



## TRAIL CONNECTION ALTERNATIVES

A number of alternatives were considered to link Paoli and the Chester Valley Trail. As shown on the map on the next page, they fell into five general corridors:

- A** Cedar Hollow Road
- B** North Valley Road
- C** Bear Hill Road
- D** Crabby Creek Park
- E** Cassatt Road and Howellville Road

The process used to evaluate each alternative is described below. In general, field views were conducted and pros and cons of each alternative presented to the Study Committee. Based on input from Township staff and the Study Committee, it was determined whether each alternative had sufficient benefits to be considered for further study.

The alternatives that were ultimately recommended for implementation, A and B2, are listed first.

### Alternative A: Cedar Hollow Road

Alternative A was one of the original alternatives shown in the Township’s grant application for the Paoli Trail Connections study. The alternative is 1.2 miles long and connects central Paoli along Central Avenue with the Chester Valley Trail at Vanguard’s headquarters along Cedar Hollow Road.

This route is appealing due to latent demand at Vanguard. There is already a pedestrian connection to the Chester Valley Trail from Vanguard Boulevard. On Cedar Hollow Road, traffic is generally low to moderate between Vanguard and Paoli. Along the lower portion of the road, there is room for additional shoulder and potentially shifting the centerline of the road. The connection along

West Central Avenue connecting Cedar Hollow Road with the station is residential in character. There are sporadic sidewalks in places along both sides of the road.

Challenges along Alternative A include the substantial grade of Cedar Hollow Road, averaging 9% between Vanguard and West Central Avenue. At one point, the grade is over 18%. This grade is quite steep for moderate and inexperienced cyclists. Another significant issue is the existing railroad underpass, which is only 17.5 feet wide. Traffic is stop-controlled on both sides of the underpass, so bicycles can negotiate it with reasonable certainty of avoiding oncoming traffic. It may be desirable, though expensive, to bore a parallel tunnel dedicated to bicycle and pedestrian traffic. Although this is the only alternative that extends outside Tredyffrin Township into Willistown Township, most destinations along the route are in Tredyffrin Township.

Due to its length and the relatively small number of residents along the road, the Study Committee initially believed this route would be better suited to bicyclists than pedestrians.

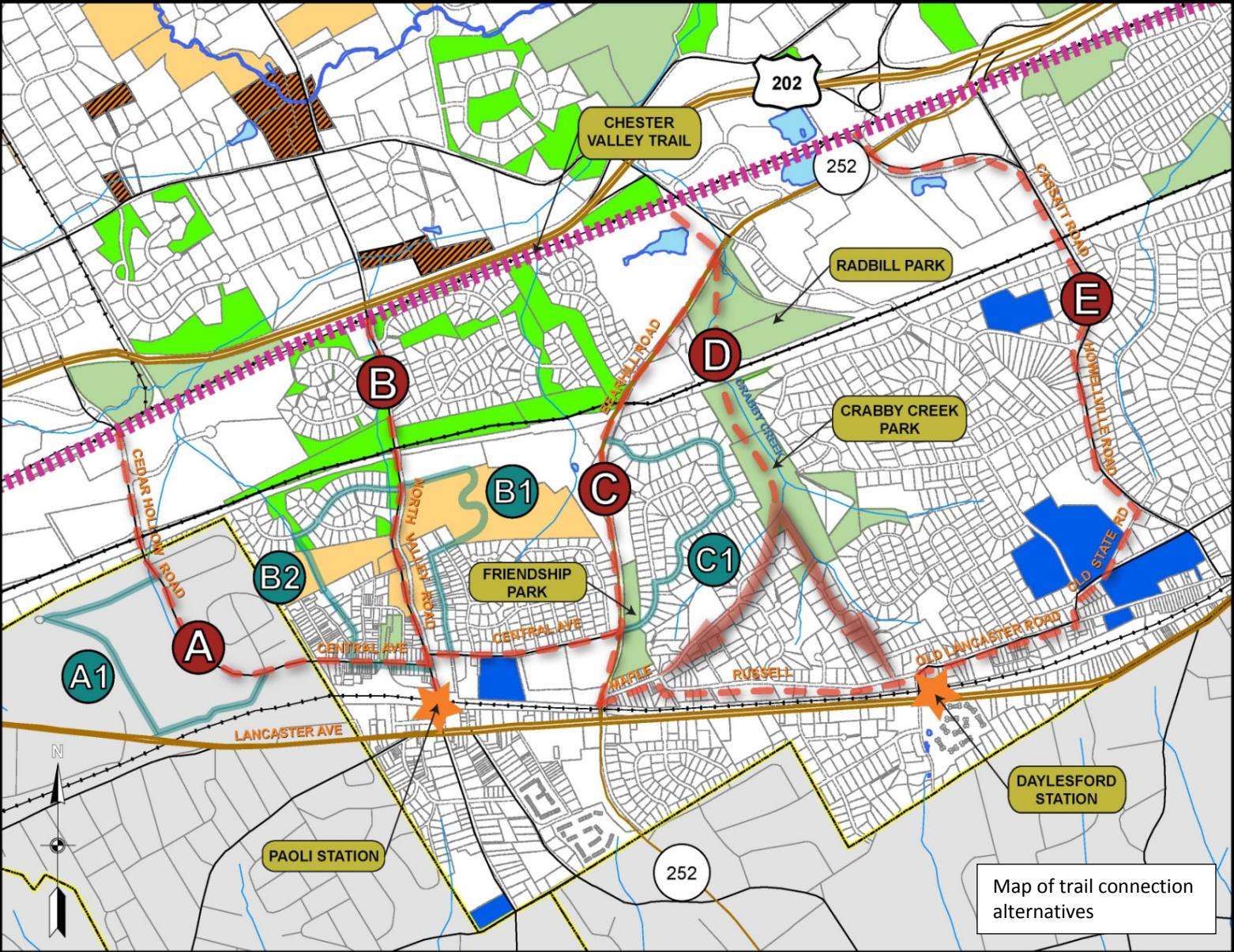
### Initial Evaluation

**Pros:** Some existing sidewalk, direct, relatively wide for bikes on-street, direct connection to Vanguard, best connection to new station location on Central Avenue

**Cons:** Narrow underpass, steep grade in one section, largely in Willistown Township

Based on the initial evaluation, especially due to the width of the road and the opportunity to connect important destinations, the Study Committee felt this alternative was worth considering in more detail.

PAOLI TRAIL CONNECTIONS



**Detailed Study**

**First segment: Central Avenue, from North Valley Road to Cedar Hollow Road**

This segment consists of striping bike lanes on Central Avenue and upgrading and repairing the existing sidewalk. The existing pavement width is 28 feet, which will accommodate two ten-foot travel lanes and one four-foot bicycle lane in each direction, as shown in the illustration to the right. Although five feet is a preferred width for bicycle lanes, four feet is permissible.

Existing sidewalks will be repaired and upgraded to meet accessibility guidelines (including curb ramps and driveway transitions) on both sides of Central Avenue between North Valley Road and Keystone Avenue, and on the south side between Keystone Avenue and the Township line. New sidewalk will be built on the north side between Keystone Avenue and Hollow Road and on the south side between the Township line and the Central Avenue/Cedar Hollow Road intersection. This final sidewalk segment could be constructed in conjunction with the rail yard redevelopment. The Study Committee also recognized the importance of frequent crosswalks at appropriate locations in this area.

**Second segment: Cedar Hollow Road, from Central Avenue to 0.2 miles north of Central Avenue**

Once the Chester Valley Trail is open, Cedar Hollow Road will undoubtedly be used by bicyclists and pedestrians traveling between the Trail and Paoli. There are some challenges to non-motorized travel in this area as it currently exists. The options below are examples of potential solutions to better address pedestrian and bicycle travel.



Rendering of potential improvements along Central Avenue

## PAOLI TRAIL CONNECTIONS

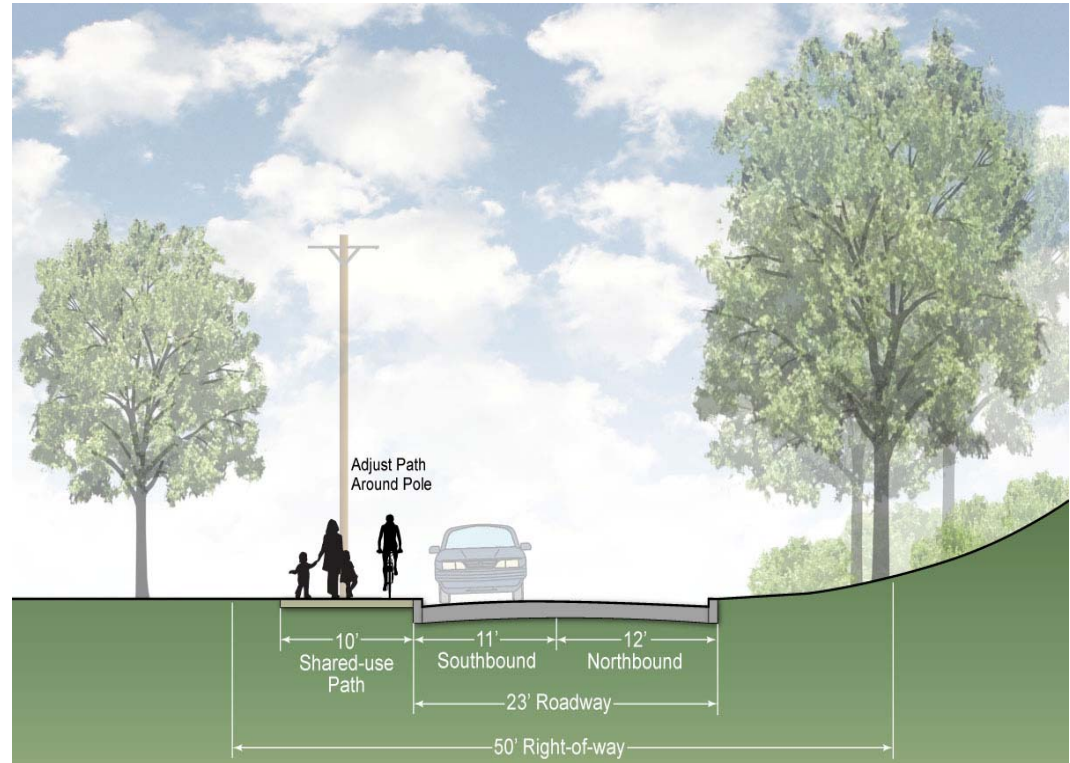
This segment is located along the residential parcels on the west side of Cedar Hollow Road. The existing pavement width is approximately 27.5 feet and the existing sidewalk is four feet wide. Utility poles are located either within a narrow grass strip or behind the sidewalk. Curb is located intermittently along the west side of the roadway and in some areas the existing sidewalk is flush with the roadway.

The Study Committee discussed two options along this segment:

- Option 1 consists of narrowing the pavement and constructing a shared-use path along the west side of the roadway. The proposed path would be aligned adjacent to the roadway and separated from the roadway by curb. It appears that the proposed path would not extend any closer to the houses than the existing sidewalk currently does, though some utility poles would be relocated.
- Option 2 consists of striping one bike lane on the roadway and reconstructing the existing sidewalk. The bike lane would be striped along the west (uphill) side of the roadway because uphill bicyclists will move much slower than motor vehicles. Bicyclists travelling northbound (downhill) would share the road with vehicles because their speed will be much closer to that of the adjacent cars.

The Study Committee recommended Option 1 in this area, consisting of narrowing the pavement and constructing a shared-use path along the west side of the roadway. A potential typical section is shown.

This area would also feature a crossing across Central Avenue at Cedar Hollow Road so westbound/northbound bicyclists can access the shared-use path.



Cross section of potential improvements along Cedar Hollow Road

**Third segment: Cedar Hollow Road, from end of residential parcels to railroad underpass**

This segment is located along steep grades on Cedar Hollow Road. The land use is mainly open space with dense tree coverage. Generally, the grading off the edge of pavement on the west side is relatively flat and would allow for the construction of a ten-foot wide shared-use path without major grading. However, the section immediately north of the residential parcels consists of a steep grade drop-off with an open drainage swale. The drainage swale would be converted to a closed drainage system with the path constructed above.

**Fourth segment: Cedar Hollow Road, from railroad underpass to Chester Valley Trail**

The railroad underpass is 17.5 feet wide and operates as STOP-controlled with only one vehicle permitted at a time. Due to the cost of a new tunnel as compared to anticipated trail usage, at least in the short term, it is proposed to stripe a pedestrian and bicycle walkway through the existing underpass. Demand may grow for a widened underpass or separate bored tunnel in the long term, once the path is constructed on both sides of the railroad.

North of the railroad, there are industrial driveways and gentle grades on the west side of the roadway. The east side of the roadway is not preferable due to aerial transmission utilities in close proximity to the road. A ten-foot wide shared-use path would be aligned on the west side of the roadway and continue to Vanguard Boulevard, then continuing on an alignment to be determined in cooperation with Vanguard to link to the Chester Valley Trail.

**Opportunities:**

- Located on the existing road alignment
- More direct
- Perception of safety along well-traveled road
- Possible traffic calming
- Sidewalk improvements
- Connection to Vanguard
- Direct connection to Paoli Transportation Center development

**Challenges:**

- Not entirely in Tredyfffin Township
- Steep grades in one section
- Narrow railroad underpass
- Drainage ditch
- Potential impacts to front yards

The Study Committee agreed to recommend this alternative for implementation. See the Recommendations section of this report for more information.

## PAOLI TRAIL CONNECTIONS

### Alternative B2: North Valley Road, Alternative Route to the West

Suggestions to use parallel routes to avoid the most challenging parts of North Valley Road were made at the March 2010 public workshop. Alternative B2 is the one of those parallel routes and generally lies west of North Valley Road. The alternative is 1.3 miles long (44% longer than Alternative B) and uses Hollow Road, an existing unpaved trail/sewer line in the Airdrie Forest Preserve, and Hawthorne Place in the Lexton Woods neighborhood, returning to North Valley Road between the railroad underpass and the Chester Valley Trail. It was first considered at the Study Committee's September 2010 meeting and was the last of the alternatives introduced.

As was noted for Cedar Hollow Road, the opening of the Chester Valley Trail is expected to result in additional bicycle and pedestrian travel along Valley Road between the Trail and Paoli. Valley Road is currently dangerous for walking and cycling, and Alternative B2 offers an option that will provide much greater safety and traveler comfort.

#### **Detailed Study**

#### **First segment: Central Avenue and Hollow Road to Airdrie Forest Preserve**

The proposed work on Central Avenue is as described above for first segment of Alternative A. Hollow Road is essentially a residential driveway with very low traffic volumes and speeds. The Study Committee agreed that sidewalk is not really needed and that an on-road route with pavement markings (see right) is appropriate for this location. At the end of Hollow Road, a metal gate blocks access into the Airdrie Forest Preserve.



Rendering of potential improvements along Hollow Road

### Second segment: Airdrie Forest Preserve

Beyond the metal gate at the end of Hollow Road is an entrance to an Airdrie Forest Preserve trail. A sanitary sewer line (in the photo below) runs north through the preserve toward Hawthorne Place in the Lexton Woods subdivision. The trail is proposed in the general vicinity of the sewer alignment to minimize impacts to the natural state of the preserve, including tree impacts. At the northern side of the preserve, the trail would continue through private property to Hawthorne Place.

It is important to note that the preserve was donated to the Open Land Conservancy (OLC) as preserved open space and may be subject to restrictions on development of formal trails, pending a decision of the OLC board.



Route of sewer line through Airdrie Forest Preserve

### Third segment: Hawthorne Place

This segment is located along Hawthorne Place, extending east to Valley Road. The Study Committee discussed the construction of sidewalk on Hawthorne Place. Due to low traffic volumes, shared-used pavement symbols should be adequate for this section of the trail. However, dependent on demand once the trail is active, sidewalk may be warranted.

At the Valley Road at Hawthorne Place intersection, vehicles turning out of Hawthorne Place have poor sight distance. As the result of Study Committee discussions on how to safely cross trail users across North Valley Road, engineering studies were conducted in accordance with Pennsylvania Department of Transportation Publication 46, Chapter 11.9.

With a posted speed of 35 mph and a daily traffic volume of 5,600 vehicles, North Valley Road meets the traffic criteria for an unsignalized pedestrian crossing. In addition, there are no nearby crosswalks or on-street parking areas. Furthermore, because the crossing is proposed, there is no way at this planning stage to evaluate pedestrian crossing volumes.

The final criterion for such a crossing is sight distance along North Valley Road. Tightening the curb radius on the southwest corner would bring users closer to the travel lanes and increase sight distance. From this point, sight distance to the north is in excess of 500 feet, past the Conrail underpass, and about 275 feet to the south. The PennDOT sight distance requirement for a downhill grade is 333 feet, which could likely be achieved by adjusting a portion of an old stone wall along the roadside. This could provide an opportunity to restore and preserve the remainder of the wall as a community asset.

Should this option be pursued, the designer should consider an enhanced crossing treatment such as a flashing beacon to warn approaching motorists of crossing pedestrians or bicyclists.

## PAOLI TRAIL CONNECTIONS

### Fourth segment: North Valley Road, from Hawthorne Place to the Chester Valley Trail

The railroad underpass along this segment is 24 feet wide. Although both travel lanes operate under a YIELD condition with only one vehicle permitted at a time, vehicles typically use the tunnel simultaneously in opposite directions. Similar to the rail underpass on Cedar Hollow Road, a short term solution is to stripe a pedestrian and bicycle walkway through the tunnel. However, due to two-way travel within the tunnel, two-way STOP control similar to the Cedar Hollow Road underpass is recommended to accommodate a bicycle and pedestrian way. See the illustration to the right. Two-way STOP control at this location may have the added benefits of lowering traffic speeds on North Valley Road and providing gaps in traffic so drivers can more easily turn onto the road from side streets. Due to the wider underpass width, concrete barriers could be considered, however they would require crash cushions to protect the blunt ends of the barrier. As with Cedar Hollow Road under Alternative A, a long term solution could be to widen the underpass or bore a separate bicycle and pedestrian tunnel next to the vehicular tunnel.

North of the railroad, a proposed shared-use path would be constructed on the east side of the roadway. There are several areas with steep grades adjacent to the roadway. The path would impact about ten residential parcels near the Valley Greene subdivision and there would likely be several short retaining walls and tree impacts. In this area curb could be considered to reduce property impacts, though providing curb may not be consistent with the rural context of this part of the community.



Rendering of potential improvements at North Valley Road railroad underpass

This study assumes that the trail will continue up a ramp parallel to the Chester Valley Trail, connecting to the CVT at the top of its embankment. Costs for a trailhead are not assumed.

**Opportunities:**

- Sewer line
- Beneficial grades
- Good community linkages
- Good access to transportation center development
- Limited private property impacts (including OLC)
- Wider railroad underpass
- Located completely in Tredyffrin Township
- Varied user experience/ aesthetics

**Challenges:**

- Crossing of Valley Road at Hawthorne Place
- May need sidewalk on Hawthorne Place
- Safety perception
- Potential natural preserve impact, but less than Alternative B1
- Grading/ tree impacts in front of residences

More information on this alternative was compiled at the request of the Study Committee. The Committee was shown renderings of how the proposed trail might appear along Central Avenue and Hollow Road, as well as under the railroad underpass. An engineering study was also conducted to determine crosswalk requirements across North Valley Road in the vicinity of Hawthorne Place.

Based on this information the Study Committee agreed to recommend this alternative for implementation. See the Recommendations section of this report for more information.

**Alternative A1:  
Cedar Hollow Road, Alternative Route**

Alternative A1 was presented as an option to avoid some of the concerns along Alternative A, primarily the steepest grades along Cedar Hollow Road and residential property impacts. The alternative is 2.0 miles long (67% longer than Alternative A) and utilizes the western portion of Central Avenue and Industrial Boulevard to bypass parts of Cedar Hollow Road.

**Initial Evaluation**

**Opportunities:** Somewhat flatter than Alternative A with lower traffic volumes

**Challenges:** Much longer than Alternative A, narrow railroad bridge on Central Avenue

The Study Committee felt this alternative did not provide any benefits over Alternative A, and so was not worthy of further study. It was dropped from further consideration at the June 2010 Study Committee meeting.

## PAOLI TRAIL CONNECTIONS

### Alternative B: North Valley Road

Alternative B was one of the original alternatives shown in the Township's grant application for the Paoli Trail Connections study. The alternative is 0.9 miles long and provides the most direct connection between central Paoli and the Chester Valley Trail using North Valley Road. The Study Committee initially felt this route would provide the best pedestrian connection due to its directness, the significant number of Township residents living in the communities along North Valley Road, and moderate traffic. The alternative also received some favorable comments from the public during the March 2010 workshop.

However, constraints to trail development along North Valley Road are significant, as shown to the right. The road is very narrow, consisting of a total pavement width of 22 feet as measured at several locations. The trees lining the road provide pleasant shade, but also severely limit the ability to provide shoulders and restrict sight distance around the numerous curves in this area. Traffic was observed traveling at high rates of speed in both directions, but especially downhill. This grade averages about 8% over most of North Valley Road, with a maximum measured grade of over 12%.

### Initial Evaluation

**Opportunities:** Very direct, short, excellent access for Tredyffrin Township residents

**Challenges:** Narrow roadway and underpass, steep grades, potential major impacts to stream and rock outcroppings

Despite the benefits provided by a very direct connection between the Chester Valley Trail and Paoli, the Study Committee agreed with the assessment that a trail directly parallel to North Valley Road is not feasible. Particularly in the segment just north of Central Avenue, North Valley Road is steep, narrow, and winding, and is lined by rock outcroppings, major trees, and a stream. A more promising alternative in the general vicinity of North Valley Road, however, is B2, discussed beginning on page 14.



Existing conditions along  
North Valley Road

**Alternative B1:  
North Valley Road, Alternative Route to the East**

Suggestions to use parallel routes to avoid the most challenging parts of North Valley Road were made at the March 2010 public workshop. Alternative B1 is one of those parallel routes and in many areas is located east of North Valley Road. The alternative is 1.4 miles long (55% longer than Alternative B) and uses Biddle Road and existing unpaved trails in the Airdrie Forest Preserve, returning to North Valley Road between the railroad underpass and the Chester Valley Trail.

**Initial Evaluation**

**Opportunities:** Partially off-road, primarily using existing trails, gentler grades, good residential access

**Challenges:** Slightly longer than Valley Road, potential impacts to preserve and residential area

Because this alternative provided such good residential access while avoiding the greatest challenges along North Valley Road, the Study Committee agreed that this alternative warranted further study. The Township invited representatives of the Open Land Conservancy (OLC), which owns and manages the Airdrie Forest Preserve, to attend the Committee’s September 2010 meeting to discuss the alternative.

**Detailed Study**

**First segment: Biddle Road to Airdrie Forest Preserve**

This segment consists of an on-road route on Biddle Road. Biddle Road is a residential roadway with low traffic volumes and the Study Committee agreed that installing sidewalk was not preferable. Given the low traffic volumes and speeds observed on Biddle Road, installing bicycle

and/or pedestrian symbols on the pavement could be an appropriate treatment.

**Second segment: Airdrie Forest Preserve**

The Airdrie Forest Preserve is located on both sides of Valley Road and is owned and managed by the OLC. The trail surface could potentially be crushed stone to maintain the natural context of the preserve as much as possible. Some drainage and erosion issues were observed during a field view of the existing trails. OLC representatives said that steep grades on some existing trails within the preserve may result in the need to clear a new switch-back path with less severe grades. They emphasized maintaining the natural state of the preserve as much as possible.

**Third segment: North Valley Road, from the Airdrie Forest Preserve to the Chester Valley Trail**

The railroad underpass along this segment is 24 feet wide. Although both travel lanes operate under a YIELD condition with only one vehicle permitted at a time, vehicles typically use the tunnel simultaneously in opposite directions. Similar to the rail underpass on Cedar Hollow Road, a short term solution is to stripe a pedestrian and bicycle walkway through the tunnel and/or place vertical flexible plastic bollards to delineate the walkway. However, due to two-way travel within the tunnel, a tunnel may need to be designated with STOP control similar to the Cedar Hollow Road underpass to accommodate a bicycle and pedestrian way. A long term solution could be to bore a separate bicycle and pedestrian tunnel next to the vehicular tunnel.

North of the railroad, a proposed shared-use path would be constructed on the east side of the roadway. There are several areas with steep grades adjacent to the roadway. The path would impact about ten residential parcels near the Valley

## PAOLI TRAIL CONNECTIONS

Greene subdivision and there would likely be several short retaining walls and tree impacts.

### Opportunities:

- Wider railroad underpass
- Direct connection for Tredyffrin residents/communities into Paoli
- Located completely in Tredyffrin Township
- Varied user experience/ aesthetics

### Challenges:

- Grading/ tree impacts in front of residences
- New trail in Airdrie Forest Preserve (different use than is typical; potential natural resource impacts)
- Less direct for transportation center development

### Next steps:

Alternative B2, discussed beginning on page 14, provides another option to parallel North Valley Road and also impacts the Airdrie Forest Preserve. After discussing both alternatives through the Preserve, the Study Committee felt Alternative B2 had several advantages over Alternative B1 and decided to drop Alternative B1 from further study.

### Alternative C: Bear Hill Road

Alternative C was one of the original alternatives shown in the Township's grant application for the Paoli Trail Connections study. The alternative is 1.8 miles long and uses Bear Hill Road (SR 252) to connect Paoli with the Chester Valley Trail.

### Initial Evaluation

Bear Hill Road has wider lanes and more sidewalk than some other options. As a state route, it has a more gradual slope and wider right of way than alternatives A and B. The restricted width of the SEPTA/Amtrak overpass limits motor vehicle travel to one lane in each direction, though each span is wide enough to accommodate a bike lane adjacent to the main travel lane. Studies to widen this overpass are underway.

This alternative carries the highest traffic of all options under consideration, including extensive queues during peak hours. When the road is not congested, speeds are high. The flatter grade results in a longer connection: almost two miles from the Paoli station to the Chester Valley Trail.

**Opportunities:** Good tie-in to Chester Valley Trail, good railroad overpass, relatively direct

**Challenges:** Very high traffic volumes, high traffic speeds, limited width in one area, somewhat steep

Without detailed study the Study Committee agreed that high traffic volumes and speeds make this alternative very undesirable. It was dropped from further consideration at the June 2010 Study Committee meeting.

**Alternative C1:  
Bear Hill Road, Alternative Route**

Alternative C1 was presented as an option to avoid some of the biggest challenges along Alternative C, primarily the area about ½ mile north of US 30 that has narrow shoulders and steep side slopes. The alternative is 2.2 miles long (22% longer than Alternative C) and utilizes neighborhood streets in Friendship Hills to bypass parts of Bear Hill Road.

**Initial Evaluation**

**Opportunities:** Somewhat flatter than Alternative C, provides much better residential access than Alternative C

**Challenges:** Much longer than Alternative C, potential impacts to residential properties

The Study Committee felt this alternative added significant length without solving many of the concerns along Alternative C, and so was not worthy of further study. It was dropped from further consideration at the June 2010 Study Committee meeting.

**Alternative D:  
Crabby Creek Park**

Alternative D was suggested subsequent to the Township’s grant application for the Paoli Trail Connections study, but before the study began. The alternative is 2.5 miles long and primarily uses Crabby Creek Park, Radbill Park, and Maple Avenue to connect Paoli with the Chester Valley Trail. A connection between Paoli and Crabby Creek Park was identified as part of the Township’s Green Routes Network in the Comprehensive Plan.

The two parks provide an open space connection from SR 252 at Swedesford Road almost to Lancaster Pike. Given the natural beauty and steep slopes along Crabby Creek, it was originally anticipated that this would be a pedestrian-only trail to tie into the existing trails in the park.

**Initial Evaluation**

Because the creek is highly eroded, the Township may wish to consider an aggressive stream bank protection program. In addition, the little league fields in Radbill Park connect to the rest of the PECO maintenance facility along SR 252. A connection through the PECO facility could provide pedestrian access to the residents of the condominiums on the west side of SR 252.

## PAOLI TRAIL CONNECTIONS

The study team examined the park in detail and determined that there are no reasonable locations to access it from the west without significant residential property impacts. There was also concern, though not studied in detail, that residents and environmental agencies would feel that a trail through the park would not be consistent with the natural setting. The slopes in the park could require fairly extensive grading to construct a trail that meets accessibility guidelines. This alternative is also longer than the previously-mentioned options. The Study Committee agreed that this route not be pursued, so it was dropped from further consideration at the June 2010 meeting.

### Alternative E: Cassatt Road and Howellville Road

Alternative E was also suggested subsequent to the Township's grant application for the Paoli Trail Connections study, but before the study began. The alternative is 3.8 miles long and primarily uses on-road routes such as Cassatt Road, Howellville Road, Old State Road, Old Lancaster Road, Russell Road, and Maple Avenue to connect Paoli with the Chester Valley Trail via Daylesford.

#### Initial Evaluation

This alternative extends well beyond the limits originally considered for the study, but had sufficient advantages to warrant review. The entire route, with the exception of a portion of East Central Avenue, is generally a long, steady grade without steep segments. Most of the route (even the bridge over Conrail) is wide enough for designated bike lanes, and traffic is generally light enough that on-road bicyclists will feel comfortable. This alternative serves several residential neighborhoods and Conestoga High School. Most of the route has been designated for non-motorized travel in the Township Comprehensive Plan.

However, this alternative is very indirect and is located well to the east of Paoli. The group agreed that, despite its benefits to other parts of Tredyffrin Township, Alternative E would not directly benefit Paoli due to its distance from the village center. However, it does merit further examination as an alternate route connecting other parts of Tredyffrin Township to the Chester Valley Trail to the east. It was dropped from further consideration under this study at the June 2010 Study Committee meeting.