



DELAWARE VALLEY
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REGIONAL
PLANNING COMMISSION

December 2017

Radnor Station Connectivity



The Delaware Valley Regional Planning Commission

is the federally designated Metropolitan Planning Organization for a diverse nine-county region in two states: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey.



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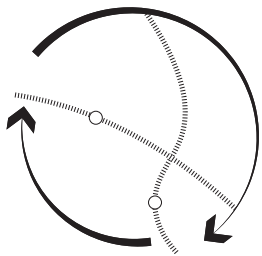
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Executive Summary

The Delaware Valley Regional Planning Commission (DVRPC) evaluated the feasibility and benefits of consolidating two Southeastern Pennsylvania Transportation Authority (SEPTA) rail stations to improve the connection between the Paoli/Thorndale Regional Rail Line and the Norristown High-Speed Line (NHSL) in Radnor Township, Delaware County. The project team concluded that current demand for transfers between the two rail stations is too low and future demand too uncertain to justify the high capital cost of station consolidation.

Results of observations, analysis, and modeling include the following main findings at the local and regional levels.

Local Transfer Demand Assessment:

- Few passengers currently make transfers between the two stations, and there is no network wayfinding or local signage to encourage it.
- The stations are connected by a sidewalk along King of Prussia Road, but that path is indirect and with changes in elevation. This leads passengers who do transfer to cut across the Radnor Financial Center parking lot.

Regional Transfer Demand Assessment:

- Transit travel times are generally not competitive with driving, particularly in a region where walking and biking to stations is difficult, and an easier transfer in Radnor would not benefit potential passengers enough to rival driving times.
- Passengers living near either of the rail lines can drive to the Radnor stations, find available parking at a low cost, and begin their transit trip there, rather than beginning their journey nearer to their home and transferring in Radnor.
- The majority of commuters' trips in the area, as determined by the locations of major employers and journey-to-work travel flows, do not align with trips that would include a transfer in Radnor Township.

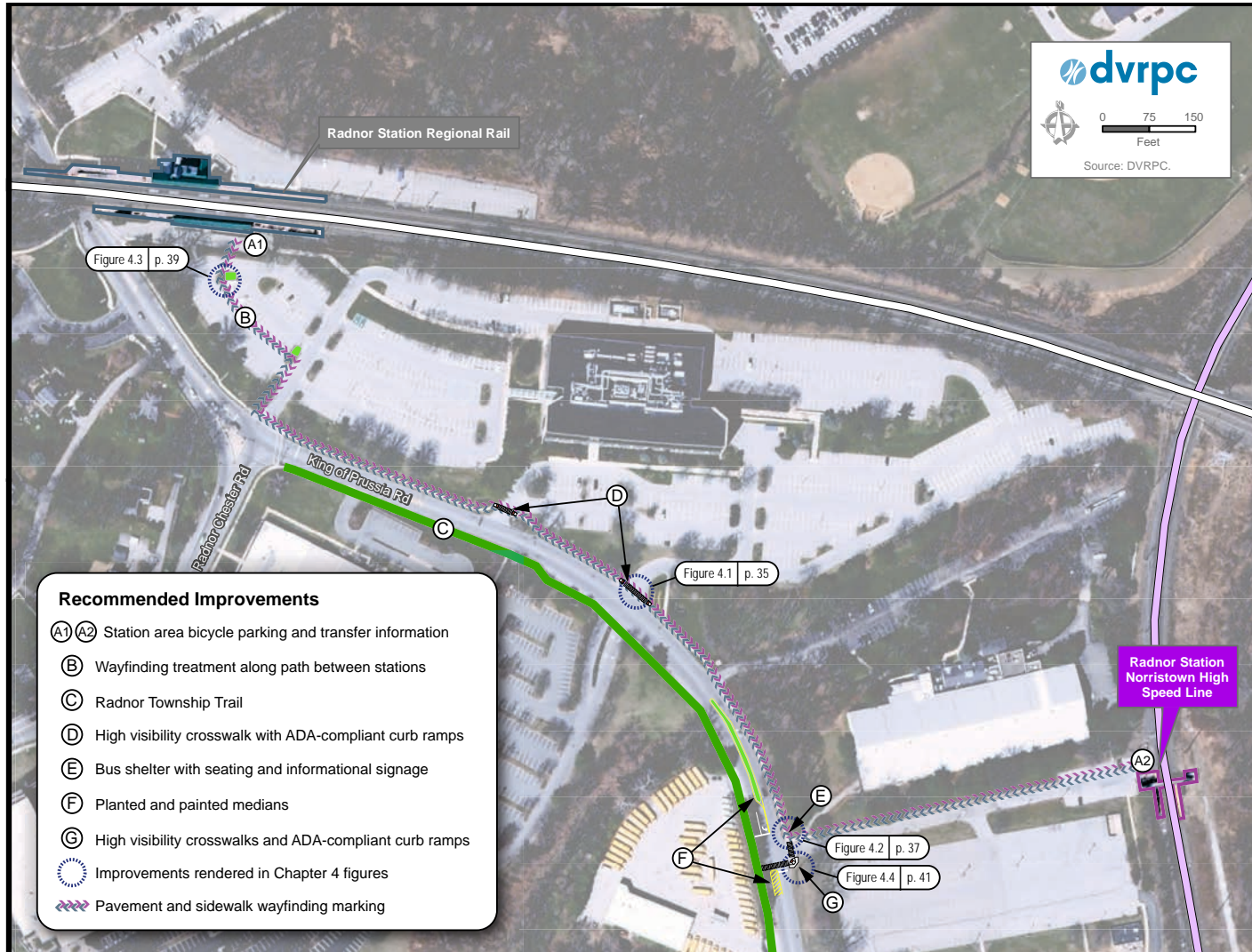
Based on the low demand for transfers, the project team recommends improvements that are inexpensive but impactful and create a more perceptible and distinct connection between the two Radnor stations for passengers who walk or bike to or between the stations. These recommendations are distinguished between improvements to wayfinding and improvements to facilities, which are shown in Figure A.

- **Wayfinding:** Better signage, maps, and pavement treatments can be installed in the short-term (1-5 years), while formalized shortcuts and real-time arrival information can be implemented in the medium-term (5-10 years).
- **Facilities:** Upgrades can be made in the short-term to increase comfort and access to transit by creating bicycle parking and improving bus stop amenities. Over the medium-term, more complete, accessible, and safe pedestrian infrastructure can be installed.

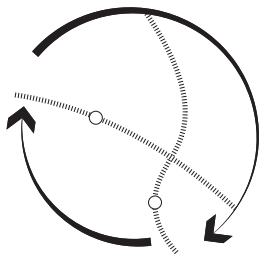
These lower-cost improvements present SEPTA with an opportunity to increase connectivity by helping passengers better navigate between these two rail stations, as well as to the local bus service and planned trail extension. Increased connectivity provides passengers with higher mobility, thereby increasing the overall flexibility of the existing network.

In the long-term (10 years+), station consolidation should be revisited, particularly once any resulting effects to transfer demand due to SEPTA's anticipated extension of the NHSL, the King of Prussia Rail Project, can be properly assessed.

Figure A: Map of Study Area Recommendations



Source: DVRPC, 2017



Chapter 1

Introduction

Project Overview and Purpose

SEPTA and the Delaware County Planning Department asked DVRPC to determine if there is a demand for a consolidated Radnor Regional Rail and NHSL station, and if so, if consolidation is feasible. Station consolidation would reduce the time and difficulty of transferring, thereby improving the transit network's efficiency, versatility, and reach.

Additionally, SEPTA is currently conducting an "Alternatives Analysis and Draft Environmental Impact Statement" for the King of Prussia Rail Project that will extend the NHSL to King of Prussia. This will increase the number of destinations accessible via the NHSL and other regional transit lines.

The Radnor Station Connectivity project explores near-term, low and high cost approaches to help improve the connection between the stations. To determine if, and what, additional investment can and should be made by SEPTA and local governments, the DVRPC project team analyzed the following questions.

1. Are there currently transfers being made between the two Radnor stations?
2. If a transfer between these two stations were easier, is there likely demand for additional transfers?

3. Would the extension of the NHSL to King of Prussia substantially increase the likely demand for transfers between the two stations?

Previous Recommendations

This is an area which has been studied by DVRPC before and some of the recommendations in this report have been identified in earlier studies. The most directly applicable study is explained below.

US 30 (Lancaster Avenue) Corridor Study: Creating Linkages and Connecting Communities

In 2011, DVRPC published a report discussing land use, and pedestrian and transit improvements along the US 30 corridor. The study area included parts of Radnor Township and this plan's study area. Recommendations from the 2011 study were based on similar principles and strategies as this report, and are outlined in detail in its *Chapter 4: Recommendations*. Figure 1.1 shows recommendations from the US 30 study that would most impact the study area of this plan. Shared recommendations between the two projects include improved wayfinding and safer pedestrian access and crossings.



Radnor Station served by the Paoli/Thorndale Line Regional Rail.

Source: DVRPC, 2016



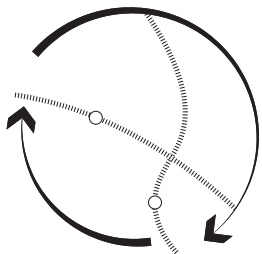
Radnor Station served by the Norristown High Speed Line (NHSL).

Source: DVRPC, 2016

Figure 1.1: Map of Radnor Sub-Area Recommendations from US 30 (Lancaster Avenue) Corridor Study: Creating Linkages and Connecting Communities



Source: DVRPC, 2011



Chapter 2

Existing Conditions

Transit Options in Radnor

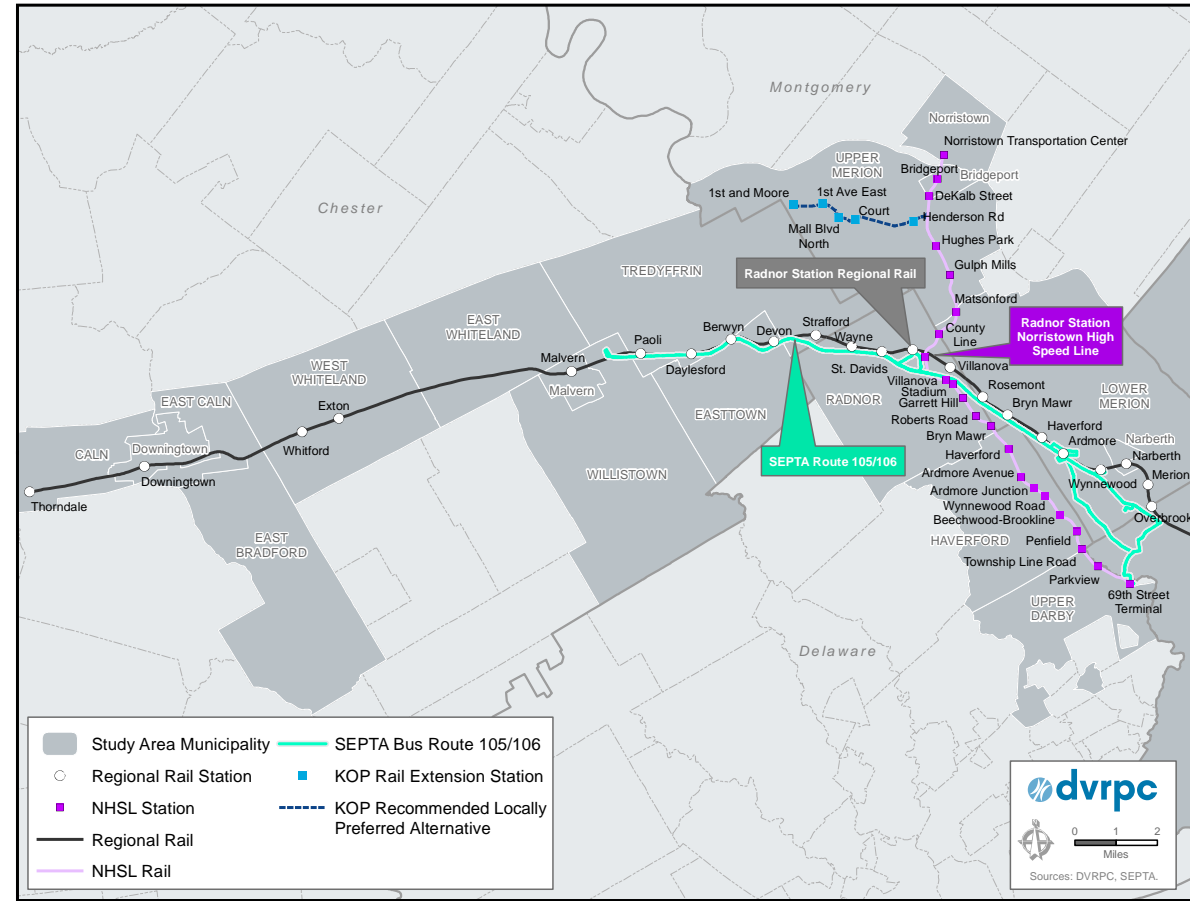
The availability of facilities such as convenient regional transit, major thoroughfares and expressways, and multi-use trails make Radnor Township an attractive place to live and work.

Regional Connections

Figure 2.1 shows the regional public transit network for Radnor Township and surrounding municipalities in Delaware, Chester, and Montgomery counties. The SEPTA Paoli/Thorndale Regional Rail Line provides service between Philadelphia (and other connecting Regional Rail lines) and the Thorndale station located in Caln Township. Amtrak train service is also provided at 30th Street Station (Philadelphia), Ardmore, Exton, and Paoli stations, each located along the Paoli/Thorndale Line, connecting to the Northeast Corridor and to Harrisburg.

SEPTA Bus Routes 105 and 106 are also shown in Figure 2.1. These routes previously operated between 69th Street Transportation Center and Paoli, serving the Radnor NHSL and Regional Rail stations. As of June 20, 2016, Route 105 was truncated to terminate at Rosemont Station, ending the duplicative service with Route 106 to Paoli. Because of this change, the only SEPTA bus service to Radnor is now Route 106.

Figure 2.1: Regional Study Area (SEPTA Schedule: Spring 2014)



The change enabled several improvements to bus service along the Lancaster Avenue corridor. SEPTA was able to provide more trips to Paoli on Route 106 with weekday rush hour headways of 30 minutes and extra

service in the afternoon rush hour between 69th Street Transportation Center and the intersection of Lancaster Avenue and Station Street in Ardmore. At the same time, SEPTA provided hourly service on Route 106 during

midday hours and on Saturdays. SEPTA coordinated schedules between Routes 105 and 106 in Ardmore for passengers continuing toward Paoli to allow for easy connections between the two routes.

Also included in Figure 2.1 is the proposed extension of the NHSL as part of the King of Prussia Rail Project, which is shown in blue. The preferred alternative for the extension includes five additional stations, terminating in King of Prussia. This new service will create additional options for passengers traveling to and from King of Prussia, which is considered in *Chapter 3: Transfer Demand Assessment*.

Table 2.1 shows the total average weekday transit ridership by mode, which is highest on the Regional Rail with 1240 boards and alights (at Radnor Regional Rail Station). Whereas the NHSL has 706 (at Radnor NHSL Station) and Route 106 has 96 (at the bus stop by the corner of King of Prussia Road and the entrance to the NHSL). Table 2.2 shows how trip times vary during the morning commute, from the study area to regional destinations. The origins and destinations (except for Suburban Station) are shown on the map in Figure 2.1.

Table 2.1: Total Weekday Ridership by Mode in the Study Area

	Mode		
	NHSL (Radnor Station)	Regional Rail (Radnor Station)	Bus Route 106 (Stop at King of Prussia Road and NHSL)
Ridership (boards and alights)	706	1240	96

Source: SEPTA, Spring 2014

Table 2.2: Travel Time by Origin and Destination Pair (AM Peak)

Mode	Origin	Destination	Travel Time (minutes)
NHSL	Norristown Transportation Center	Radnor	9-10
	Radnor	Norristown Transportation Center	10-12
	Radnor	69th Street Transportation Center*	15-22
	69th Street Transportation Center*	Radnor	10-17
Regional Rail	Thorndale	Radnor	35
	Radnor	Thorndale	41
	Radnor	Suburban Station	32
	Suburban Station	Radnor	40
Bus	Paoli	Radnor	24-25
	Radnor	Paoli	24-25
	Radnor	69th Street Transportation Center*	20-32
	69th Street Transportation Center*	Radnor	28-39

*69th Street Transportation Center is an additional 15 minutes from Center City by the MFL.

Source: Google Maps, 2016

Local Transit Access

Figure 2.2 illustrates the local study area. The map shows each station and the bus stops, as well as destinations that are accessible via SEPTA services, including large employers, such as Penn Medicine at Radnor.

Transit Vehicle Volumes

Transit vehicle volumes, or the number of vehicles that serve a station in a standard weekday, are shown in Figures 2.3 and 2.4. The color and thickness of the line indicates the number of vehicles in a 24-hour period, with green being the highest and red the lowest. Figure 2.3 illustrates the transit vehicle volumes for the NHSL and Paoli/Thorndale lines, and highlights where there is more service. Between the two rail lines, the NHSL runs higher transit vehicle volumes through Radnor Township.

The Paoli/Thorndale Regional Rail runs three different service patterns, a local, and two express variations. The red line between Malvern and Thorndale illustrates that this section of the corridor has the lowest number of vehicles serving it per day.

Figure 2.2: Local Study Area

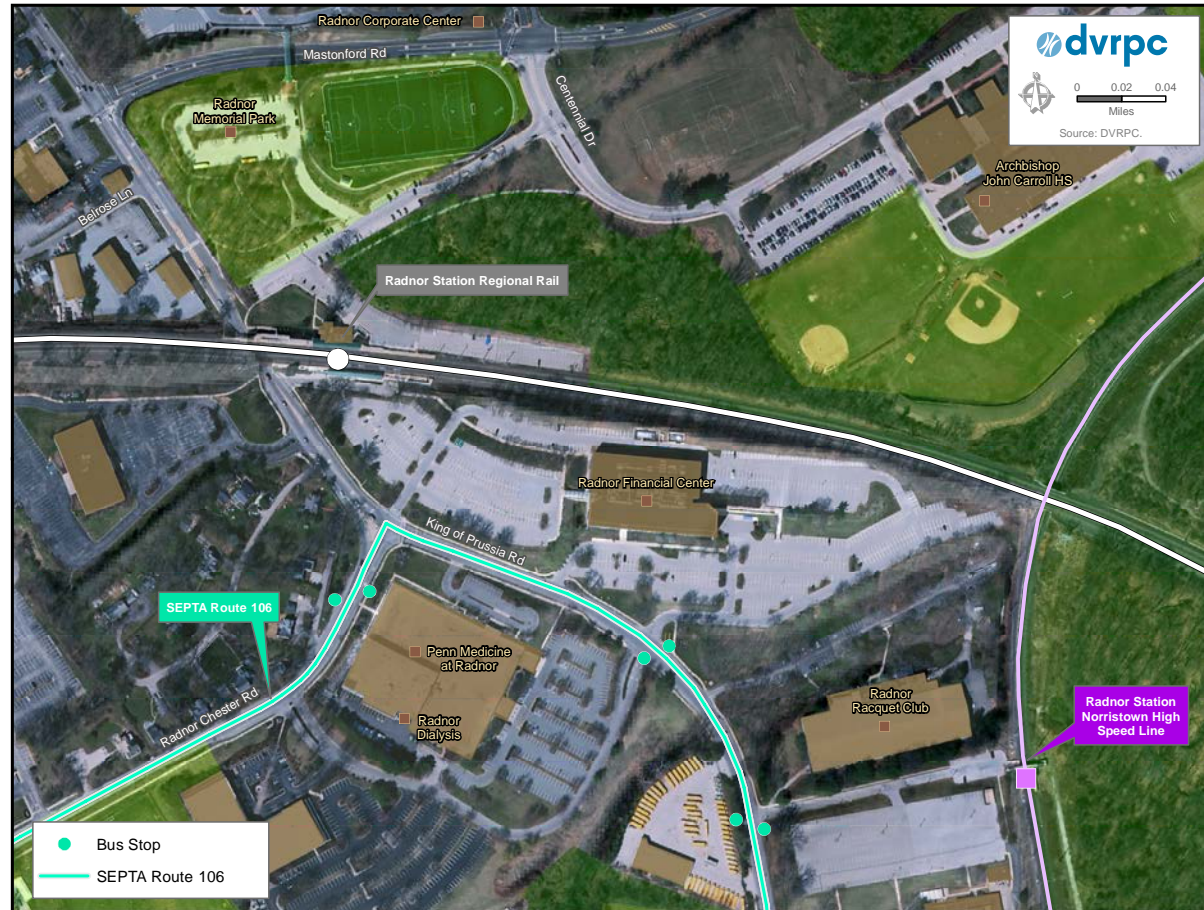
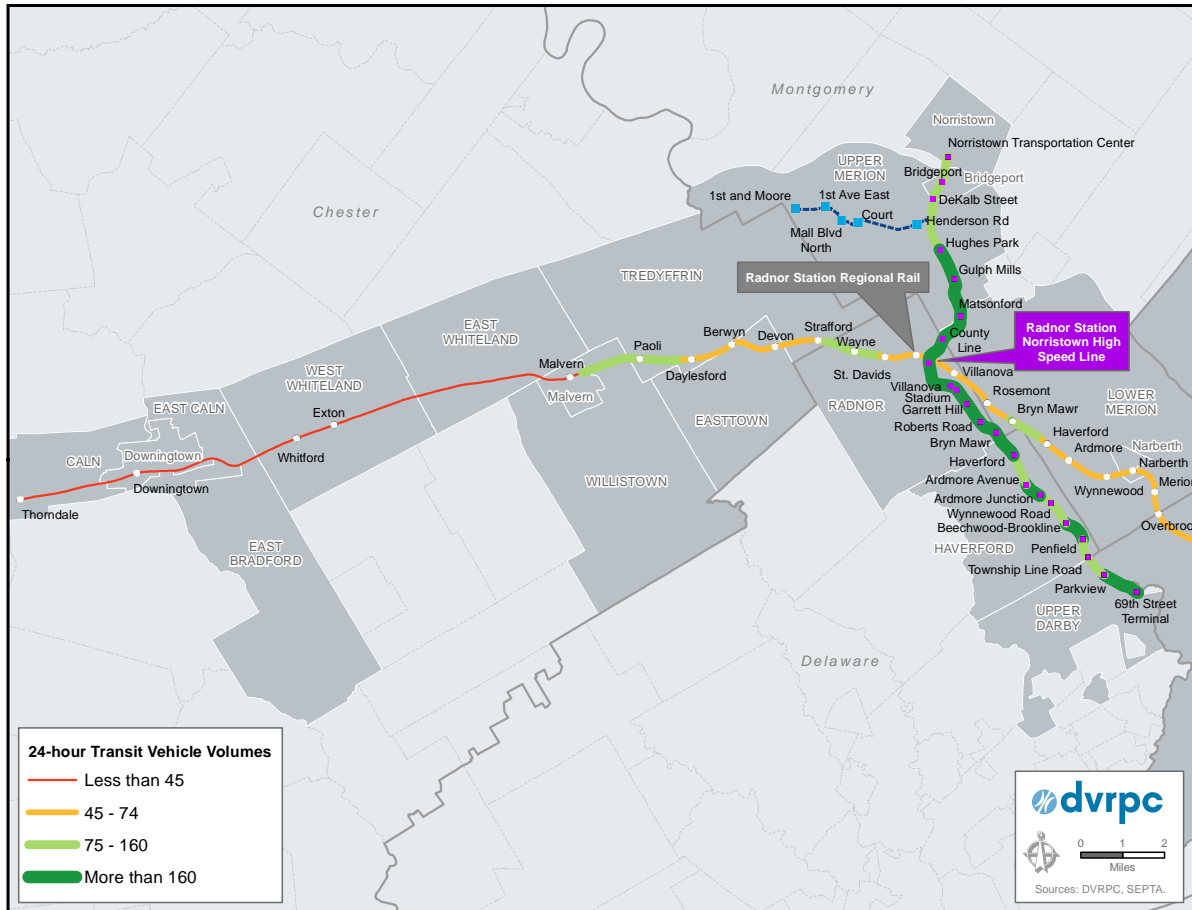


Figure 2.3: Rail Transit Vehicle Volumes (SEPTA Schedule: Spring 2014)



Improvements at NHSL Radnor Station

SEPTA made a series of improvements to NHSL Radnor Station from 2015 to 2016 to address safety and comfort concerns for transit customers. These included:

- Repairs made to the station platforms and stairs.
- Installing new guardrails and handrails.
- The shelters were upgraded with new paint, glass block windows, and roofing.
- New furniture and signage were added.
- Station lighting was upgraded.
- Station landscaping was upgraded.

Figure 2.4 illustrates the much lower transit vehicle volumes for SEPTA bus Route 106, compared to the Regional Rail and the NHSL serving Radnor Township (which are shown in Figure 2.3). Table 2.3 shows the transit frequency and hours of operations for the three modes, with the NHSL running at the highest frequency. As discussed earlier, depending on the trip pair, the total trip time can be competitive between modes. Specifically, the Paoli/Thorndale Regional Rail and Route 106 serve both Radnor and Paoli, and the travel time is similar with the bus offering access to intermediate, local destinations. However, the bus frequency of service is much lower, and it has shorter hours of operation.

Figure 2.4: Bus Transit Vehicle Volumes (SEPTA Schedule: Spring 2014)

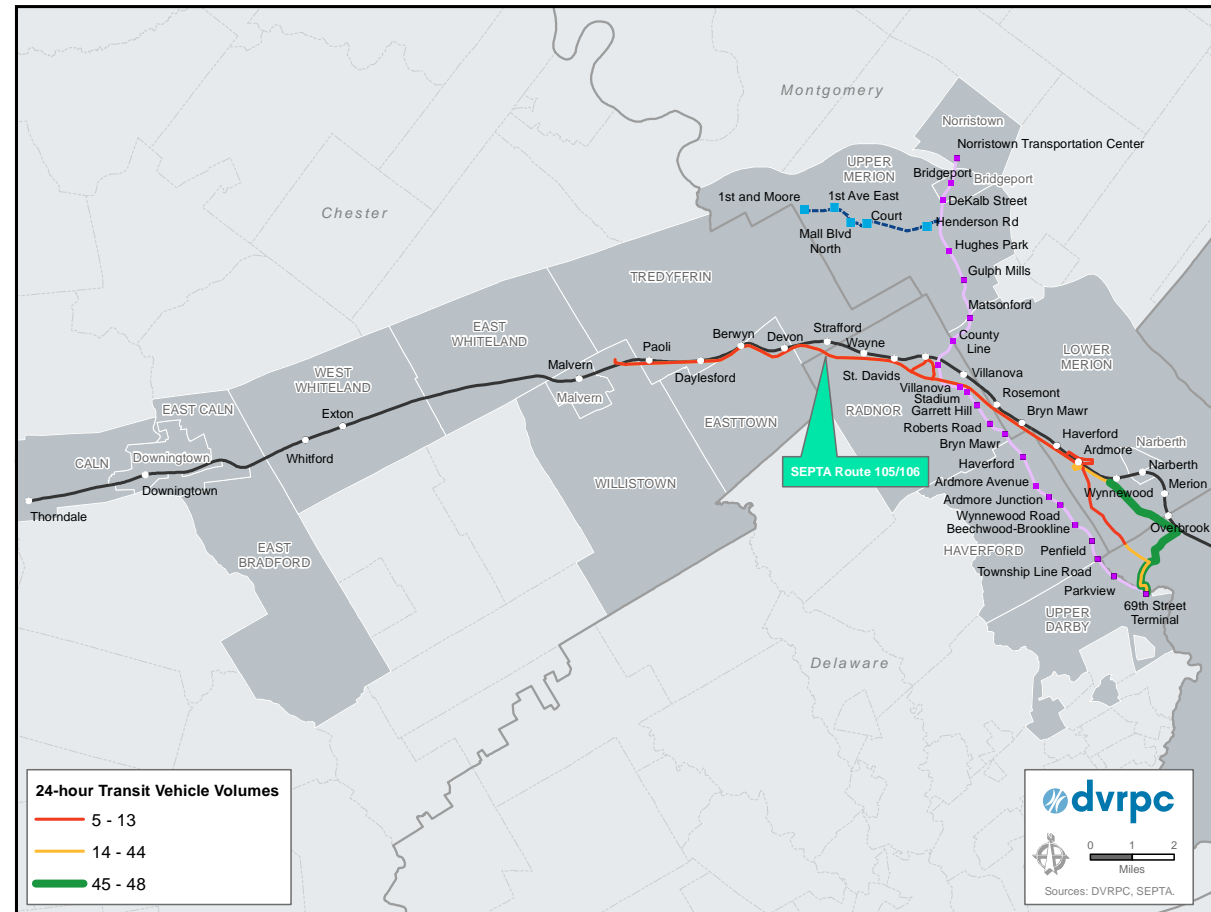


Table 2.3: Transit Headways and Availability

Mode	Base Transit Headways	Hours of Operation
NHSL	15/20 minutes	4:30 AM - 2:30 AM
Regional Rail	30 minutes	5:00 AM - 1:00 AM
Bus	60 minutes	5:30 AM - 8:00 PM

Source: SEPTA, 2016



A man waits for the bus (left photo) along King of Prussia Road just outside of the NHSL Radnor Station (right photo).

Source: DVRPC, 2016

Parking and Shuttles

Parking

The project team completed fieldwork in March 2016 in the study area, and the observations of parking use and regulations are shown in Figure 2.5. SEPTA-owned Regional Rail parking is divided between two areas: north and south of the station. On the north side of the station there are both daily and permit parking spaces. In addition, there is municipal parking which is shaded in purple.

The south side of the station has designated permit spaces. Also, on the south side of the station is a part of the Radnor Financial Center parking area that is used for station activity. The space is used as an informal passenger drop-off and pick-up area and a car and shuttle waiting area. This area is defined by a yellow shading.

Figure 2.5: Parking Conditions Observed in the Study Area



There are significantly more parking spaces at the Regional Rail station compared to the NHSL station; however, both SEPTA-owned parking lots are at capacity on a typical weekday (see Table 2.4).

The cost of parking varies between the parking areas, and likely determines how passengers are filling the spaces in the morning, with the cheapest lots filling first. Additionally, anecdotes suggest that the NHSL parking lot is frequently used by students from the high school across the street.

Shuttles

Both stations are served by shuttle services from local colleges and offices, such as Cabrini College and Eastern University, which are less than three miles away. The shuttle service provides the last-mile connection for many local destinations that are outside of walking distance. Therefore, more people have the ability to use public transit because there are private offerings for last-mile connections.

Table 2.4: Parking Capacity and Utilization

Parking Lot	NHSL	Regional Rail (Daily and Permit)	Non-SEPTA Municipal Parking (adjacent to RR)
Parking Capacity	19	141	79
Parking Utilization (%)	100%	100%*	76%
Cost (\$)	Free	\$1 per day and \$20 per month	\$.50 per hour

**From SEPTA parking census. During the two field observations for this project, the parking lots were not at 100% capacity.*

Source: SEPTA, 2016

Roadway and Walking Conditions

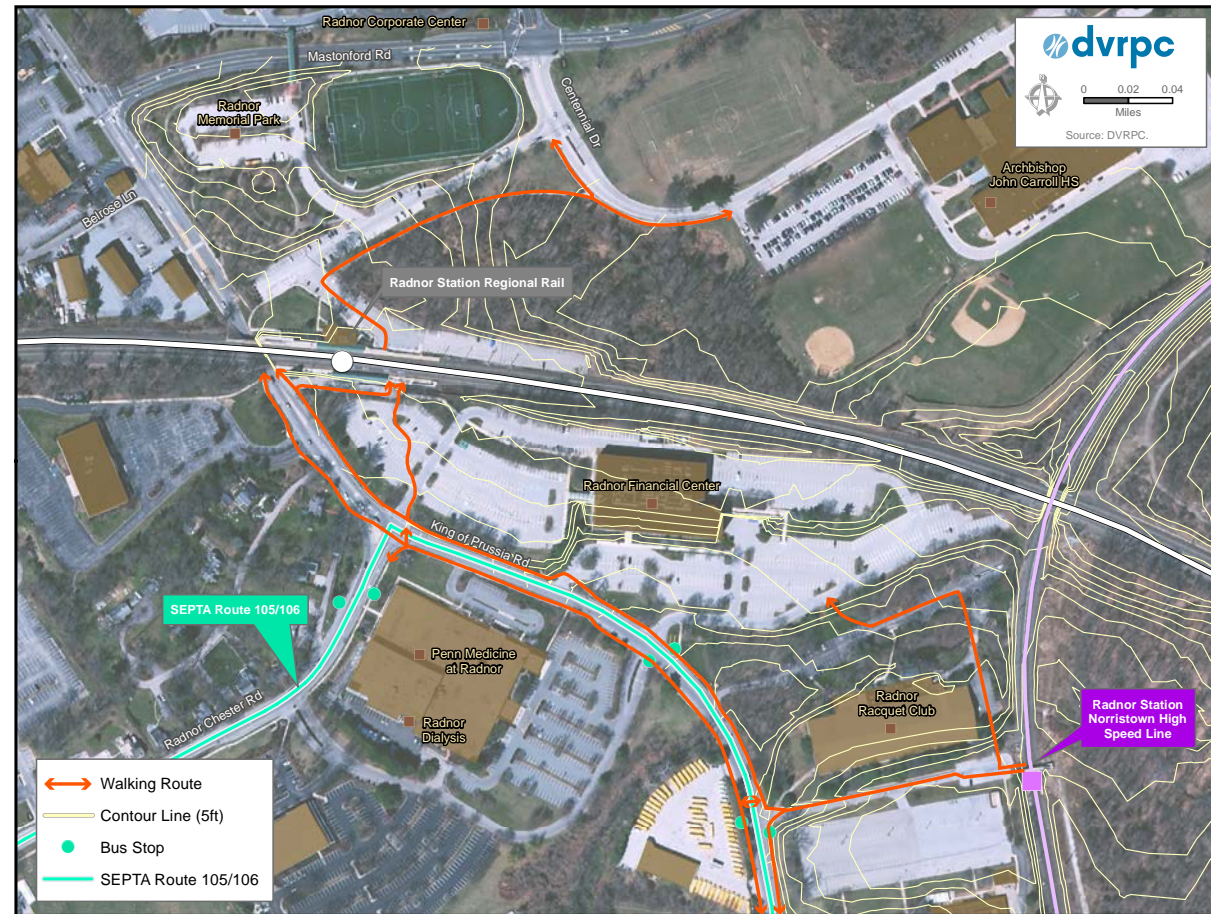
All three SEPTA services are accessible via King of Prussia Road, which is an arterial. Traffic counts collected indicate that in the southbound direction the annual average number of daily vehicles was approximately 5,000 vehicles per day, and the crash data reveals a relatively low number (six total crashes) from 2010 to 2015, none of which involved pedestrians or were fatal (DVRPC, 2016).

Walking Conditions and ADA Accessibility

Sidewalks along King of Prussia Road between the two rail stations are complete and easy for pedestrians to navigate. However, the driveway entrances to Radnor Financial Center and the NHSL station are missing crosswalks and curb ramps. Additionally, there is a lack of wayfinding signage to help communicate to passengers who may potentially transfer to another transit mode.

Figure 2.6 illustrates (in orange) pedestrian routes the project team observed during 2016 fieldwork. Typically passengers use the sidewalks along King of Prussia Road. Also shown in Figure 2.6 are the elevation changes that deter pedestrians from choosing informal pathways between the two stations.

Figure 2.6: Popular Pedestrian Paths Observed in the Study Area



However, pedestrians were observed cutting through the northwest section of the Radnor Financial Center parking lot to access the Regional Rail station or Archbishop John Carroll High School. This route does not have

a sidewalk or any other markings to increase pedestrian safety. The north side of the Regional Rail parking lot has a sidewalk that connects with the Archbishop John Carroll High School.

Transportation Alternatives Program Award and Upcoming Improvements

Building on the success of the Radnor Trail, which opened in 2005, Radnor Township was awarded a Transportation Alternatives Program grant in 2017 to expand the trail with five miles of new on- and off-road facilities. The new Radnor Township Trail will connect the existing endpoint of the Radnor Trail in Enke Park to the Radnor Regional Rail station and the Radnor NHSL station.

Within this report's study area, the new facilities will include an off-road, multi-use sidepath around the perimeter of Radnor High School and the Penn Medicine facility along Lancaster Avenue and King of Prussia Road. It also includes a mid-block crossing to the Radnor NHSL station. The sidepath would be separated from the road by barriers at this location to funnel crossing activity. Final design and a construction timeline will be determined in the coming months.

If passengers are alighting from the Radnor NHSL station, they typically walk west down the pedestrian pathway to King of Prussia Road. The project team saw many passengers alighting at the Radnor NHSL station and making the transfer to SEPTA Bus Route 106 outbound (Route 105 still served Radnor at the time of observation). The bus ridership numbers discussed earlier in Table 2.2 also suggest that a large number of transfers are taking place. This can be assumed because these numbers are significantly higher than the ridership at the other local bus stops in the study area.

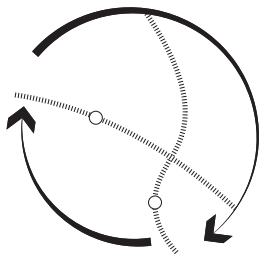
A few passengers were observed cutting through the Radnor Racquet Club and the Radnor Financial Center parking lot to get to their destination, creating an informal path.

All SEPTA buses are ADA accessible, as is the Radnor Regional Rail Station. However, Radnor NHSL Station is not ADA accessible, limiting transfers and connectivity for passengers with limited mobility.

Conclusion

From the project team's observations, pedestrian, vehicle, and transit networks are mostly in good condition and complete. The area is well-served by transit, with two rail lines and bus service. Frequencies range across these services with the highest frequency run by the NHSL, although schedules are subject to change based on maintenance and construction. The two stations provide several parking options, with a combined 150 spots adjacent to the stations with high utilization rates. There are also 79 additional spaces managed by the township that are not yet at capacity. In addition, local schools and offices provide shuttle services to and from the Radnor stations that provide the last-mile connection for many transit passengers.

While the walking environment between the two rail stations exists and is pleasant, few people were observed making a transfer between the two. For first-time users, the transfer opportunity may be unclear or unknown because of a lack of wayfinding signage indicating the potential connection between the rail stations.



Chapter 3

Transfer Demand Assessment

Existing Transfers

Because there is no current data source for SEPTA transfers, it was necessary to estimate current transfer activity by passengers. The project team investigated the occurrence of transfers between the Radnor NHSL Station and the Radnor Regional Rail Station using three methods: observation of the rail station users, an analysis of the 2011 On-Board Transit Survey, and DVRPC's Travel Demand Model.

Transfer Observations

In March 2016, the project team observed and documented transfers between the two Radnor stations. During the morning commute period, only one transfer was seen, and it was not this passenger's typical trip. Two deterrents to transferring were noted:

- Transferring between the two stations requires walking about a half mile or 10 minutes along King of Prussia Road, which has some ascents and descents that could act as obstacles, particularly for those passengers with limited mobility.
- The ability to transfer between the stations may not be apparent to passengers, since it is not promoted at the SEPTA stations, on the network map, or in any schedule.

On-Board Transit Survey

DVRPC conducted an On-Board Transit Survey of all regional public transit routes in Pennsylvania, in 2010 and 2011.¹ The main purpose of the survey was to gather current data on how the transit system was being used.

From this data source the DVRPC project team estimated a weighted total of 30 daily transfers between the NHSL and Regional

¹ The on-board survey was expanded to match the 2010 SEPTA ridership, as determined by SEPTA's 2010 Route Operating Ratio (ROR) Report. The RORs are used to report expenses and passenger revenue, and are available for every transit line.



To transfer to the Radnor Station served by the Regional Rail, the most direct route is to walk through parking lots.

Source: DVRPC, 2016

Rail. However, it is unknown whether these transfers occurred between the stations at Radnor or Villanova, or somewhere else along the two lines.

Transferring at Radnor vs. Villanova

The NHSL and Paoli/Thorndale Regional Rail Line cross in Radnor Township. Due to the proximity of the lines, passengers can reasonably transfer between the Radnor stations or the Villanova stations.

Depending on the time of day, Google Maps directs users to transfer at Radnor or Villanova. The actual distance between the Radnor NHSL Station and the Radnor Regional Rail Station is 0.5 miles or nine minutes of walking time. The path goes through the parking lot of the Radnor Financial Center.

Transferring between the two Villanova stations is a 0.4 mile distance or an eight minute walk.² Although the walk time between the Villanova stations is less, a pedestrian has to cross Lancaster Avenue. This may be undesirable because of the width and congestion of this roadway. A new pedestrian overpass is currently under construction near the Villanova NHSL Station.

² Google, 2016

Travel Demand Model

Results from DVRPC’s Travel Improvement Model (TIM 2.0), which was developed and calibrated for analyzing the proposed King of Prussia Rail Project alternatives, was another source used to estimate current transfer activity. The model assumed a 15-minute transfer time between the two stations, as a proxy for the travel time and the transfer penalty due to the preference riders have for not transferring. The model does not account for any additional monetary cost associated with transferring. Therefore, this method may overestimate the desirability of transferring between the two lines.

Using 2013 as the base year, the number of transfers estimated by the model was the highest of the three estimation methods used and about four times higher than was estimated using the 2011 On-Board Transit Survey. A higher number of transfers was calculated occurring from the NHSL to the Regional Rail station. The model also estimated that transfers were almost four times higher between the Radnor stations compared to between the Villanova stations. Model results are summarized in Table 3.1.

Table 3.1: Transfers Between Regional Rail and NHSL Stations in 2013 Base Year

2013	RADNOR		VILLANOVA	
	RR to NHSL	NHSL to RR	RR to NHSL	NHSL to RR
15-Minute Walk Time	59	85	17	22

Source: DVRPC, 2016

Each of the methods used for estimating transfers—observations, survey data, and model data—are approximations since actual transfer data is not currently available. The three estimates vary considerably. In order to compare current transfer activity with potential future activity, the ‘middle ground’ value from the On-Board Transit Survey, of approximately 30 transfers occurring between the lines per day, is assumed to be the most accurate reflection of transfers taking place.

Potential Transfers for Existing Trips

Next, the project team investigated transfer potential between the three SEPTA services in the study area, assuming the transfer becomes more convenient. The team looked at reasonable origin-destination pairs and compared the transit travel time across these modes, as well as the drive times. The team found that transferring at Radnor only becomes competitive with driving if the passenger is coming from, or going to, the end of the NHSL or the Paoli/Thorndale Regional Rail Line. There are two important factors that lead to fewer transfers.

1. Route Overlap: There are some places in the study area where transit routes overlap, making transfers less helpful in reducing travel times. SEPTA Bus Route 106 parallels the Paoli/Thorndale Line between Wynnewood and Paoli (Bus Route 105 parallels the line between Wynnewood and Rosemont). The NHSL operates within one mile of the Paoli/Thorndale Line for approximately five miles between Ardmore and Radnor stations. In order to have a one-seat ride, people often choose a longer trip time by walking or driving a short distance, rather than transfer.

2. Frequency of Service: There is higher frequency of service for some transit routes than others. The Radnor NHSL Station is an express stop and has much higher frequency than the Regional Rail or bus. This makes a transfer to the NHSL relatively convenient, but transfers to the other services less so.

Competitive Transit Trips

Analyzing potential trip pairs that would necessitate a transfer at Radnor, the project team found that longer distance transit trips provide the greatest travel time savings compared to driving. This relationship was found using a transit competitiveness ratio, which calculates a value for how competitive it is to take transit versus driving. A transit competitiveness ratio of one corresponds

Table 3.2: Most Transit-Competitive Origin-Destination Pairs

Origin	Destination	Drive Travel Time (minutes)	Transit Travel Time (minutes)	Drive Distance (miles)
Paoli (P/T Line)	69th Street Transportation Center (NHSL)	47.5	44	13.9
Paoli (P/T Line)	Township Line Road (NHSL)	40.5	40	12.8
Wynnewood (P/T Line)	DeKalb Street (NHSL)	33.5	35	9.4
Paoli (P/T Line)	Beechwood-Brookline (NHSL)	35.5	37	12.8
Berwyn (P/T Line)	69th Street Transportation Center (NHSL)	43	45	13.7
Thorndale (P/T Line)	Beechwood-Brookline (NHSL)	65	68	31.8

Source: Google Maps, 2016

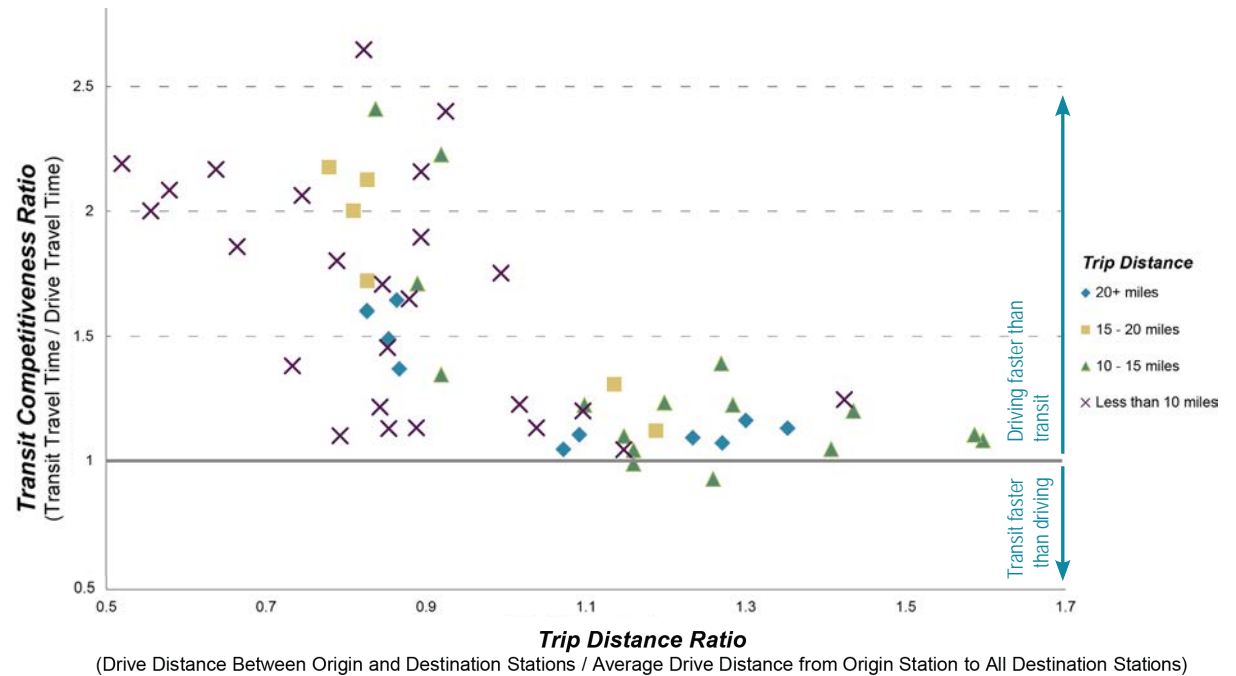
to equivalent driving and transit trip times; higher than one means that the trip takes longer by transit. All travel times were derived using Google Maps, based on a weekday departure during the morning commute.

In Figure 3.1, this ratio was graphed against trip distance for 57 origin-destination station pairs. In order to compare stations that vary greatly in distance from one another, the horizontal axis normalizes the distance between the stations by the average trip length from each origin station.

In only six origin-destination pairs is the travel time about the same whether the trip is made by driving or by transit (see Table 3.2). This suggests that few people would opt to travel by transit if they had access to a car. Further, this analysis does not account for last-mile challenges of transit that add a substantial penalty to the transit travel time across all trips analyzed. Transit-competitive trips are between the end of the Paoli/Thorndale Line and stations south of Radnor on the NHSL. Transit trips between stations east of Radnor on the Paoli/Thorndale Line and north of Radnor on the NHSL also have a transit competitiveness ratio close to one.

Based on this comparison, it is unlikely that there is strong latent demand for transferring between the Radnor stations for the locations that are currently served.

Figure 3.1: Transit Competitiveness Index



Source: DVRPC, 2016

Transit Demand Around Stations

Based on the previous analysis, trips with a transfer at Radnor are the most competitive with driving when they start near the end of the Regional Rail Line. So, to determine how impactful improvements to the ease of transferring could be, the project team examined current demographics (population and employment) near end-of-the-line stations.

Residential Population

Figure 3.2 shows the total occupied households in the regional study area. The population along the three transit routes is concentrated to the east, closer to Philadelphia. This suggests that there are fewer potential riders from the end-of-line Paoli/Thorndale Line stations, where many of the most competitive transit travel times originate. There are a substantial number of households around the Paoli/Thorndale Line stations in Lower Merion Township where transit trips originate that are competitive with driving. However, it is likely that many people do, or would opt to, travel directly to the NHSL for a one-seat ride, given the proximity of the NHSL to these communities.

Figure 3.2: Total Households by Municipality

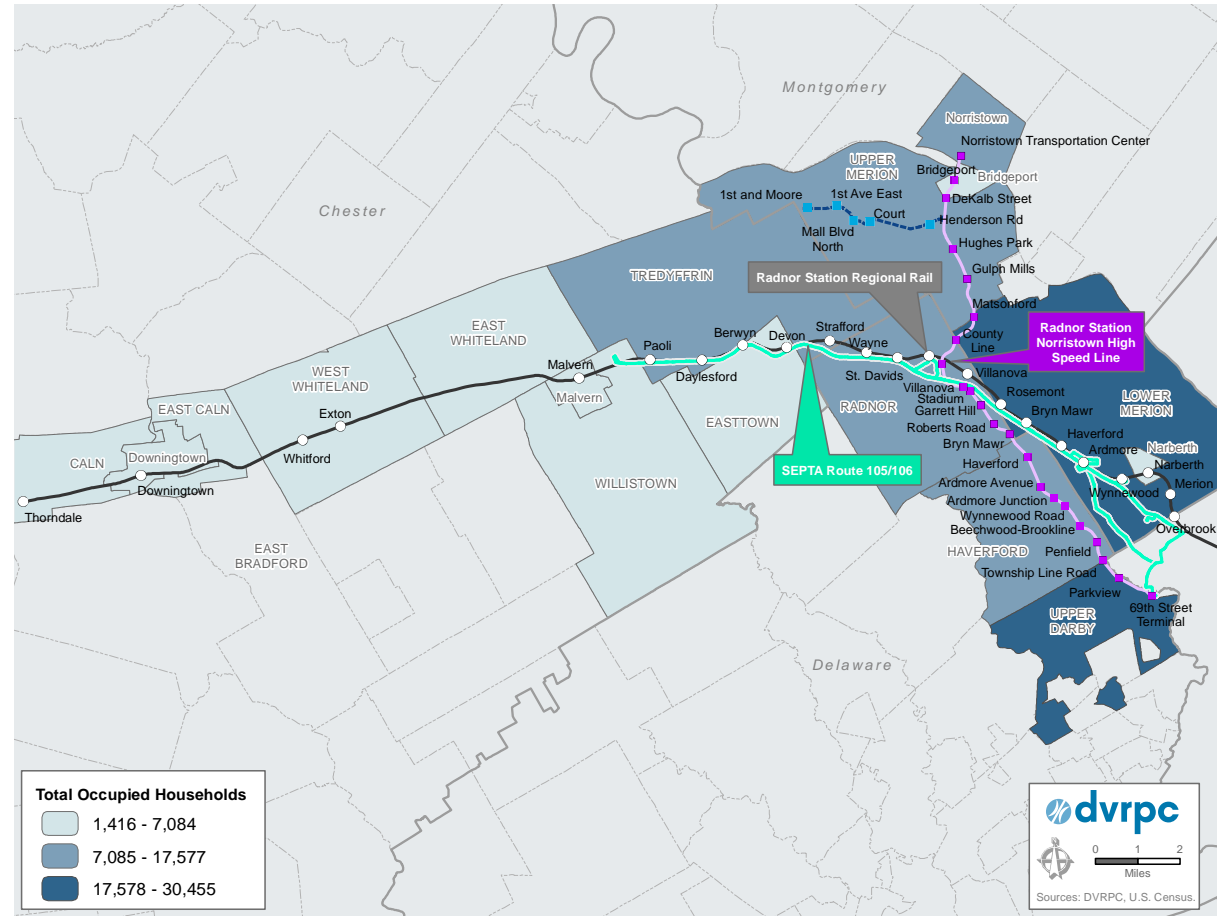
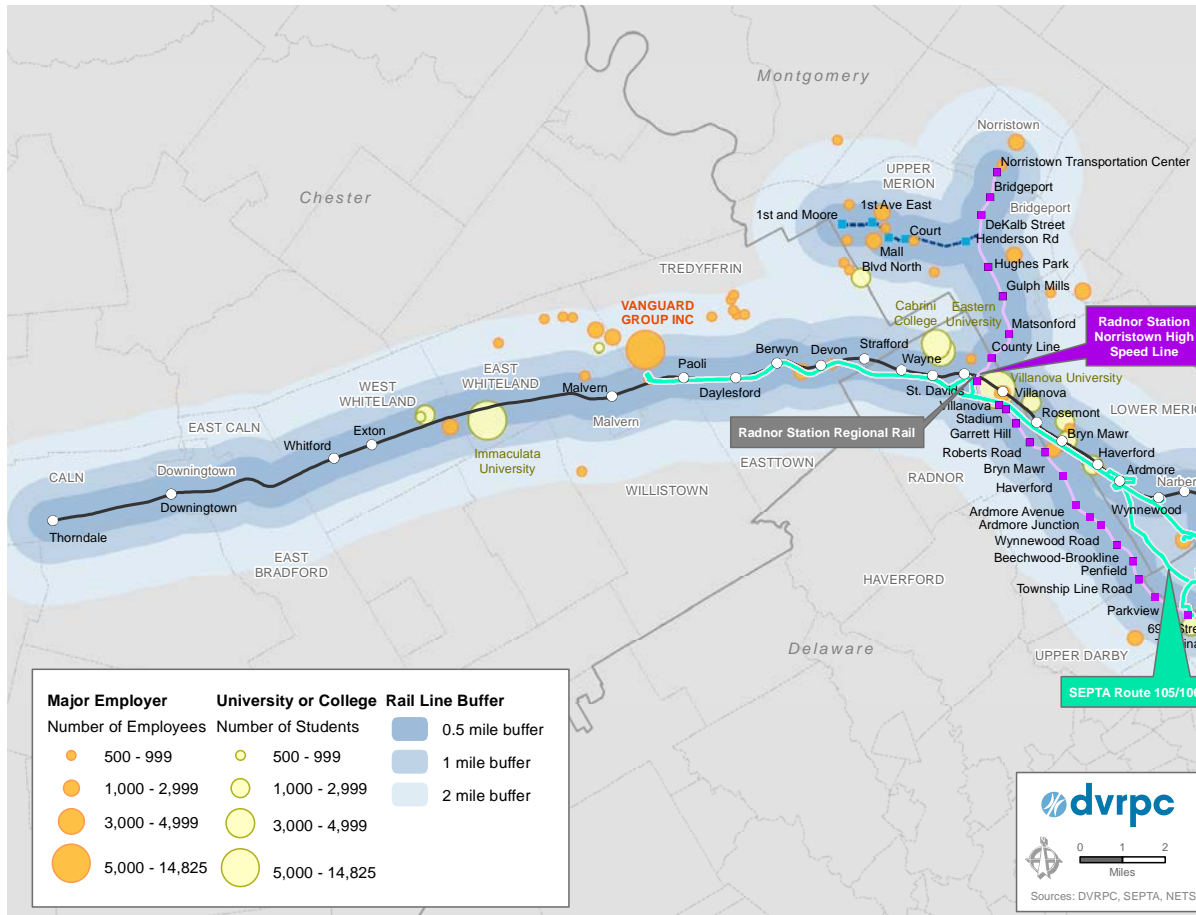


Figure 3.3: Activity Centers



Activity Centers

Figure 3.3 shows large employers and schools within two miles of the three transit routes. There is minimal potential for transfers between the Radnor stations based on this mapping because many of the largest activity centers are between stops or near both rail lines. Potential transfer activity could come from the following:

- Eastern Chester County could draw transit riders that transfer at Radnor because taking transit is competitive with driving. There could be particularly large demand for destinations around Paoli.
- Future transfer demand is plausible between Lower Merion Township stations along the Paoli/Thorndale Line and employment centers in Upper Merion Township on the NHSL. The majority of these destinations, however, will not be accessible until the completion of the King of Prussia Rail Project.

Commuter Travel in Study Area

Figure 3.4 shows journey-to-work flows between municipalities in the study area. The most substantial flows occur between Lower Merion and Upper Darby townships and between Lower Merion and Haverford townships. These flows constitute trips that are very unlikely to warrant a transfer at Radnor given the proximity of the municipalities. The work trips originating around western Paoli/Thorndale Line stations are substantially lower in volume and tend to end in Upper Merion Township, a destination where the transit travel time is not competitive with driving.

There is a significant flow of commuters between Lower and Upper Merion townships, spurred by the population and activity centers documented in these locations. A transfer at Radnor might be used for these trips once the King of Prussia extension of the NHSL is constructed, but currently, employment centers there are not accessible via any of the transit services that go through Radnor.

Overall, a look at journey-to-work data supports the two earlier findings: existing work trip flows are not competitive enough with driving to warrant a transfer, and most commuter origins are close enough to both rail lines that a transfer is not necessary.

Figure 3.4: Journey-to-Work Flows

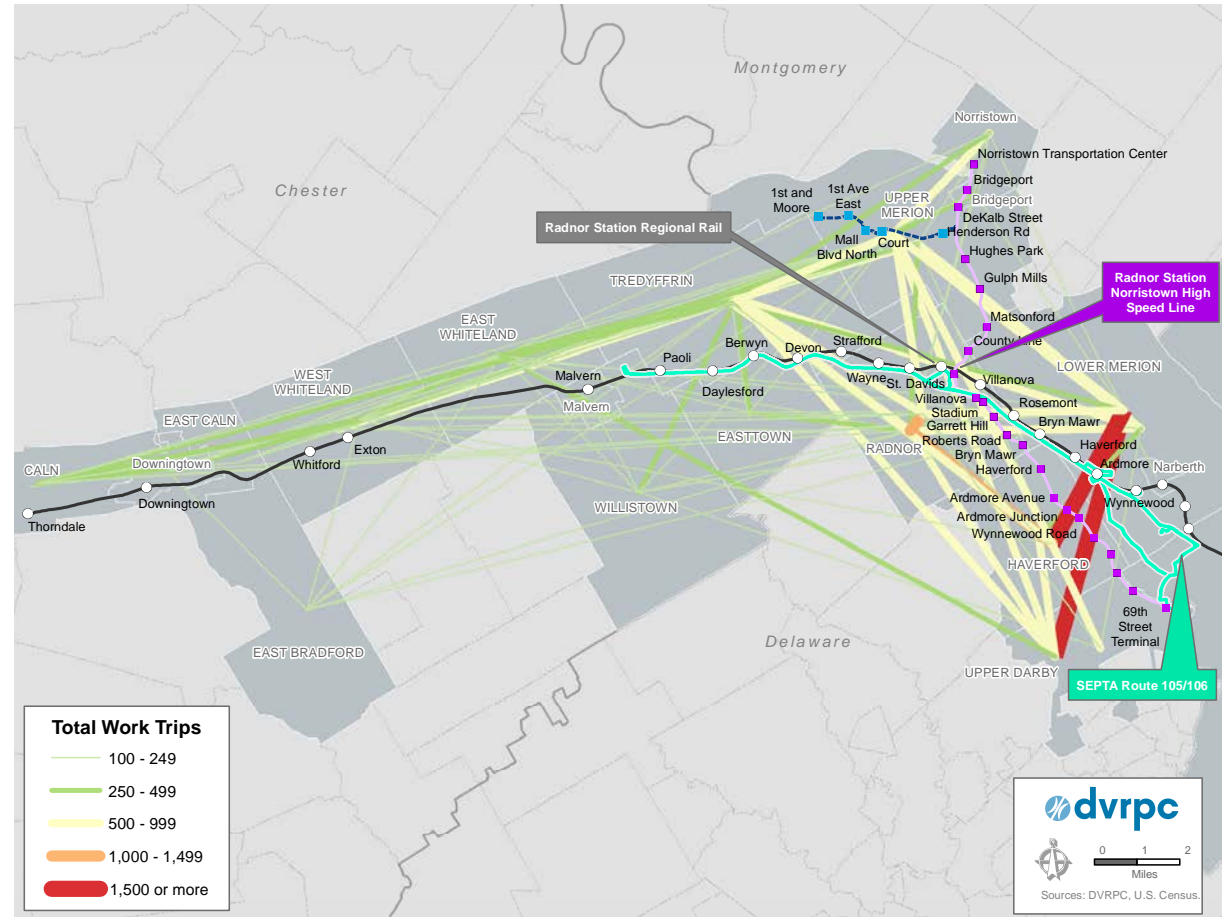
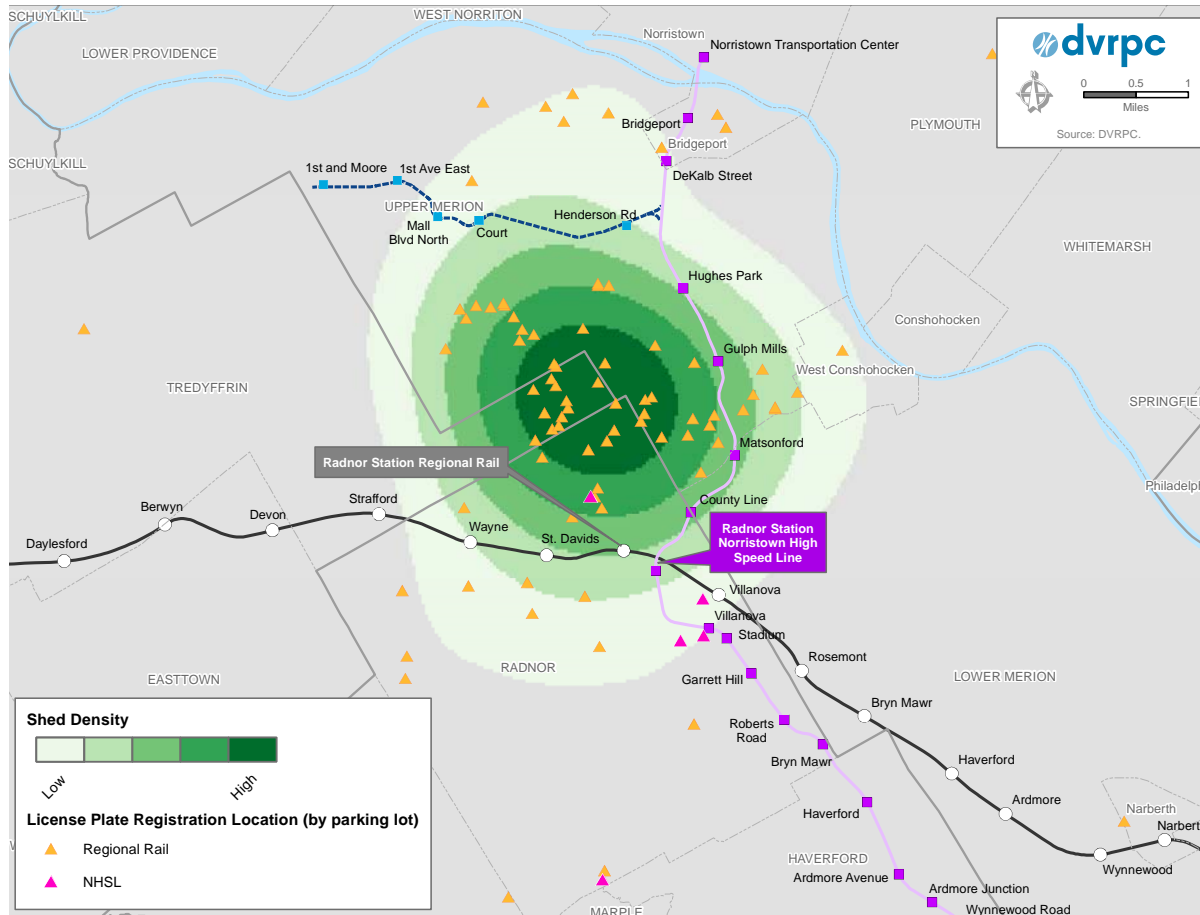


Figure 3.5: Station Shed Inventory for Radnor NHSL and Regional Rail Stations



Parking Survey

To help understand the existing and potential travel markets for service at the Radnor NHSL and Radnor Regional Rail stations, the project team completed a station shed inventory.

In partnership with SEPTA and PennDOT, DVRPC has a longstanding program to survey license plates of the vehicles that are parked at each station and map the addresses that are associated with those plates. By exploring the distribution of mapped records, the project team can get a sense of where the station's highest concentrations of park-and-ride customers originated from, as well as the typical drive-access distances. Figure 3.5 shows the license plate data collected at both parking lots in the study area.

The highest concentrations of vehicles are coming from just northwest of the study area in Upper Merion, Tredyffrin, and Radnor townships. This shows that passengers are choosing to access the Paoli/Thorndale Regional Rail line by car instead of riding the NHSL to Radnor and transferring to the Regional Rail.

Model Outputs: Effects of King of Prussia Rail Project

The project team adapted DVRPC’s Travel Improvement Model (TIM 2.0) developed to forecast the potential impacts of the King of Prussia Rail Project Recommended Locally Preferred Alternative to estimate the number of transfers between the Radnor stations as a result of the five-station extension of the NHSL, assuming a base year of 2013 and a build year of 2040.³

Despite the increased number of destinations accessible to riders of the NHSL, transfers between the two Radnor stations remain the same after construction of the King of Prussia Rail Project, assuming the stations are not consolidated and there is still a 15-minute transfer time between the two. This is Scenario 1 in Table 3.3.

To forecast the effects of a consolidated station, a 7-minute transfer time between the two Radnor stations (e.g., a lower transfer “penalty”) was modeled. This did have a significant effect on transfer activity, shown in Scenario 2 in Table 3.3. Transfers were estimated to be about six times higher in a consolidated station scenario. Demand remained higher for transfers from the NHSL station to the Regional Rail station and

³King of Prussia Rail Project, Tier 3 Screening. <http://www.kingofprussiarail.com/tier3.html>

Table 3.3: Transfers Between Regional Rail and NHSL Stations in 2040 Model Year

	RADNOR			VILLANOVA		
		RR to NHSL	NHSL to RR		RR to NHSL	NHSL to RR
Scenario 1	15-Minute Transfer Time	66	72	15-Minute Transfer Time	20	30
Scenario 2	7-Minute Transfer Time	308	466	15-Minute Transfer Time	14	11
Scenario 3	15-Minute Transfer Time	46	60	7-Minute Transfer Time	126	131

Source: DVRPC, 2016

was about 50 percent higher compared to transfers from Regional Rail to the NHSL. However, since the model likely estimates current transfer activity four times higher than the assumed actual activity, as shown in the previous section, it is also likely overestimating future transfer demand by a similar factor. Therefore, transfers at a consolidated station might increase to about 200 transfers a day.

In a third scenario, the project team tested whether there would be greater transfer demand for a consolidated Radnor station versus a consolidated Villanova station in 2040 by modeling a scenario where the Villanova stations are consolidated while the Radnor stations are not. The model estimated that a consolidated Radnor station would generate three times as many transfers as a

consolidated Villanova station.

The modeling of 2040, assuming the completion of the King of Prussia Rail Project, suggests that there may be some future demand for a consolidated Radnor station.

Challenges of Station Consolidation

While the stations are close to each other, there is a difference in elevation and curves in the rail right-of-way. This would make consolidating the two Radnor stations into one, or creating an accessible connection between them, costly. Furthermore, given the uncertainty of modeling roughly 20 years into the future and the difficulty of constructing a consolidated station, the question should be revisited following the construction of the KOP extension, if there remains interest in

a consolidated station, and actual transfers increase.

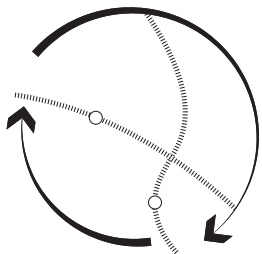
Conclusion

Based on observations, data from the DVRPC On-Board Transit Survey, and a modeling analysis, very few transfers were found to be taking place between the Radnor NHSL and Radnor Regional Rail stations, with uncertain potential for additional future demand. Additionally, given the location of residential populations, activity centers, and the resultant commuting patterns, only a few transit trips that include the transfer are time competitive compared to driving. Compounding these factors, the sloped topography and substantial costs to construct a consolidated station make it difficult to justify the investment. However, more cost-effective improvements could still significantly improve the connection between the rail stations. *Chapter 4: Recommendations* lists improvements to create a more fluid connection.



The view from the NHSL Radnor Station of where the NHSL tracks curve underneath the Regional Rail tracks.

Source: DVRPC, 2016



Chapter 4

Recommendations

This chapter outlines short-term, medium-term, and long-term recommendations, short of station consolidation, to create a more comfortable, perceptible, and intuitive connection between the two Radnor stations. These recommendations are categorized by two main strategies: 1) installing wayfinding and 2) improving multi-modal facilities. Possible project partners are proposed for each. Additionally, communicating the transfer connection with a public outreach campaign to a wider audience could increase transfers.

Station consolidation should be reexamined at a later date if and when the King of Prussia Rail Project is complete and more data is available.

- **Improving Wayfinding:** Wayfinding alerts people to the transfer possibility and marks the route between the Radnor stations. It should have a consistent style and identity that is specific to the area. Signage and maps should be installed at both the rail stations and bus stops, and should indicate the transfer opportunities in the area around the stations by marking the sidewalks and pavement that connect the transit modes.

- **Improving Multi-modal Facilities**

These improvements increase the safety and comfort of people walking, biking, and taking the bus to the Radnor stations. For the study area, this includes adding bus stop loading pads and shelters, bicycle parking at the rail stations, and crosswalks and curb ramps that allow for safer access between these facilities. Additionally, painted and planted medians would calm traffic where the Radnor Township Trail, Route 106 bus stop, and NHSL Radnor Station all converge, increasing safety for all modes.

Figure 4.1 shows how the sidewalk connection in front of the Radnor Financial Center along King of Prussia Road could be improved. Wayfinding in the form of SEPTA's logo can be incorporated into the pavement, in addition to a high-visibility crosswalk and curb ramps that create a more accessible and safe connection to the Route 106 bus stop. A new bus loading pad would improve access for riders, and signage would inform riders of how to connect to the nearby rail stations.

Many of the strategies identified in this chapter are also recommended in DVRPC's 2011 plan, *US 30 (Lancaster Avenue) Corridor Study: Creating Linkages and Connecting Communities*.

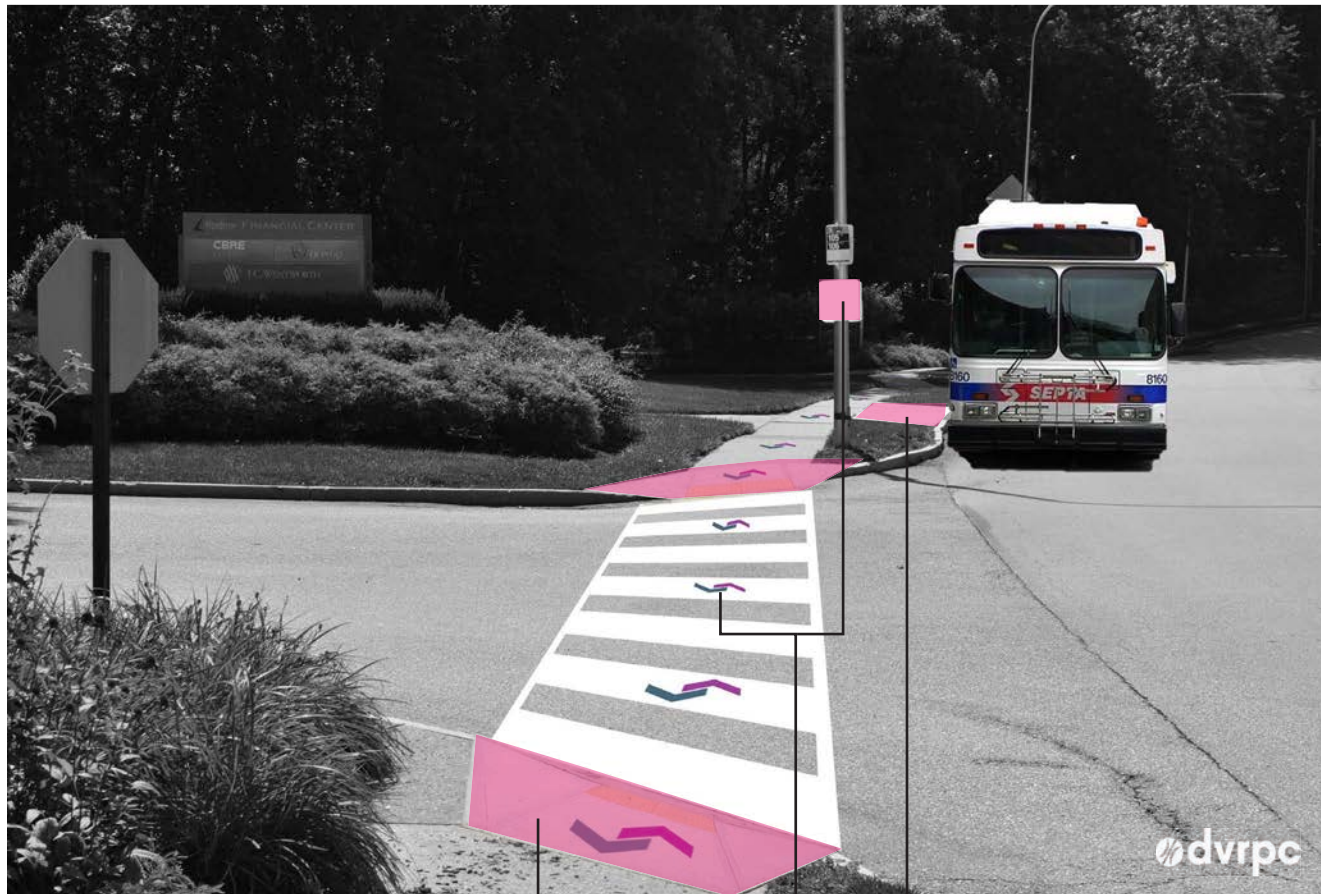


Walk! Philadelphia wayfinding signage indicates the location of nearby neighborhoods and points of interest.
Source: Andreas Olsson - Flickr Creative Commons, 2010



This brick pathway helps visitors navigate along the Boston Freedom Trail.
Source: Wikimedia Commons, 2006

Figure 4.1: Conceptual Bus Stop and Sidewalk Improvements at Radnor Financial Center



Curb ramps and crosswalk

Wayfinding between stations

Bus stop loading pad

Source: DVRPC, 2017

Short-Term (1-5 years)

These recommendations are low cost, require no major construction, and can be implemented in 1-5 years.

Wayfinding

- **Signage:** At the stations and along King of Prussia Road signage can provide directional and distance indicators for a variety of destinations, including transit stations, schools, and business parks. Signage should be visible to all travelers, including pedestrians, bicyclists, and people in vehicles.

Possible project partners: Radnor Township and property owners.

- **Maps:** Installing station area maps at both Radnor stations and at bus stops would help highlight the route between, and destinations around the stations.

Possible project partners: Radnor Township and SEPTA.

- **Public Education Campaign:** SEPTA should consider a public information campaign on the availability of transfer opportunities between the NHSL and the Paoli/Thorndale Line at Radnor. The campaign could take a variety of forms. One option is to capitalize on the public health benefits of walking to highlight the

positive aspects of a short walk between stations. Other station pairs throughout SEPTA's network offer a similar "short walk transfer" opportunity and could be folded into a system-wide campaign.

Possible project partner: SEPTA.

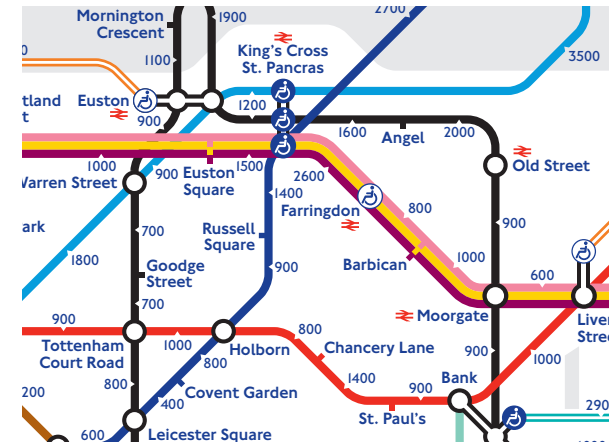
- **Pavement and Sidewalk Treatment:** To indicate where pedestrians should walk to transfer between stations, pavement and sidewalk treatments (see Figure 4.2, which includes both short- and medium-term recommendations) can increase safety and visibility of the walking route.

Possible project partners: Radnor Township, SEPTA, and property owners.

Scheduling

- **Align Schedules:** The rail schedules should be coordinated with each other, if possible, so that the Regional Rail arrivals coincide with a NHSL arrival in about 15-20 minutes, and vice versa, especially during off-peak times when headways are longer. Additionally, instances in which passengers transferring from buses just miss their train by a couple minutes should be minimized.

Possible project partner: SEPTA.



Approximate steps, based on a moderate walking speed of 100 steps per minute.

© Transport for London

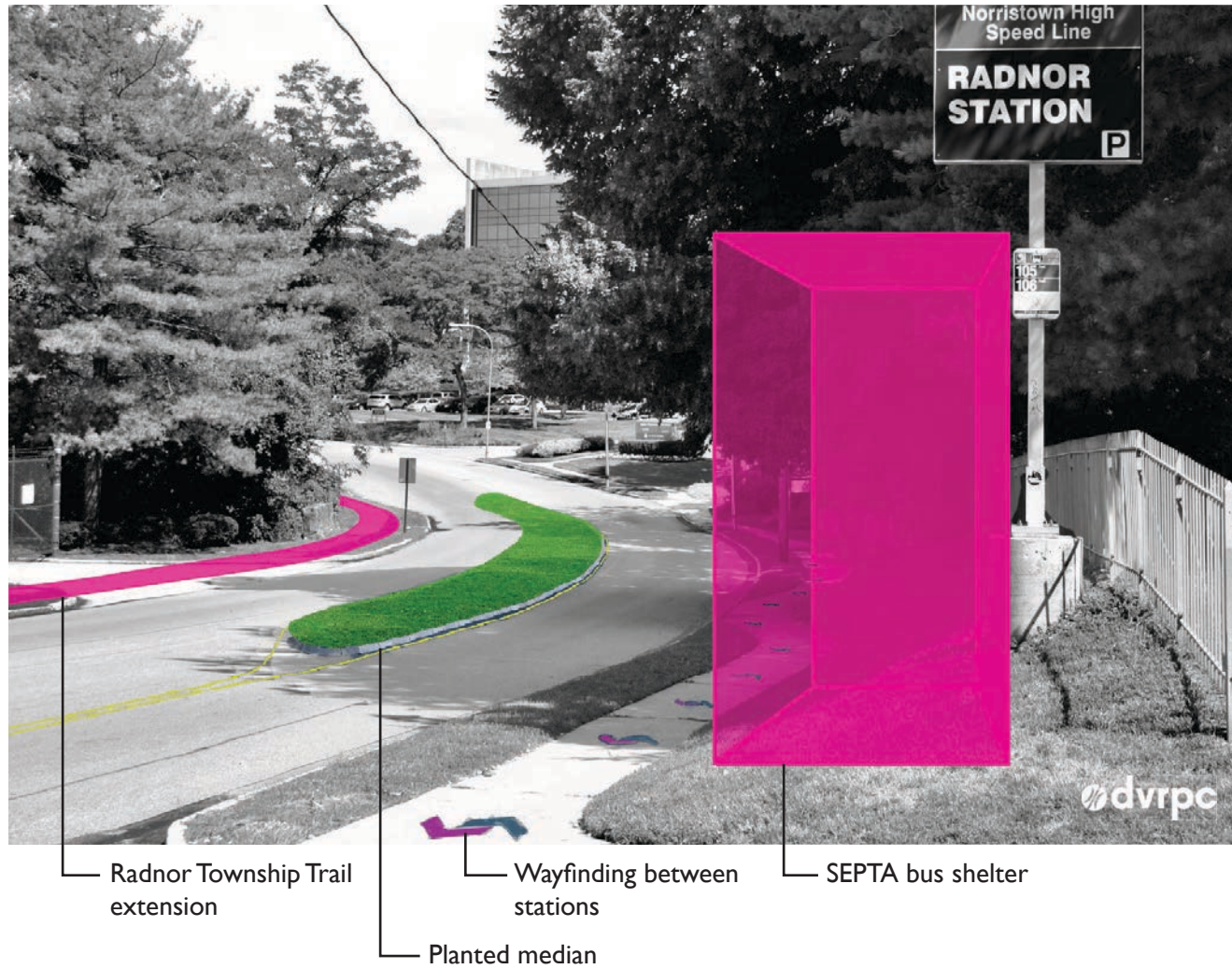


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Insets of Transport for London's "Walking Steps Tube Map" showing walking distance between stations.

Source: Transport for London, 2016

Figure 4.2: Conceptual Bus Shelter near NHSL Station and Transfer Route Wayfinding



Source: DVRPC, 2017

Facilities Upgrades

- **Bus Stops:** SEPTA Bus Route 106 has two bus stops along King of Prussia Road between the Radnor stations. Currently, more people transfer from the Radnor Station (NHSL) to local bus service than transfer to Regional Rail. Informational signage indicating the route map, schedule, and transfer information for the nearby rail stations should be installed at all three bus stops along King of Prussia Road between the stations. More substantial improvements should be planned for medium-term implementation and are described in the next section.

Possible project partners: Radnor Township, property owners, and SEPTA.

- **Bicycle Infrastructure:** Improved bicycle facilities are already planned for the area through the new Radnor Township Trail (see *Chapter 2: Existing Conditions*). To ensure convenient access to transit, bike parking should be provided at stations, along with signage indicating local connections to the Radnor Township Trail and bicycle-friendly routes.

Possible project partners: Radnor Township and SEPTA.

- **Parking:** SEPTA should consider improvements to automobile access to the Radnor Station (NHSL). Potential improvements could include introducing paid parking and increasing parking violation enforcement to ensure that people who park there are using the station.

Possible project partner: SEPTA.

- **Painted and Planted Median:** To calm traffic in front of the NHSL station and Route 106 bus stop, a painted median could be installed in a portion of the left-turn lane on King of Prussia Road, increasing safety for people walking and biking to transit (see Figures 4.2 and 4.4).

Possible project partner: PennDOT.



Bike parking at Swarthmore Station served by the Media/Elwyn Line Regional Rail.

Source: SEPTA, 2015

Medium-Term (5-10 years)

These recommendations are higher cost, require construction, and can be implemented in 5-10 years.

Wayfinding

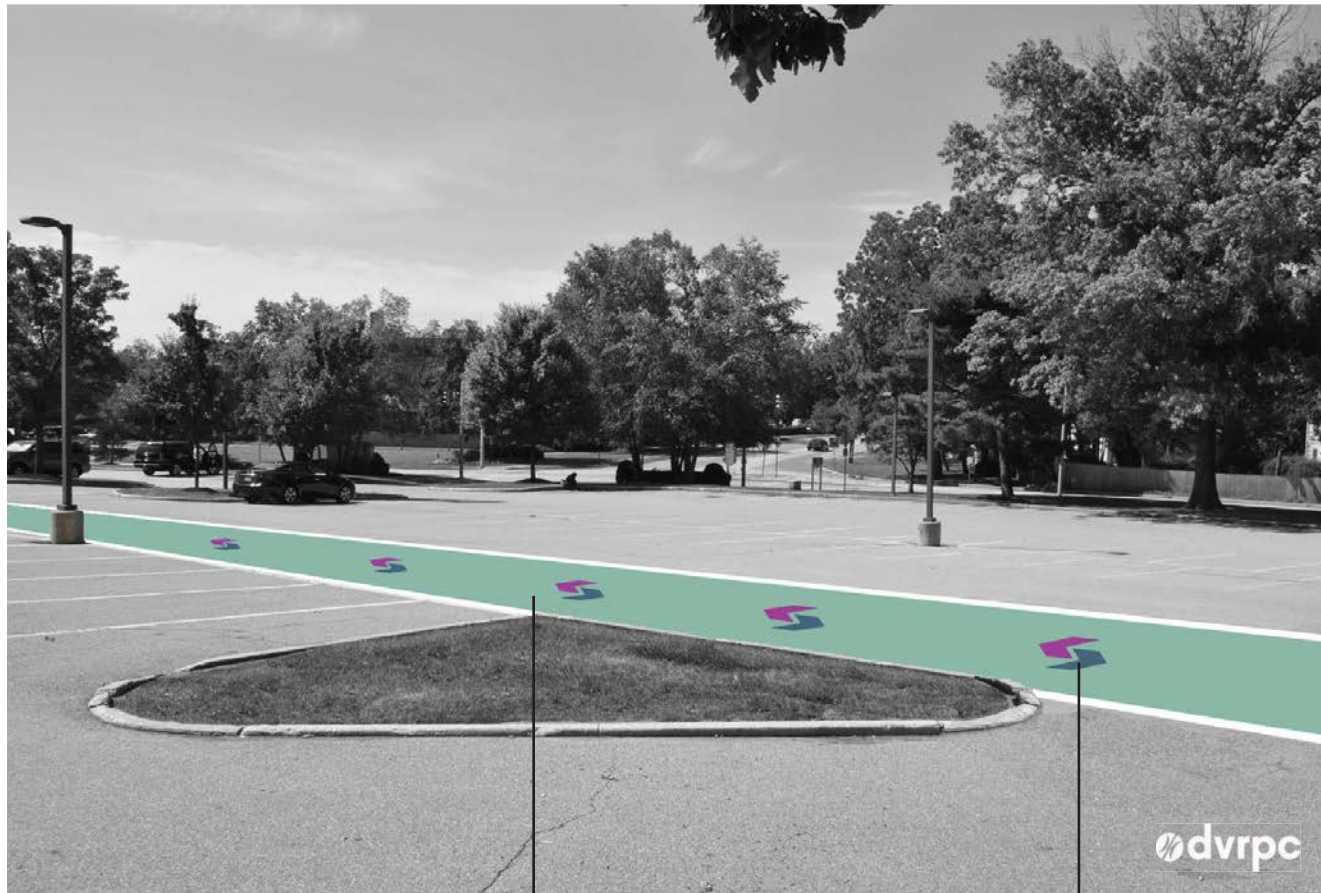
- **Formalized Shortcuts:** SEPTA and municipal authorities could open discussions with relevant property owners to formalize space for passenger use, including pedestrian paths and other pick-up/drop-off use. The Radnor stations, for instance, would benefit from a formalized pedestrian path traveling across the Radnor Financial Center parking lot. Distinctive pedestrian walkways through the large parking fields could create a safe and effective connection (see Figure 4.3).

Possible project partners: SEPTA, Radnor Township, and property owners.

- **Real-Time Information:** Installing real-time arrival information at stations would increase rider convenience and could aid transfers with information on connecting services.

Possible project partner: SEPTA.

Figure 4.3: Conceptual Pedestrian Path with Transfer Route through Radnor Financial Center Parking Lot



Pavement treatment of pedestrian path

Wayfinding between stations

Source: DVRPC, 2017

Facilities Upgrades

- **Pedestrian Infrastructure:** To incentivize more activity to and between the Radnor business parks and stations, Radnor Township and PennDOT should invest in facilities that enhance safety and comfort, such as:
 - » Wider sidewalks (5- to 6-foot path, 5- to 10-foot buffer) should be installed.
 - » Sidewalks should include ADA-compliant curb ramps.
 - » Intersections should have high visibility crosswalks (see Figure 4.4).
 - » At the station entrances, high visibility mid-block crossings should be installed, where appropriate.
 - » Countdown pedestrian signals should be installed as part of any signal or intersection project.
 - » Right-turn on red prohibition should be implemented where appropriate.
 - » Pedestrian-scale lighting, landscaping, and seating should be installed.

Possible project partners: PennDOT and Radnor Township.

- **Bus Stops:** At a minimum, bus stops along King of Prussia Road should have a loading pad connected to a pedestrian path with an unobstructed stop area. In addition, bus stops should be considered for additional amenities, including: transit shelters; stop area seating; and lighting. These improvements are defined in the *SEPTA Bus Stop Design Guidelines*.

Possible project partners: Radnor Township, property owners, and SEPTA.

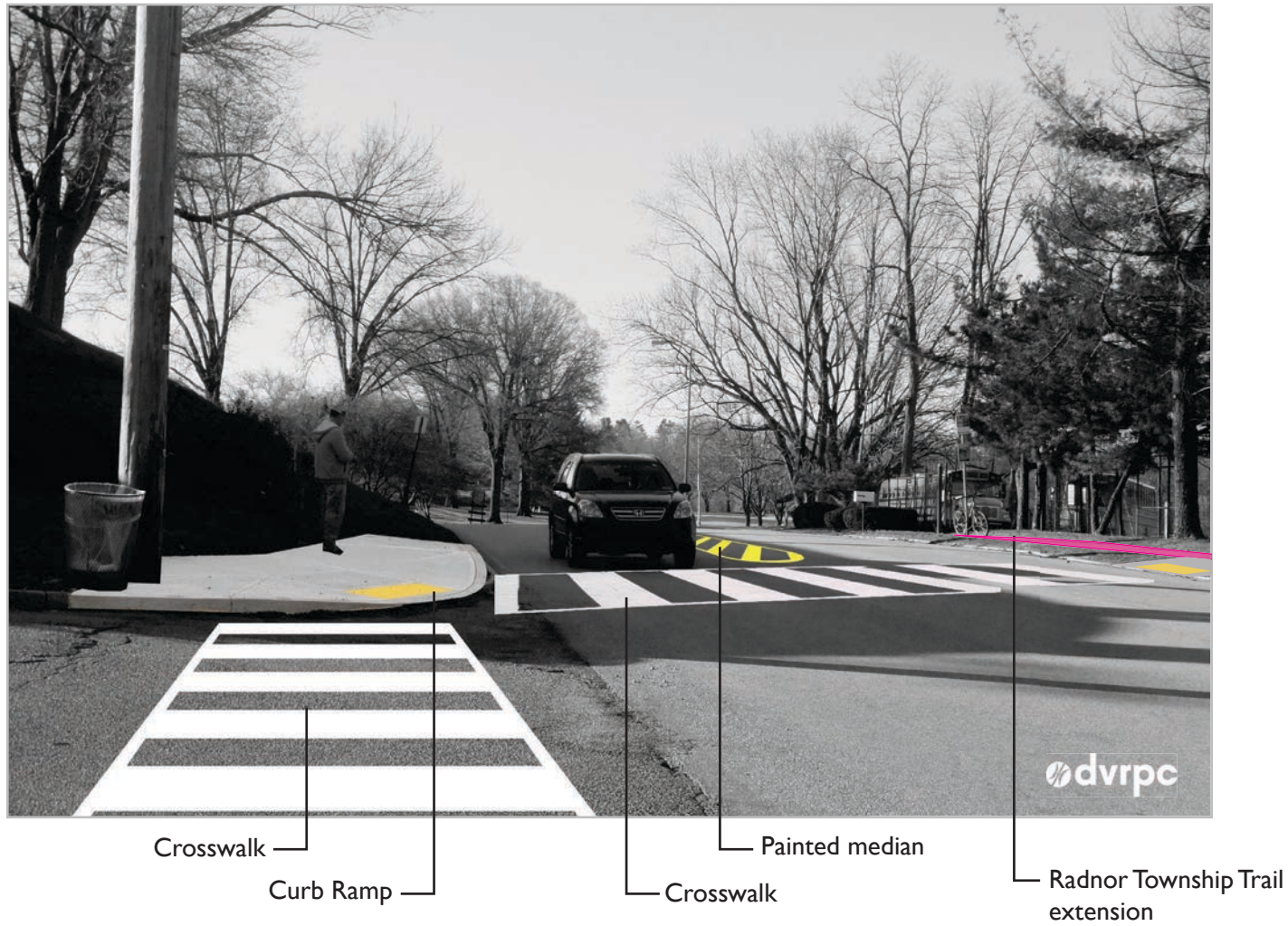
- **Planted Median:** A planted median on King of Prussia Road would reduce speeds and improve safety for all modes, and allow for safer left-turns at the NHSL driveway.

Possible project partners: PennDOT and Radnor Township.

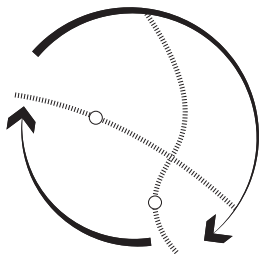
Long-Term (10 years+)

Pending the outcome of the proposed King of Prussia Rail Project and related land use changes, the Radnor stations consolidation project may need to be reevaluated in the long-term. By pursuing the strategies outlined here, comfort for passengers making transfers now will be improved and more transfers may begin to occur between the stations. An increase in the incidence of transfers between the stations is necessary to justify the expense of station consolidation at Radnor.

Figure 4.4: Conceptual Pedestrian Connection from NHSL Station to Radnor Township Trail



Source: DVRPC, 2017



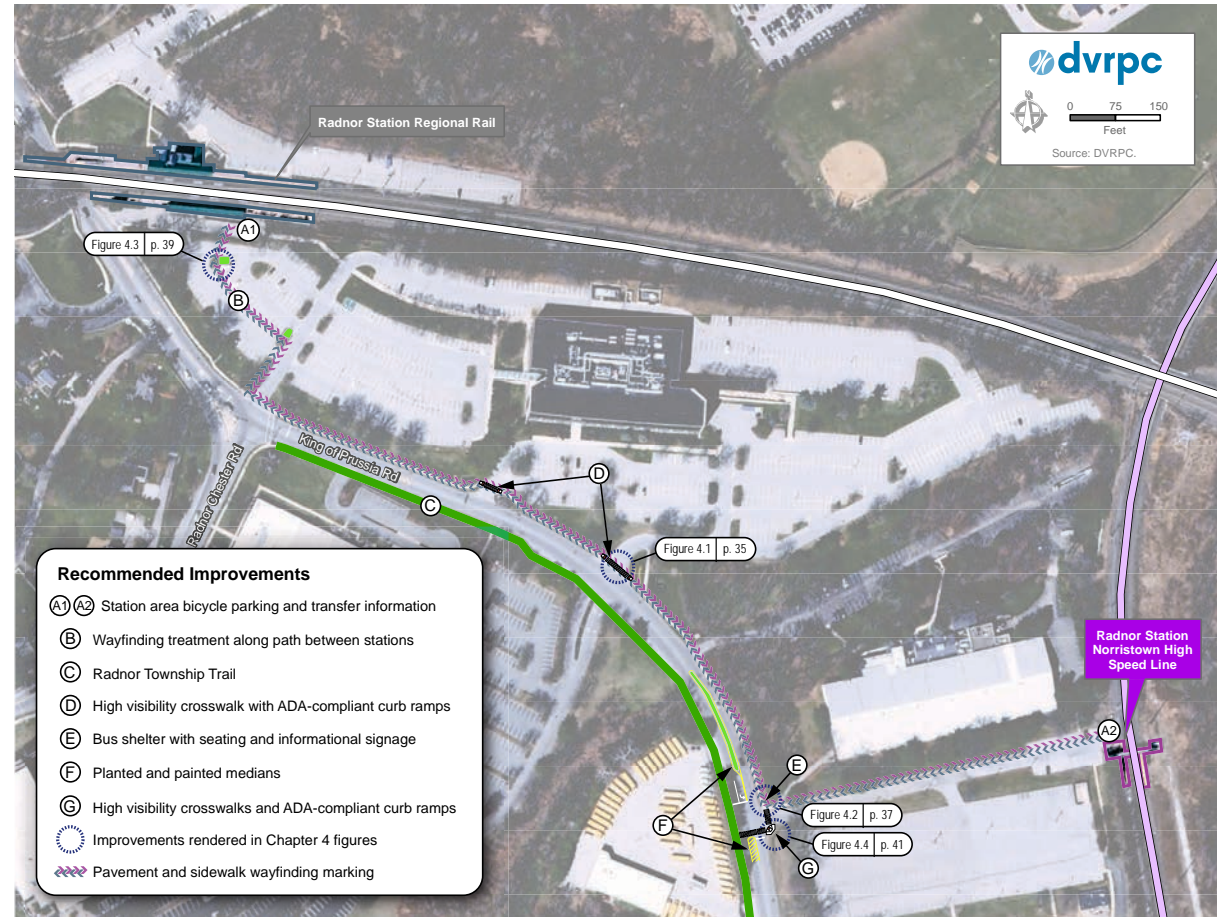
Chapter 5

Conclusion

Through strategies that combine coordinated wayfinding with improvements to multi-modal facilities, King of Prussia Road can serve as a more distinctive and intuitive connection between the Radnor stations, while being an anchor of a more walkable area for Radnor businesses. Ensuring consistent branding and following best practices for visibility, safety, and pedestrian comfort are key elements of successful implementation. The popularity of bus transfers warrants investments to improve bus stops and facilities to access them. Figure 5.1 shows where the DVRPC project team has made its individual recommendations, which are described and rendered in figures in *Chapter 4: Recommendations*.

Station consolidation should be set aside for the time-being. As the observations, analysis, and demand assessment in the previous chapters demonstrated, the low transfer demand does not warrant pursuing the expensive and difficult station consolidation and instead existing passengers will benefit most from the short- and medium-term recommendations. If transfers increase between the Radnor stations over the long-term—particularly after the completion of the King of Prussia Rail Project—station consolidation could be reconsidered.

Figure 5.1: Map of Study Area Recommendations



Source: DVRPC, 2017

Radnor Station Connectivity

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ABSTRACT

This project evaluated the feasibility and benefits of consolidating two rail stations to improve the connection between the Paoli/Thorndale Regional Rail Line and the Norristown High Speed Line (NHSL) in Radnor Township, Delaware County. The project team concluded that current and future demand of transfers between the two rail stations is too low to justify the high capital cost for station consolidation. However, the project team recommends implementing coordinated wayfinding signage and pavement treatments along with improvements to multi-modal facilities to create a more perceptible, intuitive, and comfortable connection between the two Radnor stations.

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