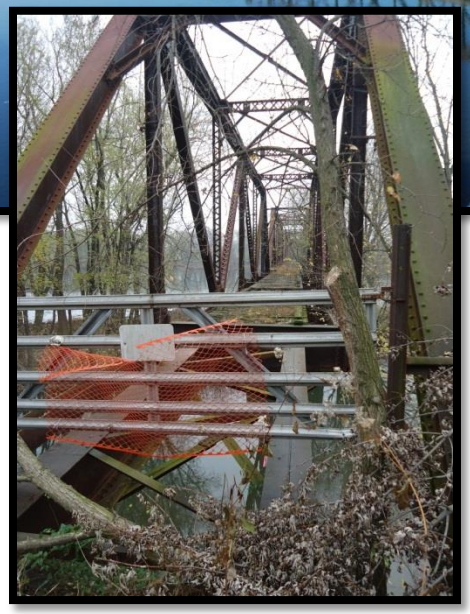
Project Overview



Route 15 Crossing – Planning Agenda

- Signalized pedestrian crossing does not currently meet warrants.
- Southbound Route 15 vehicle queuing extends over BVRT alignment creating safety concerns.
- Design options require further engineering evaluations to determine constraints and costs.
- Extensive coordination needed with Route 15 Corridor study recommendations.

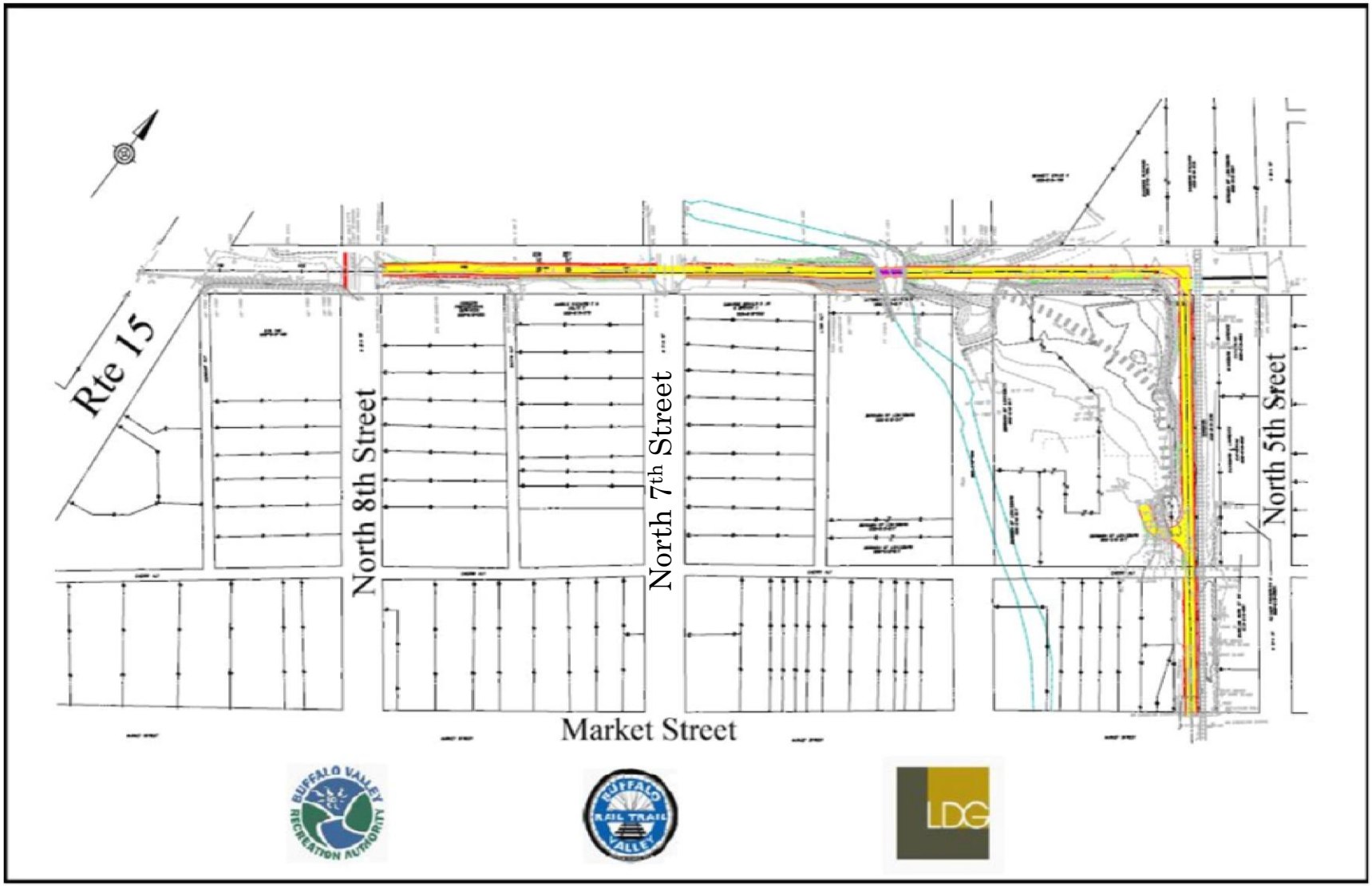
Railroad Bridge Design



Existing Conditions

Norwattuck Case Study
Northampton, MA

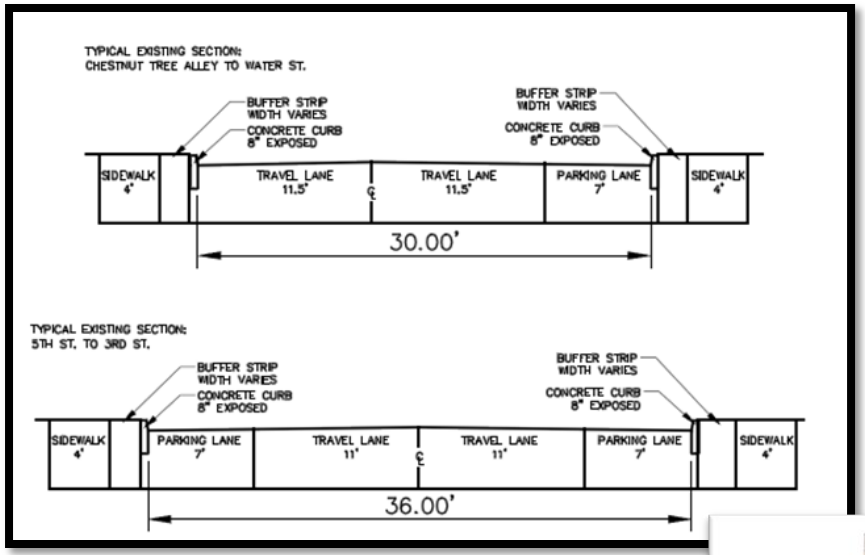
Alignment from 8th to 5th with Extension to Market Street

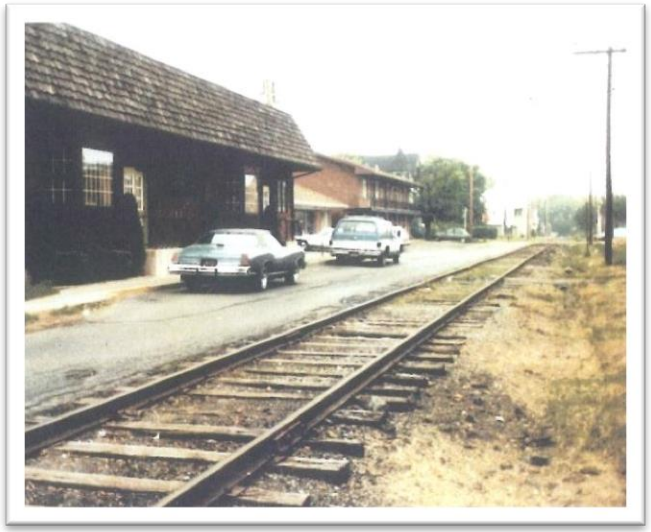


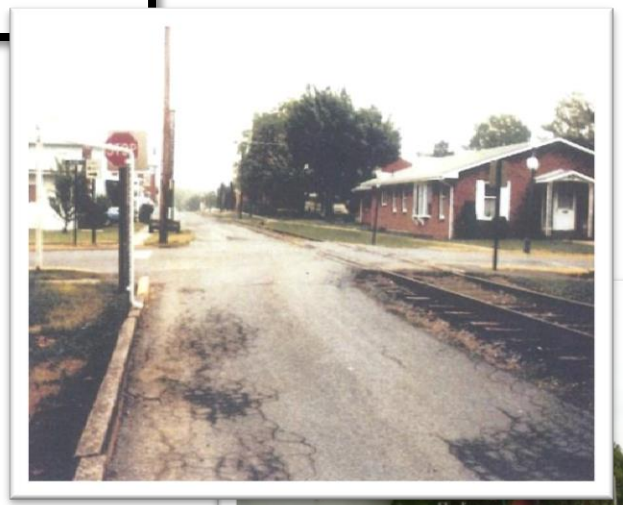
Alignment from Route 15 to 5th with Extension to Market Street

Typical Trail Segments

St. John Street Existing Conditions

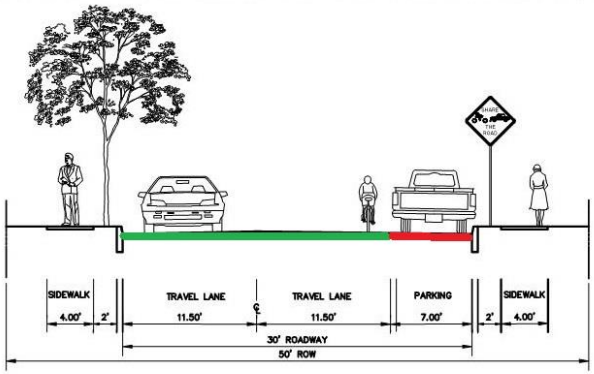




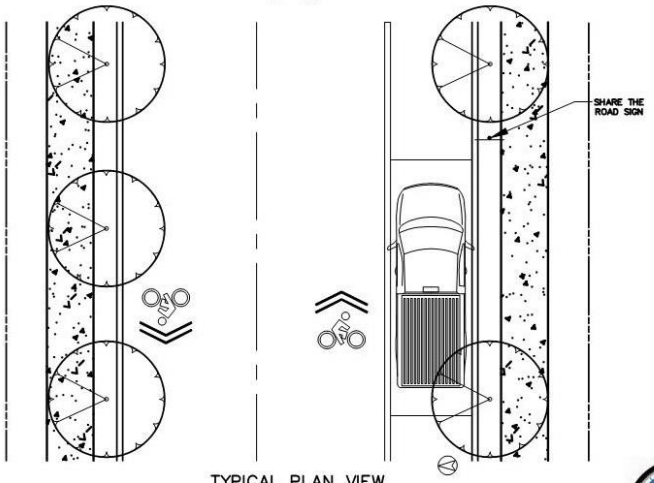


St. John Street Reconfiguration Option 1:

OPTION 1A: TWO-WAY STREET WITH SIGNAGE AND PAVEMENT MARKINGS



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'

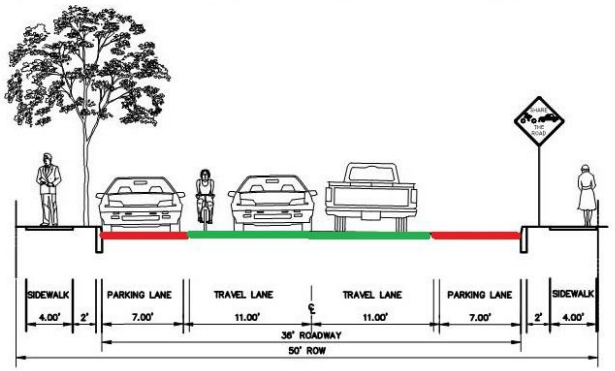


TYPICAL PLAN VIEW
1"=10'

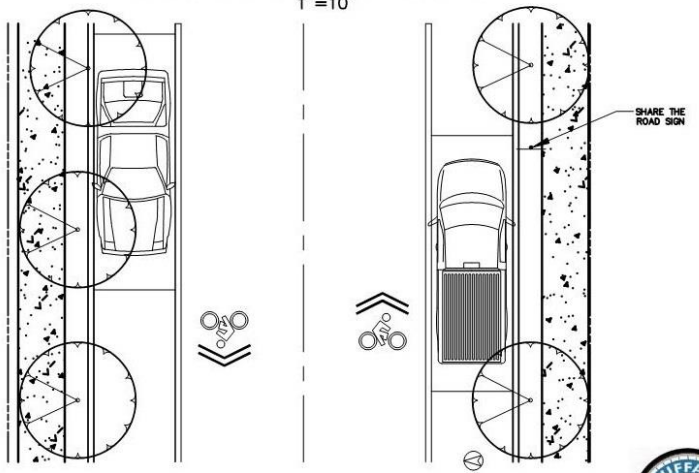
OPTION 1A
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-1A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 1B: TWO-WAY STREET WITH SIGNAGE AND PAVEMENT MARKINGS



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

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OPTION 1B
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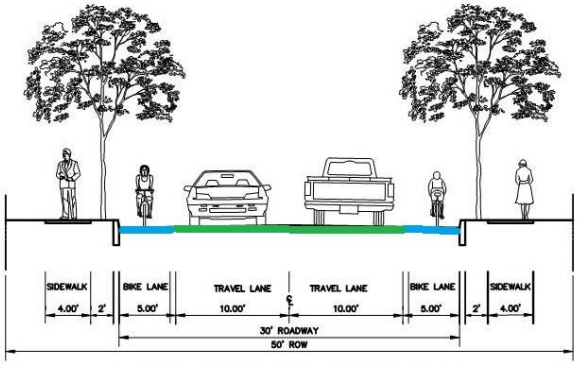
DATE: 4/16/2013
SHEET NO.: OPT-1B
PROJECT NO.: 7020-006
SCALE: VARIES

Legend

- Bike Lane / Cycle Track
- Travel Lane
- Parking

St. John Street Reconfiguration Option 2:

OPTION 2A: TWO-WAY STREET WITH BIKE LANES



TYPICAL SECTION VIEW (LOOKING EAST)
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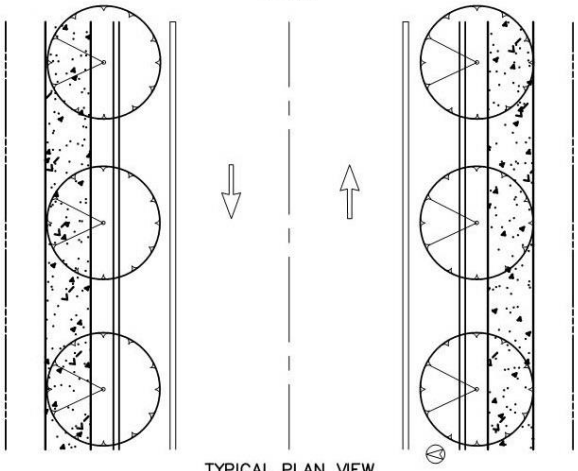

TYPICAL PLAN VIEW
1"=10'

OPTION 2A
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FOR
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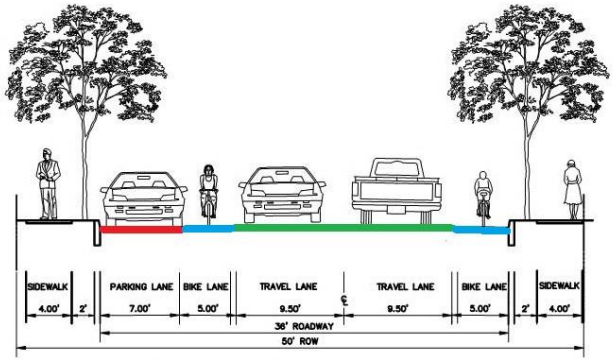
DATE: 4/16/2013
SHEET NO.: OPT-2A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 2B: TWO-WAY STREET WITH PARKING AND BIKE LANES



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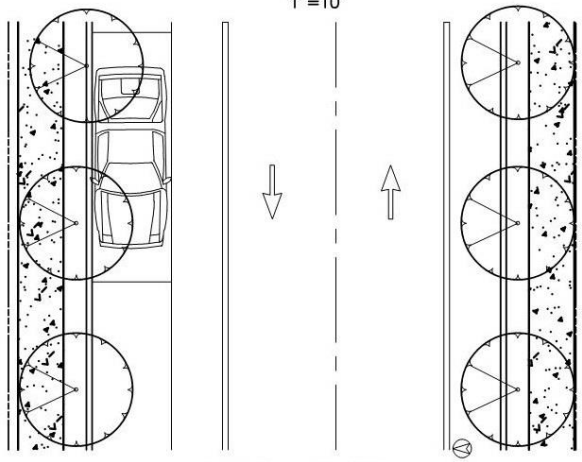

TYPICAL PLAN VIEW
1"=10'

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DATE: 4/16/2013
SHEET NO.: OPT-2B
PROJECT NO.: 7020-006
SCALE: VARIES

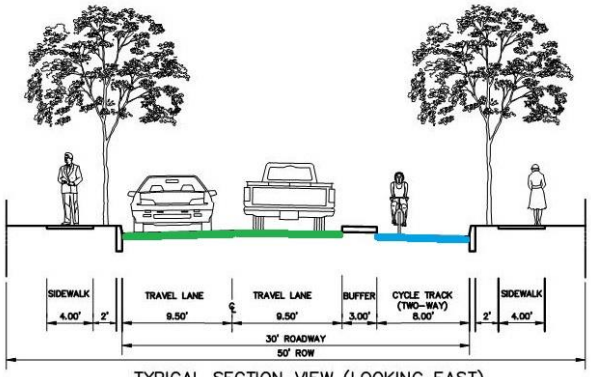
Legend

- Bike Lane / Cycle Track
- Travel Lane
- Parking

Bike Lane Examples:

St. John Street Reconfiguration Option 3:

OPTION 3A: TWO-WAY STREET WITH CYCLE TRACK



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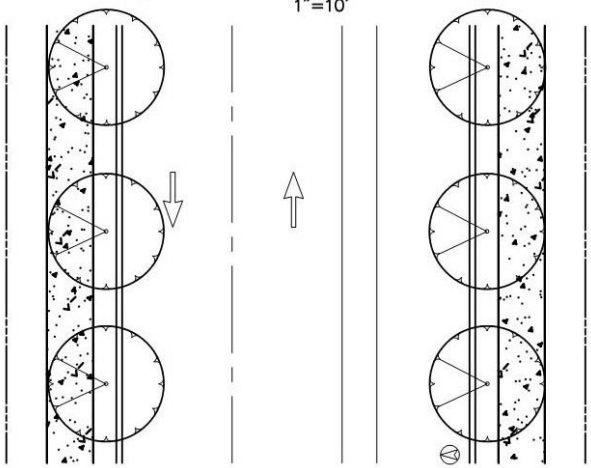


TYPICAL PLAN VIEW
1"=10'

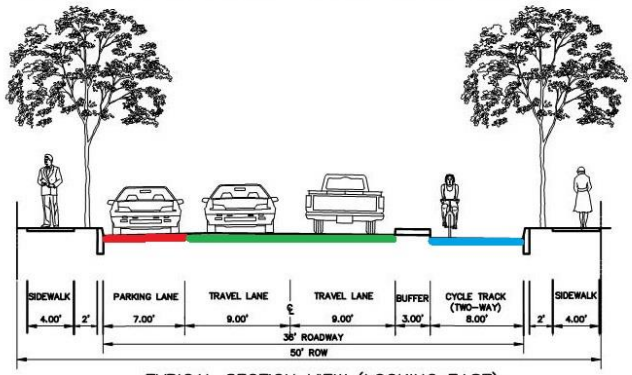
Legend

- Bike Lane / Cycle Track
- Travel Lane
- Parking

OPTION 3A
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-3A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 3B: TWO-WAY STREET WITH PARKING AND CYCLE TRACK



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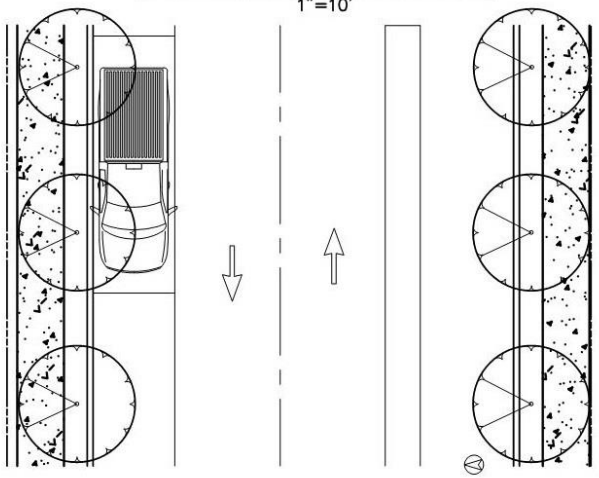

TYPICAL PLAN VIEW
1"=10'

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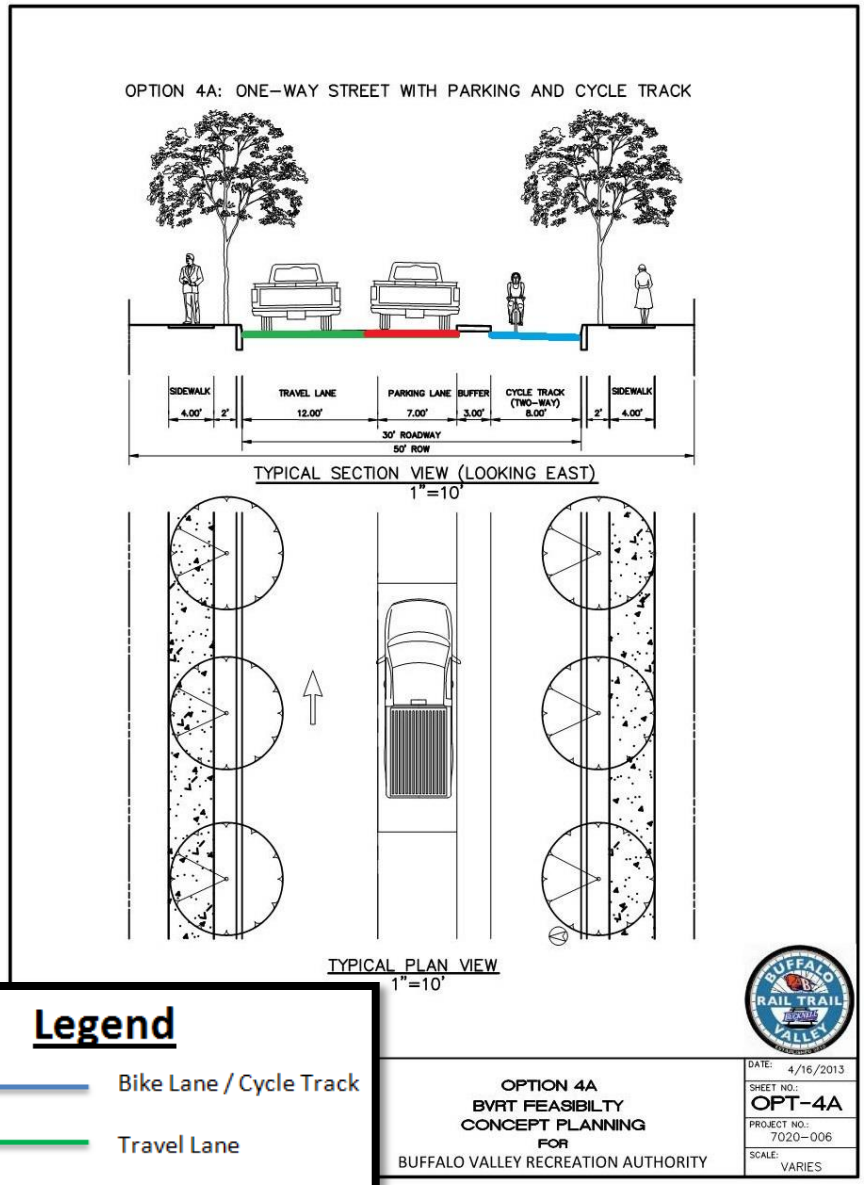
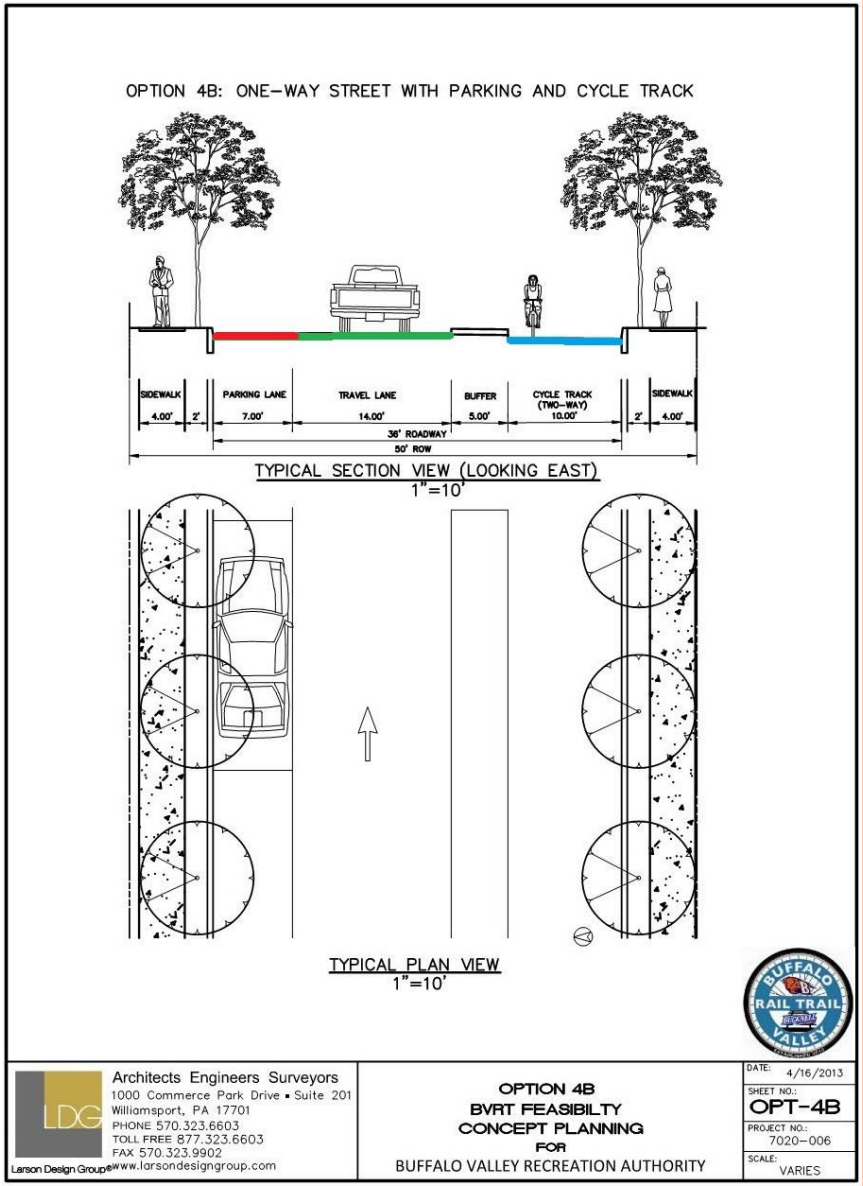
DATE: 4/16/2013
SHEET NO.: OPT-3B
PROJECT NO.: 7020-006
SCALE: VARIES

St. John Street Reconfiguration Option 4:





Legend

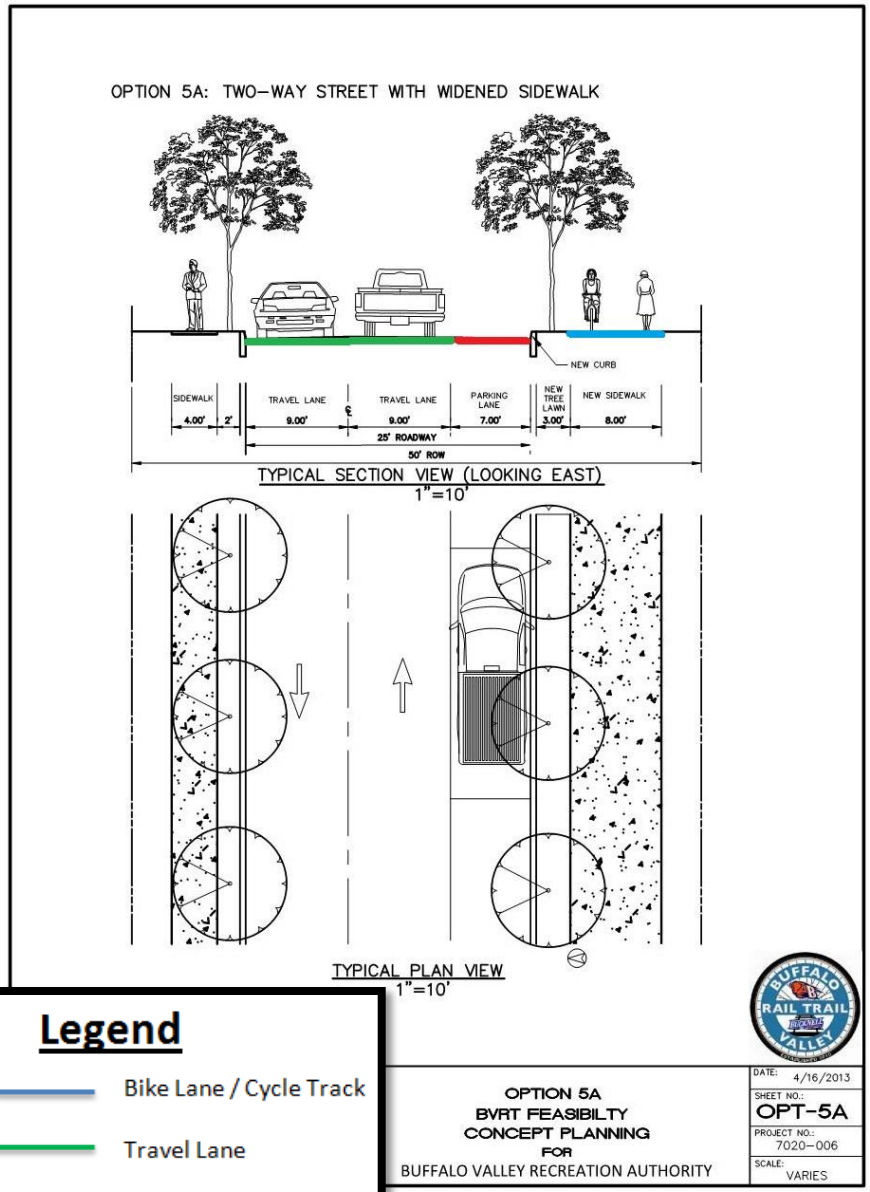
- Bike Lane / Cycle Track
- Travel Lane
- Parking

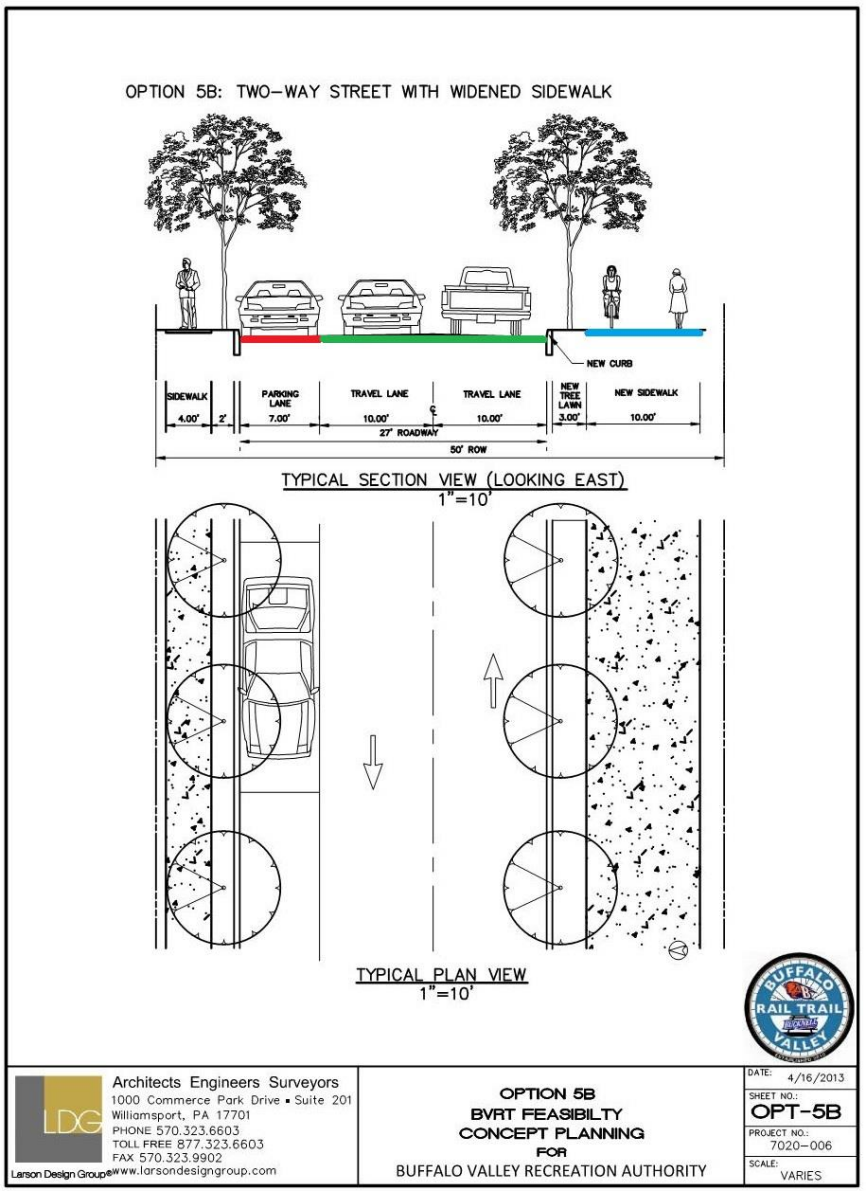
Cycle Track Examples

Cycle Track Examples

Cycle Track Examples

St. John Street Reconfiguration Option 5:



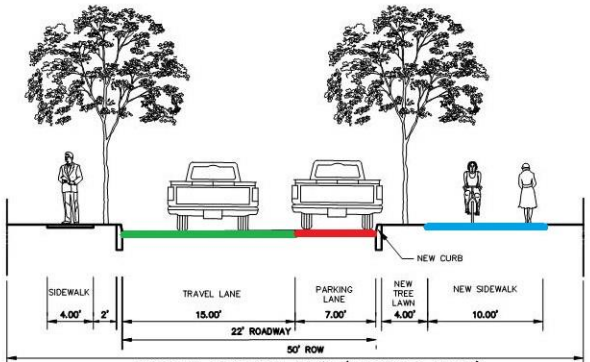


Legend

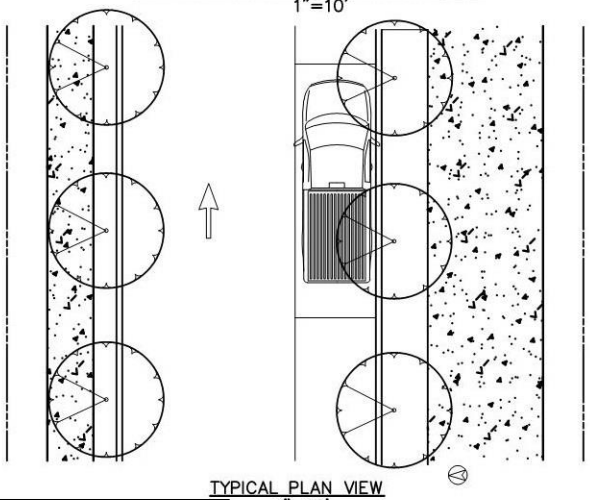
- Bike Lane / Cycle Track
- Travel Lane
- Parking

St. John Street Reconfiguration Option 6:

OPTION 6A: ONE-WAY STREET WITH WIDENED SIDEWALK



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

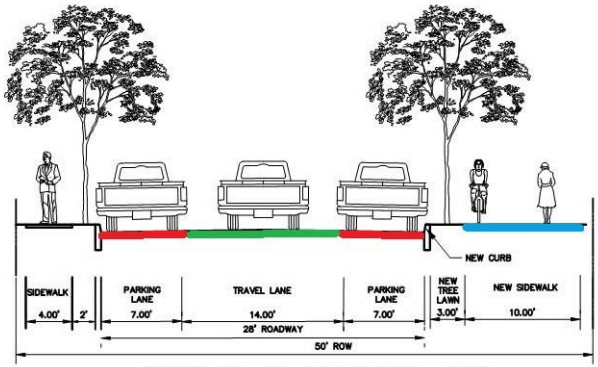
Legend

- Bike Lane / Cycle Track
- Travel Lane
- Parking

OPTION 6A
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-6A
PROJECT NO.: 7020-006
SCALE: VARIES

OPTION 6B: ONE-WAY STREET WITH WIDENED SIDEWALK



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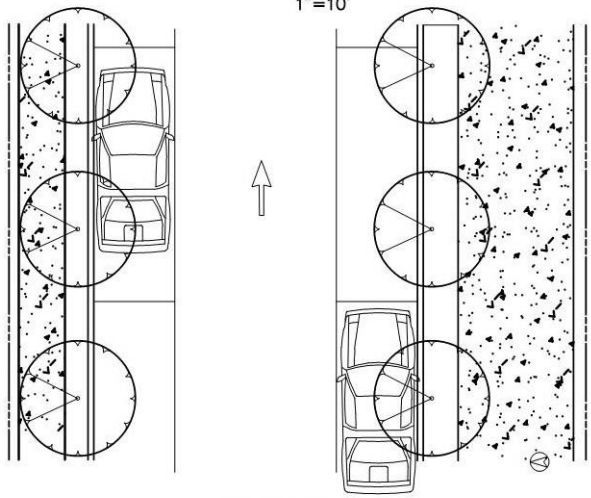

TYPICAL PLAN VIEW
1"=10'

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OPTION 6B
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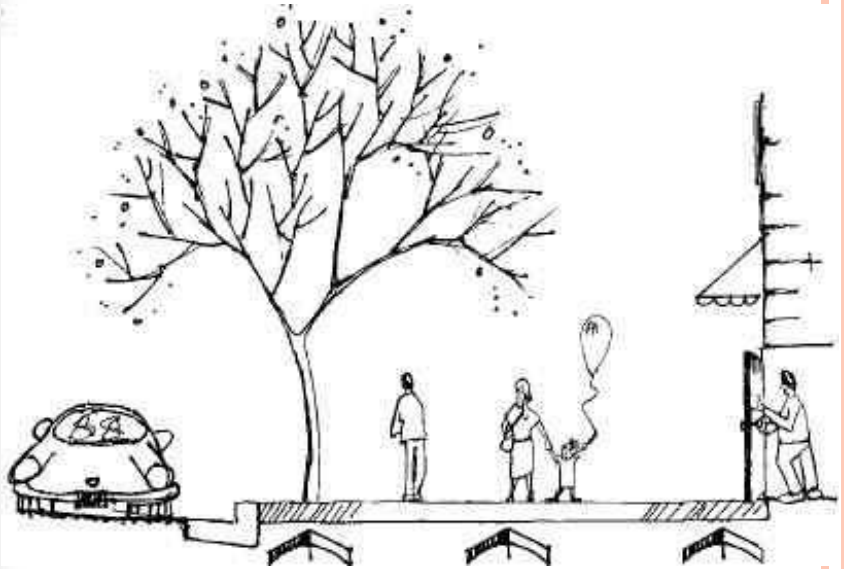
BUFFALO VALLEY RECREATION AUTHORITY

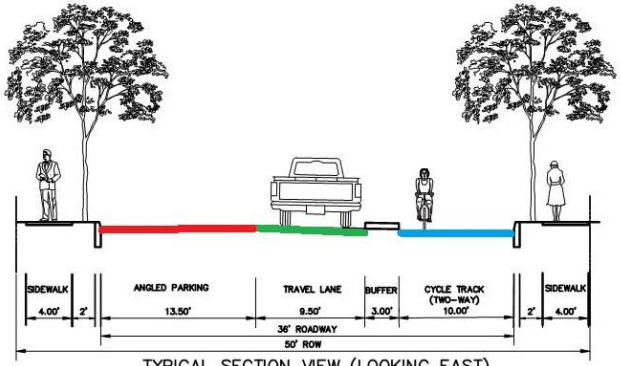
DATE: 4/16/2013
SHEET NO.: OPT-6B
PROJECT NO.: 7020-006
SCALE: VARIES

Widened Sidewalk Examples

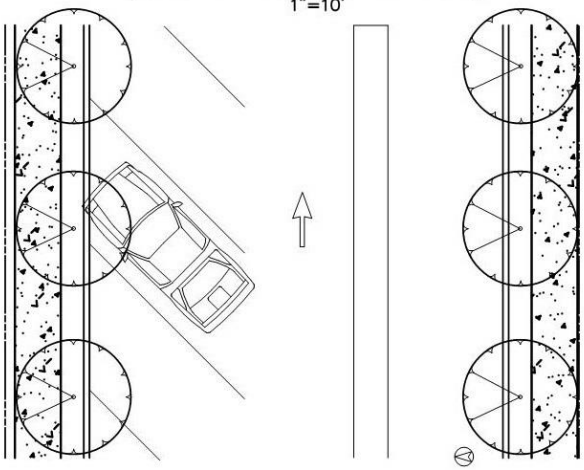


St. John Street Reconfiguration Option 4C & 6C:

OPTION 4C: ONE-WAY STREET WITH ANGLED PARKING AND CYCLE TRACK
(BETWEEN NORTH 3RD STREET AND HAZEL TREE ALLEY)



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

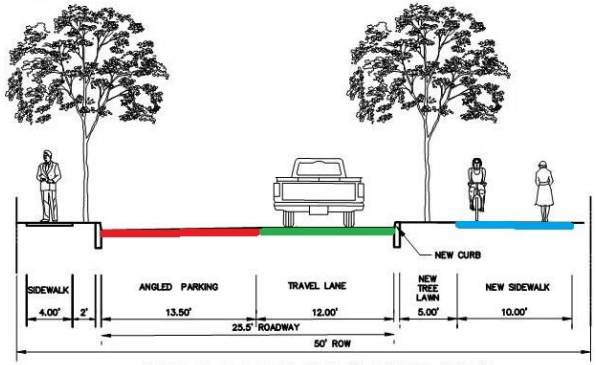
OPTION 4C
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-4C
PROJECT NO.: 7020-006
SCALE: VARIES

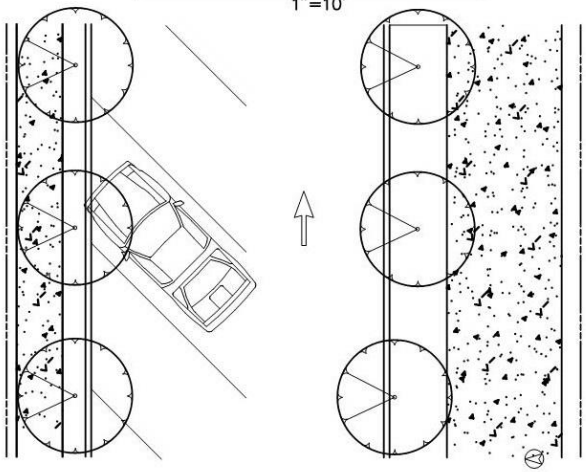
Legend

- Bike Lane / Cycle Track
- Travel Lane
- Parking

OPTION 6C: ONE-WAY STREET WITH WIDENED SIDEWALK AND ANGLED PARKING
(BETWEEN NORTH 3RD STREET AND HAZEL TREE ALLEY)



TYPICAL SECTION VIEW (LOOKING EAST)
1"=10'



TYPICAL PLAN VIEW
1"=10'

Architects Engineers Surveyors
1000 Commerce Park Drive • Suite 201
Williamsport, PA 17701
PHONE 570.323.6603
TOLL FREE 877.323.6603
FAX 570.323.9902
Larson Design Group www.larsondesigngroup.com

OPTION 6C
BVRT FEASIBILTY
CONCEPT PLANNING
FOR
BUFFALO VALLEY RECREATION AUTHORITY

DATE: 4/16/2013
SHEET NO.: OPT-6C
PROJECT NO.: 7020-006
SCALE: VARIES

Parking Analysis

Parking Analysis	Data
Current Parking Availability (# of spaces)	70
Max Parking Used (# of spaces)	55
% of Spaces Unused	21%

Parking Analysis	1A/1B	2A/2B	3A/3B	4A/4B	4A/4C	5A/5B	6A/6B	6A/6C
Parking Still Available	70	15	15	52	64	52	70	64
Parking Spaces Lost	0	55	55	18	6	18	0	6
%Spaces Lost	**0%**	**79%**	**79%**	**26%**	**9%**	**26%**	**0%**	**9%**

Decision Matrix – Range Index Method

Metrics	Weight (1-10) *10 = Best	Option 1	Option 2	Options 3	Option 4A/4B	Option 4A/4C	Option 5	Option 6A/6B	Option 6A/6C
Bike LOS	9	2	8	10	10	10	5	8	8
BCI	6	2	9	10	10	10	10	10	10
Parking Availability	7	10	1	1	9	10	8	9	10
Cost	7	10	9	8	8	8	2	2	2
Safety	10	1	3	10	10	8	8	8	6

One-Way Street Ranking	Option
First	Option 4A/4B
Second	Option 4A/4C
Third	Option 6A/6B
Fourth	Option 6A/6C

Two-Way Street Ranking	Option
First	Option 3
Second	Option 5
Third	Option 2
Fourth	Option 1

Matrix values completed based on results of quantitative analysis for cost, % of parking available, BCI and Bike LOS metrics.

Benefits of a rail trail extension

Numerous studies occurring around the nation have concluded:

- No negative effect on property values
- No negative effect on resale of homes
- No increase in crime rates
- Residents indicated that living near a trail was better then living next to an abandoned rail bed
- Appraisers and real estate agents believe trails are a positive selling point
- Increase in local business sales and tax receipts

Current Project Funding

- Bucknell University senior design team to assist LDG through May 1st on Concept Planning with $5,000 grant from Susquehanna Greenway.
- LDG contracted to complete Preliminary Design of Route 15 to North 5th Street (with extension to Market Street) trail segment.
- Transportation Alternative Program funding was awarded on May 20th for the construction North 8th St to North 5th St trail segment.
- Community Recreation and Conservation Program funding submission made on April 10th to PA DCNR for design of 12th St to 5th St (with extension to Market Street) trail segment, construction of trail from 12th Street to Route 15 and preliminary design of a Route 15 crossing.

Susquehanna GREENWAY

DCNR pennsylvania DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

pennsylvania DEPARTMENT OF TRANSPORTATION


DISCUSSION

APPENDIX G

May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

This comment form is an opportunity to contribute to the planning process. For further information about the project, please contact: Ms. Katie Davis by phone: 524-4774 or email: director@bvrec.org.

1. **How did you hear about the Public Meeting?** Standard Journal

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

Changing the nature of the neighborhood
Increasing Car traffic along St John's
Too many cars coming in, taking parking

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   a. Keeping the maximum amount of parking
   b. Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**
   4C optimizes parking & safety
   Maximizes foot traffic in front of peoples houses

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**
   Need parking space near bridge

Please return by May 31st, 2013 to:
Katie Davis
Buffalo Valley Recreation Authority
220 Brookpark Circle, Suite 9, Lewisburg, PA 17837
Email: director@bvrec.org

May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** Newspaper

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

   Crossing Route 15. Otherwise No Concerns

May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   a. Keeping the maximum amount of parking
   (b.) Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**
   OPTION #1 KEEP AS CLOSE AS POSSIBLE TO WHAT WE HAVE NOW.
   #4C IS SECOND CHOICE.

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**
   HAVE ANOTHER SET OF RESTROOMS, END OF BRIDGE?
   NO FENAGLE PARK?

Please return by May 31st, 2013 to:
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May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** The Daily Item

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

   none

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   a. Keeping the maximum amount of parking
   b. Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**

Please return by May 31st, 2013 to:
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May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** from the previous meeting

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   (d.) In ~~Lewisburg Borough~~/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month) about 1 or 2 times every couple of months/quarter
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   (b.) Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

   The car + truck traffic ; safety

May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** Facebook - Sam Pearson + Katie Davis

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away) 1 block away
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month) would use it more if it connected into downtown
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

Safety for bikers and pedestrians

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   (a.) Keeping the maximum amount of parking
   b. Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**

[4C] see notes on back → for rationale

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**

~~[illegible]~~ The concerns raised in this meeting about finding/creating additional parking lots are important ~~to address~~. ~~would address business owner & resident concerns~~ Business owners along this corridor would be more amenable if these concerns were addressed.

It is very important to create a useable bike trail through town — it has many more benefits than risks. The potential business gains are valuable.

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May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** email

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

I have none, I think it's great!

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   - (a) Keeping the maximum amount of parking
   - b. Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**

#4 i'm fine w/ #4 a/b or 4C

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**

Right now I feel like Lewisburg is cut off from the benefit of the trail. Doing nothing will not benefit the town and is incredibly unsafe. I think we do need to balance needs with progress and incredible benefits of having a trail in town to connect the community and grow business.

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May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

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1. **How did you hear about the Public Meeting?** Newspaper

2. **Where do you live or operate a business?**
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   b. Near the trail (several blocks away)
   c. On Bucknell campus
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   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

   Crossing Rt. 15

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   a. Keeping the maximum amount of parking
   b. Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**
   Seems as though the one way option is best, to provide the best mix of parking, auto traffic access, & safe biking areas.

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**
   Keep up the good work

Please return by May 31st, 2013 to:
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May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** _____

2. **Where do you live or operate a business?**
   - (a.) Immediately adjacent to the trail or St. John Street
   - b. Near the trail (several blocks away)
   - c. On Bucknell campus
   - d. In Lewisburg Borough/East Buffalo Township far from trail
   - e. Outside the area
   - f. Other _____

3. **How often do you use the existing rail trail?**
   - a. Very frequently (almost every day)
   - b. Frequently (about once a week)
   - (c.) Occasionally (once per month)
   - d. Rarely (less than 6 times a year)
   - e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   - a. Strongly Agree
   - b. Agree
   - c. Undecided
   - (d.) Disagree
   - e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

PARKING, EFFECT ON BUSINESS

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

6. **As a user of the St. John Street which is more important if you had to choose only <u>one</u> of the following: (circle one)?**
   a. Keeping the maximum amount of parking
   b. Keeping the street open to two-way traffic

7. **Of all the options presented (and in your handout) for St. John Street which one do you like the best and why?**

1

8. **Please offer any additional comments, concerns or ideas that you feel may be important to consider while evaluating the design options presented.**

Please return by May 31st, 2013 to:

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220 Brookpark Circle, Suite 9, Lewisburg, PA 17837
Email: director@bvrec.org

May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** FLYER in MailBox

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street [redacted] N 7TH ST.!!
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

   SO MUCH BETTER WAY TO SPEND PUBLIC FUNDS RATHER THAN ON A TINY MINORITY'S WHINY

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

   DESTRUCTION of QUIET NEIGHBORHOOD By NOISY TRAFFIC

May 23, 2013

RAIL TRAIL EXTENSION PUBLIC INFORMATION MEETING

COMMENT FORM

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1. **How did you hear about the Public Meeting?** News Paper.

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   b. Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other Own property adjacent.

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   b. Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   a. Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

May 23, 2013

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COMMENT FORM

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1. **How did you hear about the Public Meeting?** Sam Pearson

2. **Where do you live or operate a business?**
   a. Immediately adjacent to the trail or St. John Street
   (b.) Near the trail (several blocks away)
   c. On Bucknell campus
   d. In Lewisburg Borough/East Buffalo Township far from trail
   e. Outside the area
   f. Other _____

3. **How often do you use the existing rail trail?**
   a. Very frequently (almost every day)
   (b.) Frequently (about once a week)
   c. Occasionally (once per month)
   d. Rarely (less than 6 times a year)
   e. Never

4. **Constructing an extension of the rail trail into Lewisburg Borough should be a high priority for the community:**
   (a) Strongly Agree
   b. Agree
   c. Undecided
   d. Disagree
   e. Strongly Disagree

5. **Please tell us what your biggest concerns are with building the trail extension in Lewisburg Borough.**

Safety - kids + adults should be able to cross town and Hwy 15 safely. I strongly support dedicated bike paths in order to do this, and allow borough residents safe access to PA House, St Mary Park, + the existing trail.