Chapter 7: Design Standards

7.1 Trails

The following recommendations are not intended to replace or conflict with current guidelines and standards, but to supplement those guidelines. The following design standards are intended to survey as a guide in the future design the proposed trail system.

7.1.1 Surfaces

Several factors must be considered when choosing a trail surface including:

- User acceptance and satisfaction
- Accessibility
- Cost to purchase and install materials
- Cost of maintaining the surface
- Life expectancy
- Availability of material

In addition, a decision must be made on whether the surface is going to be a hard or soft surface. Hard Surfaces are more accommodating for multi-use trails and can withstand frequent use. However, they are more expensive to build. Soft surface trails are less expensive to build. However, they often do not hold up well under heavy use or varying weather conditions and require more maintenance. Since this trail system will be heavily used and the weather conditions in the Wyoming Valley can be extreme, a hard surface trail appears to be the local choice for this project. Two types of hard surface trail systems are currently used in this region, crushed stone and asphalt.

Crushed stone: *(limestone, sandstone, crushed rock)* Crushed stone holds up well under heavy use and is more economical than asphalt. This trail surface can accommodate nearly every type of trail use, except inline skaters. Existing crushed stone trail systems in the region include the Back Mountain Trail, Susquehanna Warrior Trail and the D&L Trail System. This trail surface is recommended for most of the trail system proposed in this study. It is well suited for the proposed sections of trail on abandoned rail beds and those adjacent to the active rail lines. Construction of this type of trail will consist of a minimum 2 inches of compacted #10 crushed stone over 6 inches of compacted 2RC stone.

Asphalt: This trail surface is well suited for most user types including bicycle commuters and inline skaters. Although the cost to construct this trail surface is higher, it is more stable and has a life expectancy of seven to 15 years. Asphalt trails are often used in urban areas or near trailheads and access points where stability is important. Existing asphalt trail systems in the region include the West Side Trail and Luzerne County Levee Trail System. Due to its high cost, asphalt is currently recommended only on the sections of trail which require the greatest stability *(ie. steep slopes, levees, urban areas).* If an "upgrade" to asphalt is desired for sections of trail in the future, the proposed crushed stone surface will provide an excellent base for the pavement. Construction of this type of trail will consist of a minimum 2 inches bituminous concrete over 4-6" of compacted 2A stone and geotextile.

Concrete: Sidewalks will also be upgraded in some areas to facilitate their incorporation into urban sections of the proposed trail system. A minimum of 4 inches pour-in-place

(3,000 psi) concrete will be installed over 4-6 inches of compacted 2A stone. Reinforcement and concrete thickness will be required at locations where vehicles will cross or use the walk. Provide a maximum 2% cross slope to move storm water off the surface.

Boardwalks: In order to cross wetlands and areas of steep cross grade, sections of boardwalk may be incorporated into the proposed trail. However, due to their excessive price, boardwalks are only recommended in limited areas where no other trail surfaces are feasible.

7.1.2 Standard Trail

As previous stated, the majority of the trails proposed will have a crushed stone surface. However, in some areas an asphalt surface may be more desirable. The standard trail width proposed is 10 feet with a minimum of two feet of cleared shoulder on each side of the trail. This width will be sufficient for two way travel and save passage of slower trail users. Design considerations should be made to meet current ADA Standards. Maximum trail slopes should be limited as follows:

- 8.3 percent for a maximum of 200 ft
- 10 percent for a maximum of 30 ft
- 12.5 percent for a maximum of 10 ft

Near the top and bottom of the maximum grade segments, the grade should gradually transition to less than 5 percent. In addition, rest intervals should be provided within 25 feet of the top and bottom of a maximum grade segment. The cross slope of the trail should not exceed 2 percent.

Ideally, objects should not protrude into any portion of the clear tread width of the trail. If an object must protrude into the travel space, it should not extend more than 4 inches. Furthermore, a minimum vertical clearance of 8 feet should be provided above the trail. If equestrian use of the trails is anticipated, the minimum vertical clearance should be increased to 12 feet.

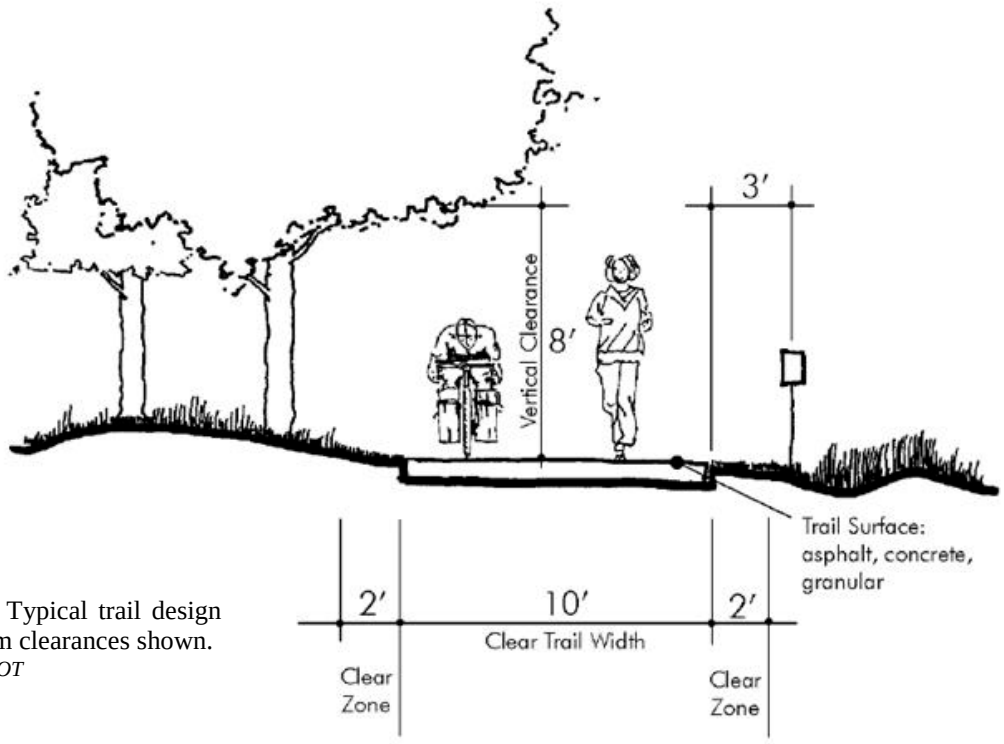

Figure 7-1: Typical trail design with minimum clearances shown.
Source: Iowa DOT

7.1.3 Rails with Trails

Portions of the Parsons Trail and the Carey Avenue Connector Trail will be adjacent to an active rail spur which is owned by the Redevelopment Authority of Luzerne County. This "Rails with Trails" segment will require additional safety measures and buffers. Rails with Trails are operating successfully around the county under a wide variety of conditions. Some are very close to rail tracks and others further away. Some use extensive separating fences or barriers. Some are next to high-speed, high-frequency train services. Others are on industrial branch lines or tourist railroads with slower trains operating only a few times per week. Some have at-grade crossings while others use underpasses or overpasses. There are currently no national standards or guidelines dictate Rails with Trails facility design. Locally, the Luzerne County National Recreation Trail in Pittston is an example of a Rails with Trails system.

Although Rails with Trails are currently operating along train corridors of varying types, speeds, and frequencies, there simply is no consensus on an appropriate setback recommendation. Thus, an analysis of technical factors relating to setback distance should include the following factors:

- Type, speed, and frequency of trains in the corridor
- Separation technique
- Topography
- Sight distance
- Maintenance requirements
- Historical problems

In the case of the Parsons Trail and the Carey Avenue Connector Trail, the adjacent active rail line is a spur which in used by slow moving trains on an infrequent basis. Neither topography nor sight distance appear to be a problem along the proposed section of trail. Under similar conditions, some trails are located as close as 10 feet from the track centerline. However, this minimum setback would require vertical separation or techniques such as fencing or walls to provide a safety barrier between the trail and the rail. Based upon the current Luzerne County GIS Parcel Data, it appears that the width of the railroad property varies in width from 45 feet to 60 feet. Where ever possible, a minimum setback of 20 feet between the track centerline and the edge of the trail should be maintained.

More than 70 percent of existing Rails with Trails utilize fencing and other barriers *(vegetation, vertical grade, walls, and/or drainage ditches)* for separation from adjacent active railroads and other properties. Fencing style varies considerably from chain link to wire, wrought iron, vinyl, steel picket, and wooden rail. To follow are some examples of buffer configurations from the U.S. Department of Transportation publication *Rails-with-Trails: Lessons Learned. Literature Review, Current Practices, Conclusions:*

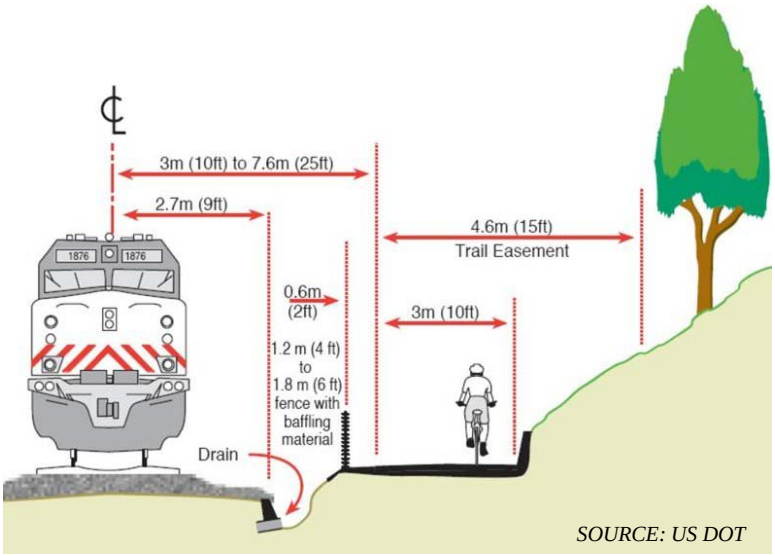

Figure 7-2: Minimum Recommended Rails with Trails Setback.

SOURCE: US DOT

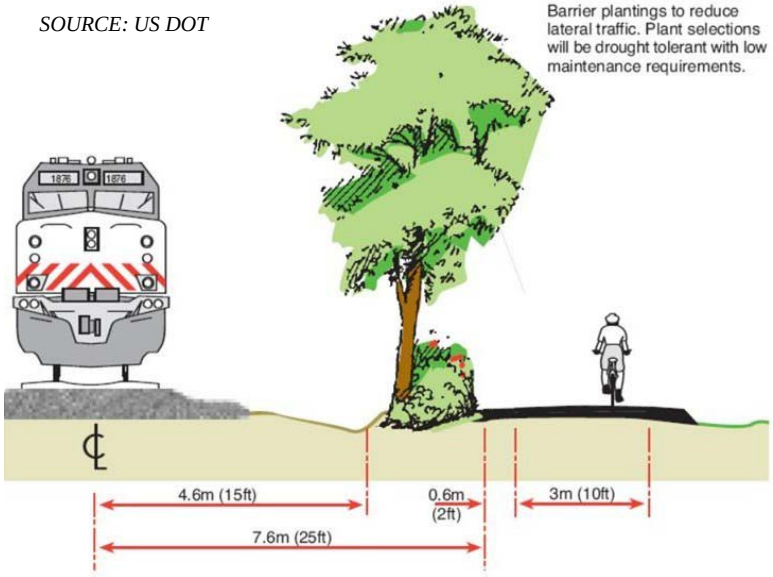

Figure 7-3: Example of Use of Vegetation for a Buffer Between Trail and Active Rail Line.

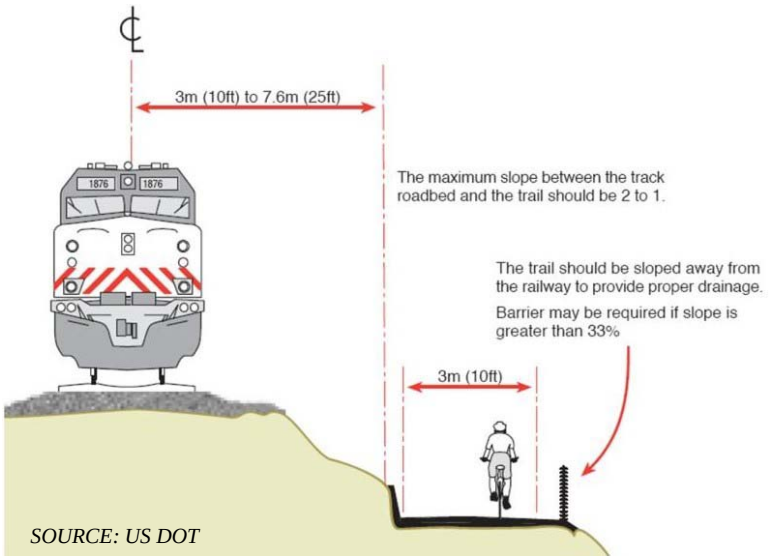

Figure 7-4: Minimum Recommended Rails with Trails Setbacks Along a Fill Section.

7.1.4 Sidewalks

Existing sidewalks will be used for several trail segments in urban areas. Where feasible, improvements should be made to the increase the sidewalks to a minimum of 6 feet wide. All sidewalk improvements should include compliance with ADA requirements.

7.1.5 Bike Lanes

Cyclist should be discouraged from riding on the sidewalk. In conjunction with upgrades to the existing sidewalks, where feasible, bike lanes should be designated on the adjacent roadway to allow for safe cycling. Detailed traffic studies will be needed to determine the suitability of existing roadways for bike lanes. In some cases, road improvements may be required to accommodate these lanes.

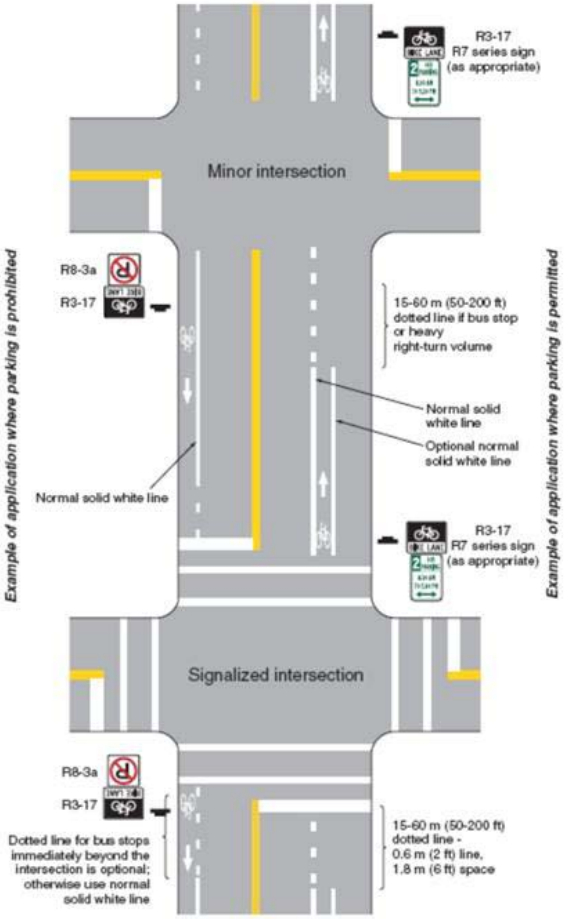

Figure 7-5: Example of Pavement Markings for Bicycle Lanes on a Two-Way Street
Source: US DOT

Photo 7-1: Bicycle lane in an urban setting with curbside parking.

7.2 Trail Intersections

The overarching goal is to design road and trail intersections that minimize risk for both trail users and motorists. Sight distance is probably one of the most important considerations when designing a trail/roadway intersection in order to provide the greatest amount of advance warning for motorists and trail users. A motorist must be able to see a trail user preparing to cross a roadway in time to yield or take evasive action. Likewise, trail users must be able to see oncoming traffic in time to safely cross a roadway. Although not always possible, having a clear view of trail users approaching an intersection will allow a motorist to recognize a potential conflict and take evasive action if the trail user, especially a bicyclist, darts out into the roadway.

Crossings should be designed to be perpendicular to the roadway so trail users will be in a position where they can readily see approaching traffic from both directions. Warning signs are used to alert motorists to the presence of a crossing ahead. They are especially effective at mid-block crossings where pedestrians and trail users are not anticipated.

7.2.1 Crosswalks

At unmarked or uncontrolled trail intersections, bicyclists and pedestrians are required to yield to vehicles in the roadway. This requirement can be reinforced by placing STOP signs or yield signs on a trail approach to an intersection to specifically assign the right-of-way to vehicles in the roadway.

Crosswalk markings have two functions: 1) to provide guidance for pedestrians who are crossing roadways, and 2) to alert road users of a pedestrian crossing point across roadways not controlled by highway traffic signals or STOP signs. If there is a need to assign right-of-way to trail users, STOP signs or YIELD signs and appropriate pavement marking should be used in conjunction with a marked crosswalk.

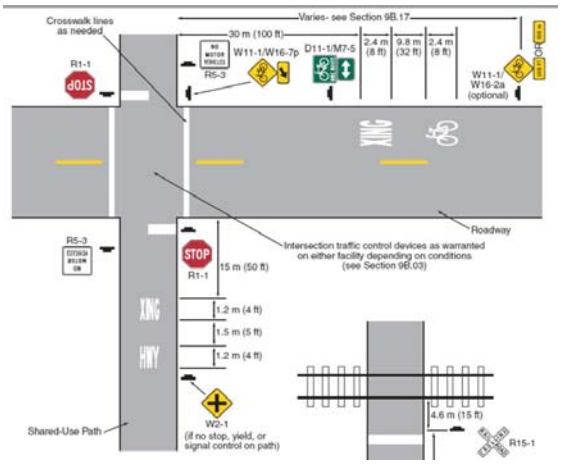

Figure 7-6: Example of Signing and Markings for a Multi-Use Trail / Roadway Crossing.
Source: US DOT

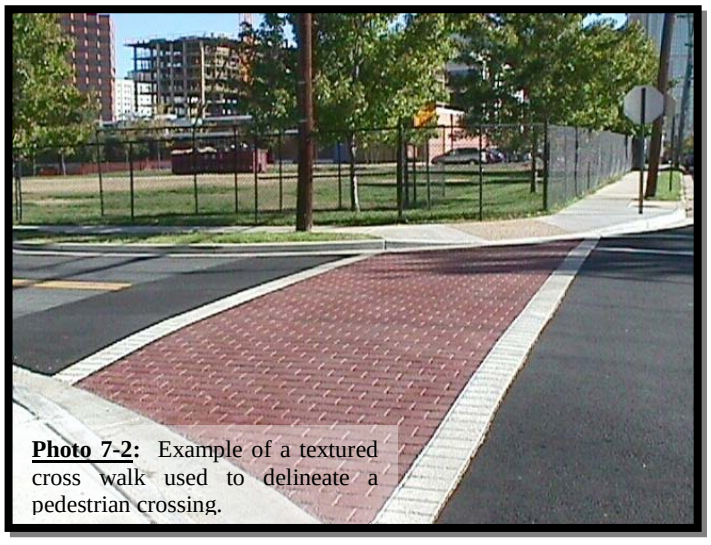

Photo 7-2: Example of a textured cross walk used to delineate a pedestrian crossing.

Recent traffic safety studies have concluded that marked crosswalks without other safety improvements should not be used under the following conditions:

- Where the speed limit exceeds 40 mph.
- On a roadway with four or more lanes without a raised median or crossing island that has (or will soon have) an ADT of 12,000 or greater.
- On a roadway with four or more lanes with a raised median or crossing island that has (or will soon have) an Average Daily Traffic of 15,000 or greater.

7.2.2 STOP Signs / Traffic Lights

If trail users need to wait for long periods of time before acceptable gaps in traffic occurs, they will take greater risks by attempting to cross during unacceptable gaps. When the volume of vehicular traffic becomes so great that trail users have difficulty crossing the roadway, consideration should be given to assigning right-of-way to trail users. Assignment of right-of-way to trail users should also be considered when there are large volumes of trail users. Greater numbers of trail users increases the exposure to risk, even under normal traffic conditions. In addition, larger queues occur at crossings which increase the risk by having larger numbers of trail users crossing at the same time. Right-of-way can be assigned with the installation of a STOP signs or a Traffic Signal. Traffic Signals have an advantage over STOP signs in that it alternates right-of-way allowing less of an impact on the roadway capacity. Pedestrian-actuated signals can be installed to allow the signal to change right-of-way only when actuated. Traffic studies should be completed before these devices are used to assure that the capacity of the roadway is not unduly affected.

7.2.3 Flashing Signals (Cross Alert)

A new warning system for trail crossings that is gaining popularity is a system of lights that is activated when trail users approach a sensor mounted on the system at a roadway crossing. The system consists of a red LED light and STOP sign on the trail for trail users and an amber, or yellow, Light Emitting Diode light and warning sign on the roadway to warn motorists. The system was designed not to alter the flow of vehicular traffic, but to only forewarn oncoming vehicles that trail users are near or in the crosswalk.

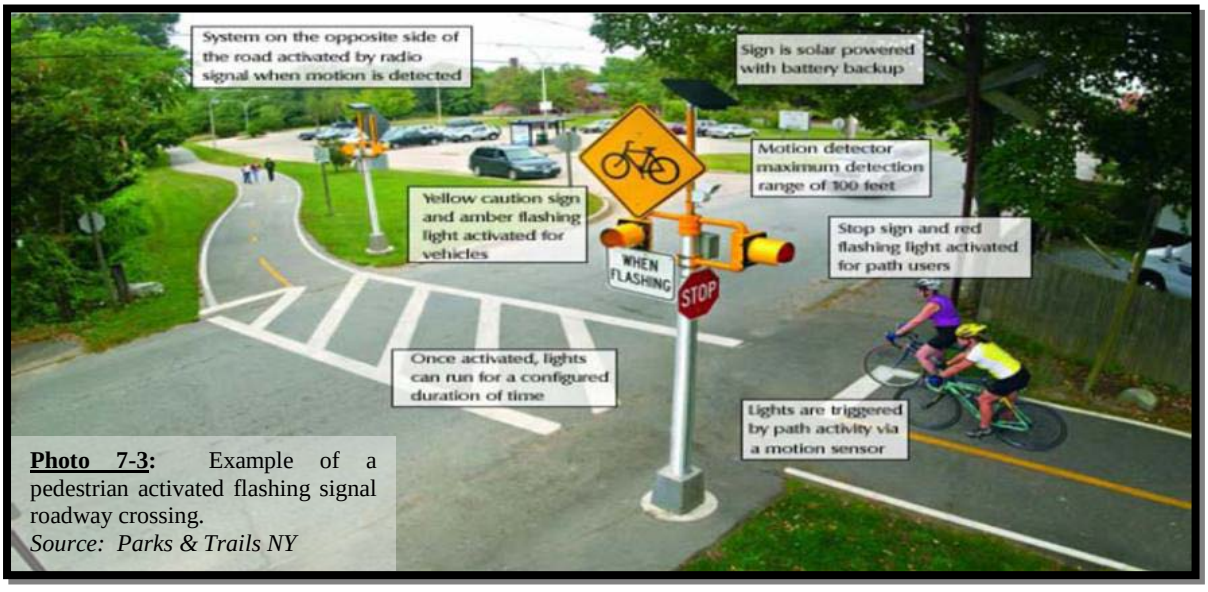

Photo 7-3: Example of a pedestrian activated flashing signal roadway crossing.
Source: Parks & Trails NY

7.2.4 Refuge Islands

The task of crossing multiple lane roadways or even high volume two-lane roadways can be made much simpler and safer by providing a pedestrian refuge island in the middle of the road. The refuge island, should be a minimum of six feet wide to allow the complete length of a bicycle to be within the refuge area. The crossing area in the refuge island should be slightly skewed towards oncoming traffic. This configuration will allow a trail user to focus their attention on oncoming traffic.

Photo 7-4: Refuge Islands provide a safe haven for pedestrians crossing busy intersections.

7.2.5 Rail Crossings

The point at which trails cross active tracks is the area of greatest concern to railroads, trail planners, and trail users. Railroad owners, the FRA, and State DOTs have spent years working to reduce the number of at-grade crossings in order to improve public safety and increase the efficiency of service. The railroad company or agency, and State DOT or Public Utility Commission, will need to approve any new crossings, the design of which must be in compliance with the relevant regulations.

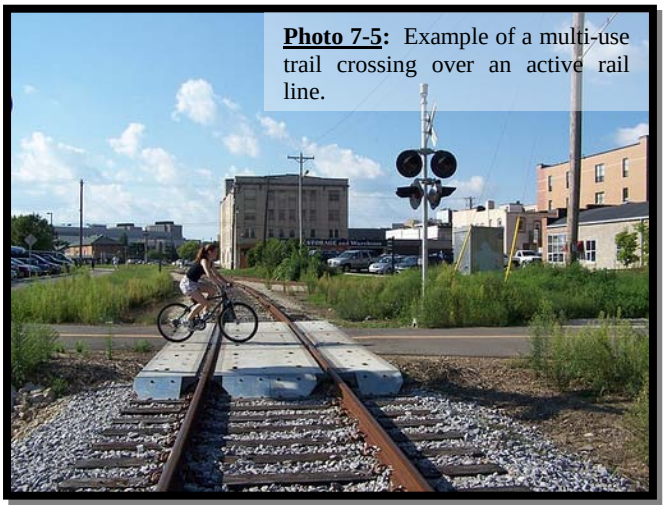

Photo 7-5: Example of a multi-use trail crossing over an active rail line.

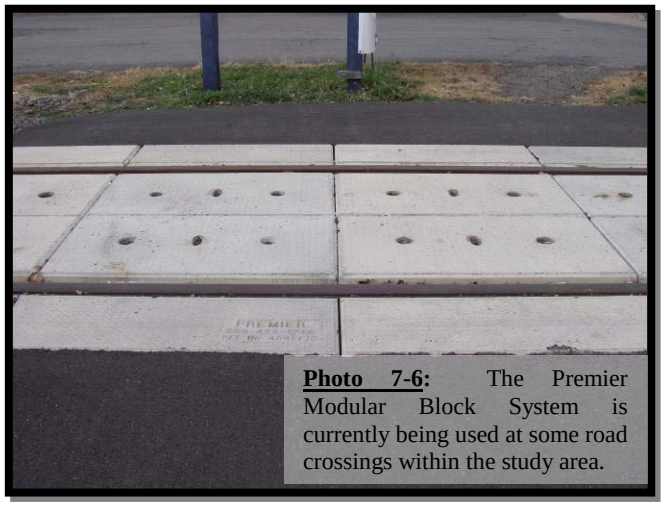

Photo 7-6: The Premier Modular Block System is currently being used at some road crossings within the study area.

More than half the existing RWTs in the U.S. include some sort of track crossing, mostly at-grade. Several have active warning devices such as gates or alarms.

Modular block systems such as the Premier System showing here can be used to create a stable railroad crossing.

7.3 Auxiliary Structures

7.3.1 Barriers and Emergency Access

With the exception of maintenance, police, and emergency vehicles, motor vehicles are prohibited from multi-use trails. A ten-foot wide multi-use path is wide enough to be easily mistaken as a driveway or a street to the motorist, and vehicles can erroneously or deliberately enter a trail.

Photo 7-7: Example of bollards used on the Levee Trail to restrict access my motor vehicles.

The use of barriers at the entrance to a trail with a separate means of access for authorized vehicles is routinely used by trail designers. The barrier usually consists of a series of bollards spaced approximately five feet apart to allow a bicycle with a trailer or a wheelchair to pass through. Authorized vehicle access is often accommodated through a separate gate or by removing the center bollard. This type of barrier treatment effectively eliminates all motor vehicles except ATVs.

7.3.2 Pedestrian Lighting

Trail lighting in this area is currently limited to the Levee Trail in the area of Kirby Park. All other trail systems are currently unlit. For safety, it is recommended that all new trail intersections be lit using either standard pole mounted streetlights or self-standing light poles similar to the ones in Kirby Park.

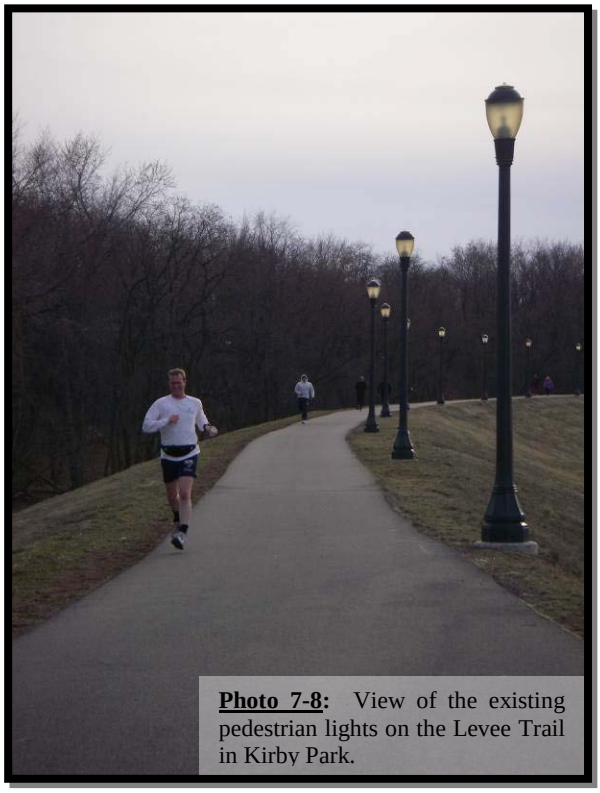

Photo 7-8: View of the existing pedestrian lights on the Levee Trail in Kirby Park.

7.3.3 Bridges

As currently proposed, the Parsons Trail will require the construction of a pedestrian bridge over the Laurel Run. Preliminary evaluation of this crossing indicated that the existing footings from the previous railroad bridge may be sufficient for installation of a prefabricated steel bridge. Additional engineering studies will be required to assure the structural stability of this structure.

Photo 7-9: Concrete bridge footings left from the previous railroad bridge which spanned Laurel Run.

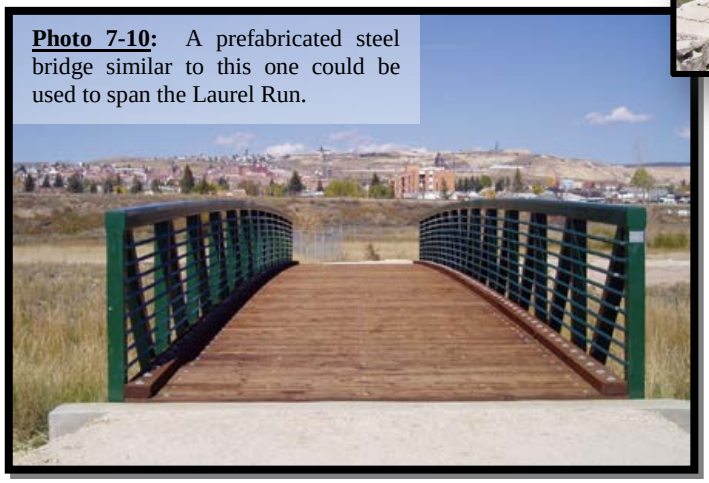

Photo 7-10: A prefabricated steel bridge similar to this one could be used to span the Laurel Run.

7.3.4 Underpasses

The proposed trails will pass under US Route 309 in two locations. In both cases, the trail will utilize existing underpasses. For the Parsons Trail an existing, active railroad underpass will be used for the trail. Due to the configuration of this underpass, space for the proposed trail will be limited. Therefore, the trail will have to abut the side of the underpass to maximize the space. In these areas, an elevated boardwalk, similar to a system used on the Housatonic Rail Trail in Monroe, Connecticut may be desirable. Not only will this system maximize the distance between the trail and the roadway or tracks, but it will also elevate the trail.

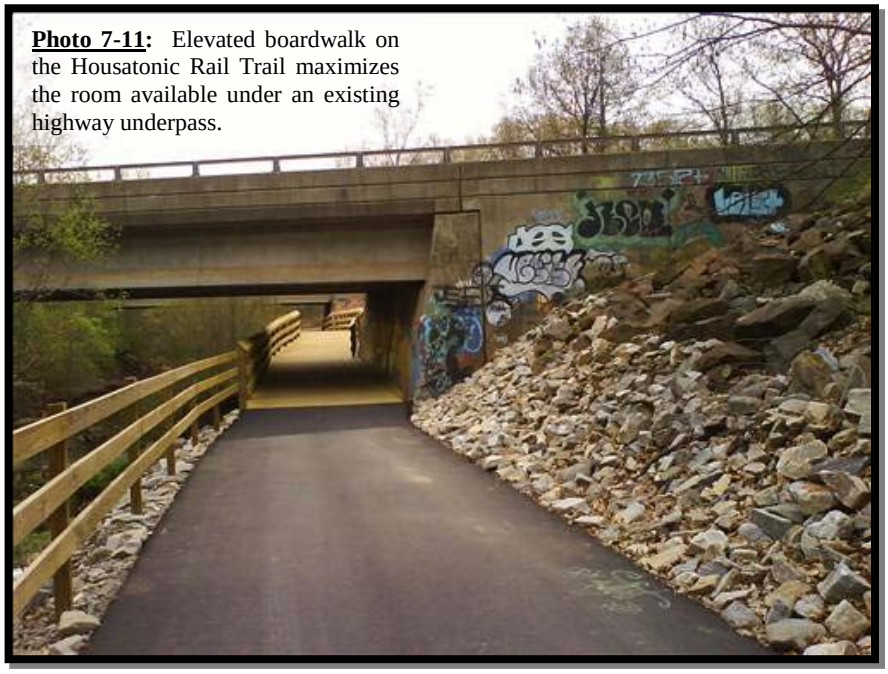

Photo 7-11: Elevated boardwalk on the Housatonic Rail Trail maximizes the room available under an existing highway underpass.

7.4 Trail Signage

Each of the existing trail systems in this area has its own distinctive style of signs. As part of the final design of this trail system, a comprehensive signage plan should be developed to tie together the various sign styles and format.

7.5 Accessibility

Everyone should have the opportunity to experience and enjoy the outdoors. To the maximum extent feasible, trails should be designed to accommodate the access needs of all designated users. Considering accessibility when designing trails and installing accessible built facilities such as ADA compliant restrooms, handicapped parking at Trail Heads, and lowered drinking fountains will permit more people to enjoy the outdoors. In addition, providing detailed information about existing path conditions and available facilities can help visitors select trails. Such trail information reduces the likelihood that a trail user will become stranded or endangered and can improve safety and visitor enjoyment.

Because trails are transportation and recreation facilities, accessibility is mandated by the federal Americans with Disabilities Act of 1990 (ADA), which requires certain design standards for facilities to be in compliance with the law. ADA compliance is important to keep in mind as a trail enters the design and construction phases. On October 19, 2009 the United States Access Board published the Draft Final Accessibility Guidelines for Outdoor Developed Areas to establish accessibility guidelines pursuant to the Architectural Barriers Act (ABA). Requirements proposed under these guidelines for Accessible Trails included:

Surface - The surface of trails and their related passing spaces and resting intervals shall be firm and stable.

Clear Tread Width - The clear tread width of trails shall be 36 inches minimum.

Passing Spaces - Trails with a clear tread width less than 60 inches shall provide passing spaces at intervals of 1000 feet maximum.

Obstacles - Tread obstacles on trails and their related passing spaces and resting intervals shall not exceed ½ inch in height measured vertically to the highest point.

Slopes - No more than 30 percent of the total length of a trail shall have a running slope steeper than 1:12. The running slope of any segment of a trail shall not be steeper than 1:8.

Cross Slope - Where the surface is concrete, asphalt, or boards, the cross slope shall not be steeper than 1:48. Where other trail surfaces are used, the cross slope on other surfaces shall not be steeper than 1:20.

Trail Signs - Trail signs should include the following information:

- Length of the trail or trail segment
- Surface type
- Typical and minimum tread width
- Typical and maximum running slope
- Typical and maximum cross slope

Typically, problems in complying with ADA requirements for a trail design arise due to steep slope issues. However, since much of this proposed trail system is located within existing road right-of-ways and rail grades, steep slopes are not as much of a design issue as they would be in a natural landscape. Therefore, it is anticipated that with well thought-out design, the entire Wilkes-Barre Trail System can comply with ADA regulations.