

Reading to Philadelphia Passenger Rail Analysis

Final Report

December 2020



prepared for:



prepared by:



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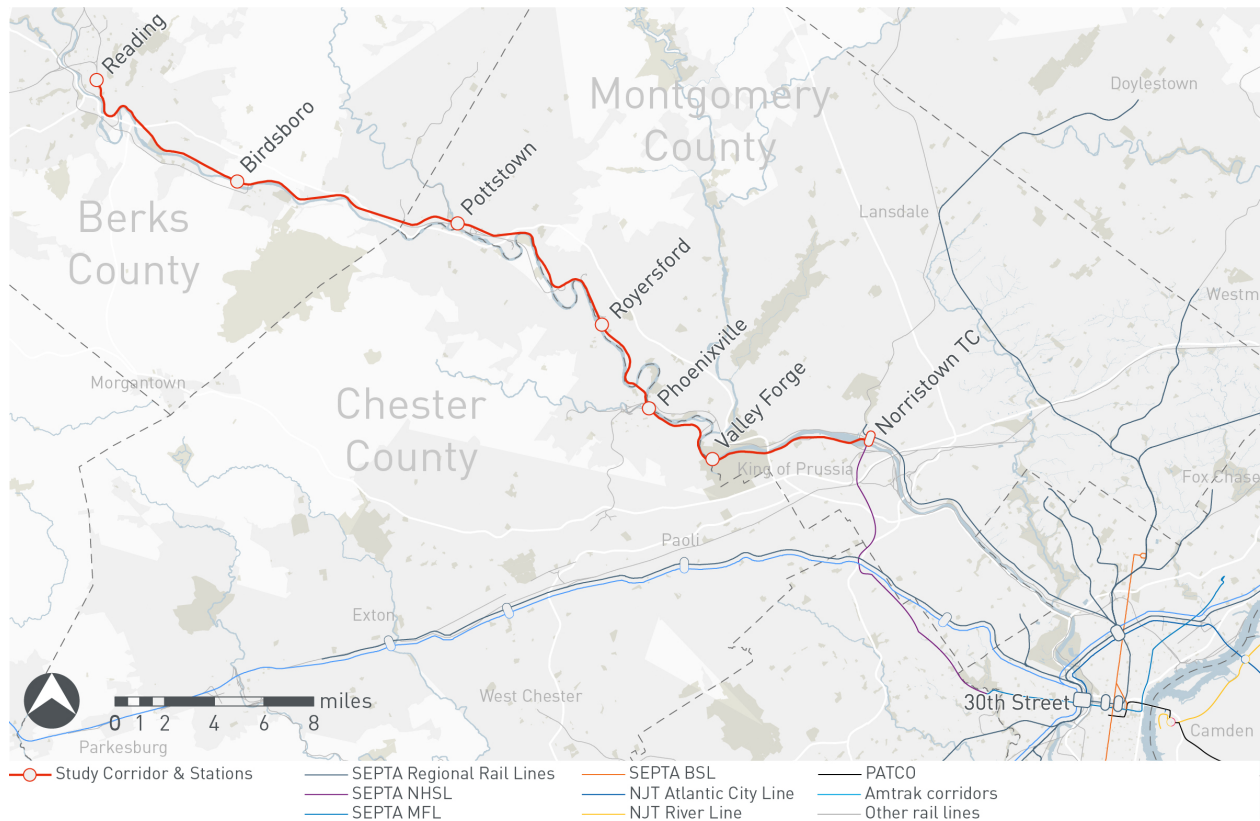
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EXECUTIVE SUMMARY

PennDOT initiated the Reading to Philadelphia Passenger Rail Analysis to examine the critical path necessary to restore passenger rail service between Philadelphia and Reading along the historic rail corridor connecting Norristown to Reading. The analysis explored feasible service alternatives, capital improvements, and next steps required to initiate service. Several assumptions were made at the study's onset including:

- Proposed service corridor includes SEPTA's Main Line from Center City Philadelphia, SEPTA's Norristown Line to Norristown, and Norfolk Southern's Schuylkill River Bridge and Harrisburg Line to Reading.
- Proposed station stops in six markets: Valley Forge, Phoenixville, Royersford, Pottstown, Birdsboro, and Reading (see Figure 1) at the historic station locations. Stations are completely ADA-compliant and include train length high-level platforms.
- Preference for a direct Reading-to-Philadelphia one-seat ride using dual powered equipment. The preferred basic service plan features nine weekday roundtrips requiring the operation of three revenue consists during peak periods.
- Fast and reliable service competitive with auto trip times between Philadelphia, Reading, and intermediate markets along the corridor.
- Infrastructure capacity investments that enable reliable and sustainable service including potential future passenger and/or freight growth, focusing on the Norristown-to-Reading portion of the corridor. This includes the expansion of critical capacity chokepoints such as Norristown Transportation Center and the Black Rock Tunnel. Infrastructure investments on the SEPTA portion of the corridor would require further study to address potential congestion, especially on SEPTA's Main Line between Center City and 16th Street Junction.
- SEPTA is the assumed operator for this analysis considering the agency's existing Regional Rail service in the Philadelphia region and their ownership of the Norristown Line as well as having a lower cost structure in comparison to Amtrak. However, the service provider issue can be reconsidered in the future as planning efforts advance.

Figure 1. Proposed Rail Service Corridor to Reading



The Reading to Philadelphia Passenger Rail Analysis was prepared during the COVID-19 pandemic and ridership data was estimated based on pre-COVID commute data. While COVID-19 may have long-term impacts on work-from-home rates and the desire of commuters to use transit, the ridership growth rate used from the past 10 years captures the 2008 recession and subsequent recovery years which may at least partially align with the current economic and societal crisis resulting from COVID-19. For high level estimates examining a relatively near-term horizon year (i.e., 2030), it seems reasonable to base growth on historic trends.

Ridership was estimated based on weekday ridership demand in the analysis year of 2030 and is expected to range from a low of approximately 2,300 daily riders for service with a transfer in Norristown to a possible high of approximately 6,400 daily riders for a single-seat ride into Philadelphia. These ridership forecasts do not include passengers presently using the existing Norristown-Philadelphia corridor service (SEPTA's Manayunk-Norristown Line), which had daily ridership of 9,800 in 2018. The estimated ridership demand is comparable to other relatively new commuter rail

services such as the Northstar in Minnesota (2,700 daily ridership) and Sonoma-Marín Area Rail Transit in California (2,500 daily ridership).¹

Implementing passenger rail service on the corridor will require nuanced decisions addressing a multitude of factors, such as land acquisition for stations, equipment procurement, and the siting of one or more maintenance facilities. Some of the over-arching challenges to activating rail service to Reading include:

The corridor from Reading to Norristown is owned and actively used by Norfolk Southern (NS). NS will need to be a willing party to negotiate access to the corridor, associated fees, and required capacity and capital improvements necessary to accommodate passenger operations.

The corridor from Reading to Norristown is not electrified, complicating decisions around what type of service is provided and what equipment is needed. For single-seat service, the corridor would either need to be electrified from Norristown to Reading or dual-power locomotives would need to be used. However, preliminary information from SEPTA indicates dual-mode equipment may exceed their network's weight limitations. Additionally, fire and life safety analysis of the Center City tunnel may be required to ensure the safe operation of dual-powered locomotives. Alternatively, diesel equipment could run on the Reading corridor providing a transfer connection to existing electric service in Norristown.

SEPTA's existing Norristown to Philadelphia corridor is heavily utilized and may not be able to accommodate additional trains under current operating and infrastructure conditions. The Norristown corridor serves 55 daily trains and joins SEPTA's Main Line at 16th Street Junction, on which 350 daily scheduled trains operate. The scheduling and implementation of additional service will require coordination with SEPTA to understand necessary capacity and/or service improvements.

Critical decisions around these issues will have cascading effects on the type of service provided, the equipment needed, staffing, where maintenance facilities can be sited, and the level of infrastructure investment required. For example, if transfer service is provided, then less expensive diesel

¹ National Transit Database: 2018 Sonoma-Marín Area Rail Transit District Agency Profile.

equipment could be procured and capacity improvements at 16th Street Junction may be avoided.

Numerous iterations of service, equipment, and infrastructure packages would result from these different choices. For illustrative purposes, a higher level of through service might offer nine daily roundtrips between Reading and Philadelphia. Dual-mode equipment for that service is estimated to cost approximately \$145 M (FY 2020). Building a dedicated third track from Reading to Norristown is estimated to cost approximately \$510 M. A dedicated third track would accommodate new station facilities featuring ADA-compliant high-level platforms estimated to cost approximately \$53 M, upgrades to Norristown Transportation Center (NTC) are approximately \$36 M, while required maintenance and storage facilities would be an additional \$74 M. The total capital costs are estimated to cost approximately \$818 M. It should be noted that a less costly, but still viable option for track work was developed at \$308 M, providing a total capital cost of \$616 M. Given the current posture by Norfolk Southern towards the project, the costlier track work option that preserved existing freight capacity was identified to represent likely infrastructure needs. The final track infrastructure improvements necessary must be determined by Norfolk Southern and will be heavily influenced by the negotiations process. The annual O&M costs are estimated at approximately \$25 M (2020\$). These estimated costs do not include land acquisition or other infrastructure investments that might be required on the SEPTA-owned portion of the corridor.

It may be possible to offer service at lower capital cost by implementing a transfer service option utilizing diesel equipment between Reading and Norristown, then at NTC passengers transfer to an existing SEPTA train. However, it is assumed that single-seat service is the more desirable service option.

Continued efforts to establish passenger rail service to Reading will require more detailed studies of ridership potential, verification of station locations, the development of a service plan, and clarity on total infrastructure needs. However, even more critical to advancing the project will be securing owner support (NS), the identification of an operator, and a financial plan that likely includes dedicated funding.

An illustrative process for advancing passenger rail service to implementation is identified in Figure 2. The first five steps indicate pivotal

decision points where outcomes can determine the likelihood of the project advancing. The critical steps include:

1. Feasibility Assessment of New Service

A detailed infrastructure analysis and service feasibility assessment will need to be completed. The project sponsor must identify a service operator and obtain their commitment to the project. For the purposes of this study, SEPTA was identified as a potential service operator considering the SEPTA-owned Philadelphia to Norristown portion of the corridor and existing Regional Rail operations provided by SEPTA in the Philadelphia metropolitan area. The project sponsor would need to formally identify and confirm the service operator before advancing planning efforts.

2. Operational Feasibility Study by NS

The project sponsor would provide funds to NS to enable an assessment of the capacity for passenger trains and freight trains to operate on the NS network without delay or impact on their corridor and conform to other needs to be discussed in coordination with NS. The project sponsor will need to obtain preliminary support from NS for the project to advance. The project sponsor would incorporate the findings from the NS operational study into their feasibility assessment.

3. Obtain Local Support and Determine Funding Sources

Several funding sources will likely be required to provide construction funding and continued operational support and subsidy. This can be a lengthy process which impacts the overall project schedule.

4. Preparation of Planning and Environmental Documents

The preparation of project plans and environmental clearances will enable subsequent design and construction work to proceed and can be a requirement to seek public funding.

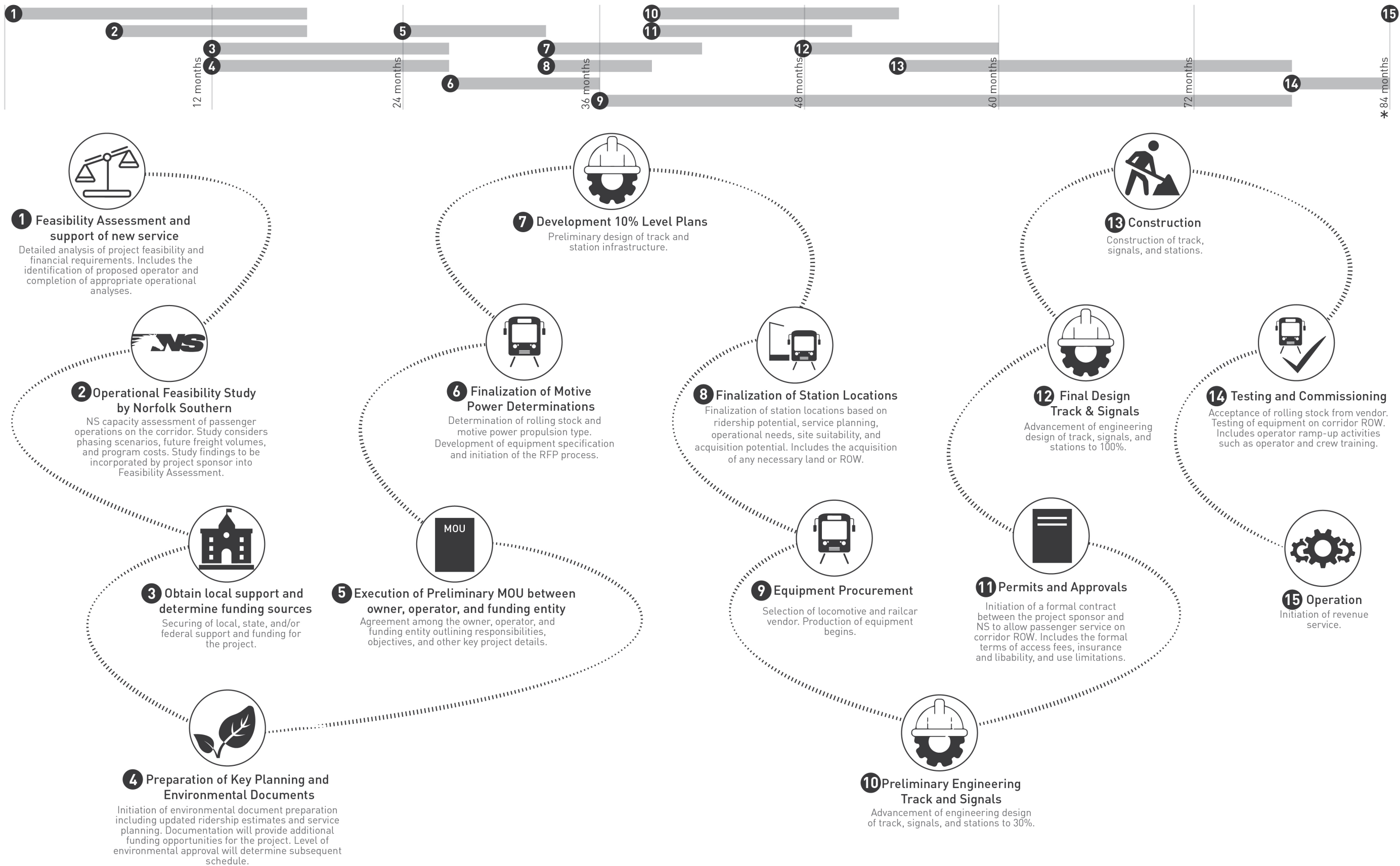
5. Execution of Preliminary MOU between Owner, Operator, and Funding Entity

An MOU between the property owner (NS), the proposed operator, and the identified project sponsor who is arranging funding will layout guidelines for each party and establish project expectations, such as

the operating service concept. If the proposed operator is not SEPTA then the MOU will need to include SEPTA as an additional property owner.

The first five steps are essential to defining the project and will determine whether and how the project could be implemented. The final remaining steps in Figure 2 outline a typical process for design, construction, equipment procurement, and initiating operations. The overall project schedule will largely be determined by how quickly the initial steps can be completed to the satisfaction of key participants. Once project support and a realistic funding plan are determined, the design, engineering, and construction work could advance and likely be completed in approximately 48 months. Equipment procurement oftentimes determines project schedules and should be prioritized early in the planning process.

Figure 2. Planning Process and Next Steps



* Timeline is reflective of a typical schedule. The overall schedule may be shortened.

PREVIOUS RAIL SERVICE STUDIES

Historically, passenger rail service operated from Philadelphia to Reading, Pennsylvania, starting in the mid-1800s through the early 1980s. Initially operated by the Reading Railroad, and then by Conrail under contract to SEPTA, service to Reading was suspended in 1981 during SEPTA's transition to an all-electric network. Service from Norristown to Reading used diesel equipment and was therefore discontinued.

Over the decades since passenger rail service ended, numerous studies assessed the feasibility of reintroducing passenger rail service to Reading on the historic corridor. These studies include:

1. 2003 Schuylkill Valley Metro Corridor Station Area Planning and Implementation Study (*Delaware Valley Regional Planning Commission*)
2. 2005 Schuylkill Valley Rail Assessment Study (*Norfolk Southern*)
3. 2007 Schuylkill Valley Metro Task Force Study (*SEPTA and Berks Area Regional Transit Authority*)
4. 2008 R6 Norristown Line Service Extension Study (*Montgomery County Planning Commission*)

Table 1 compares key indicators from these previous studies to the results from the 2020 Reading Rail Study. These include daily roundtrips to Reading, average daily ridership, capital costs (in 2020\$), and annual operating and maintenance costs (in 2020\$). This 2020 study falls within the range of previously estimated ridership, capital costs, and annual O&M costs.

While these studies indicate the continued interest in re-establishing service beyond Norristown to Reading and other points west, significant challenges were identified in each study which remain unresolved: primarily that the corridor is a freight corridor owned by Norfolk Southern (NS) who has indicated that the restoration of rail service on their corridor is inconsistent with their business aims; and the corridor west of Norristown is not electrified, thereby making single seat service into Center City Philadelphia complicated to implement.

Table 1. Comparison of Previous Studies with 2020 Reading Rail Study

Study	Description	Daily RT to Reading	Avg Wkdy Boardings	Capital Costs (2020\$)²	Annual O&M Costs (2020\$)³
2003 Schuylkill Valley Metro Corridor Station Area Study	Examined TOD opportunities along the rail corridor between Philadelphia and Reading (Wyomissing), with an alternative alignment to 52 nd Street included.	--	50,000 by 2007	--	--
2005 Schuylkill Valley Rail Assessment Study	Analyzed rail service potential along the US-422 corridor, with additional service and station improvements occurring through three stages.	20	13,000 by 2025	\$682 M - \$859 M	\$72 M
2007 Schuylkill Valley Metro Task Force Study	Examined five different service scenarios between Reading and Philadelphia, ranging from diesel service to 30 th Street Station to full electric service from Wyomissing to Center City. It did not select a preferred alternative.	7	12,000 - 14,000 by 2025	\$45 M – \$1,110 M	\$33 M - \$50 M
2008 R6 Norristown Line Service Extension Study	Examined seven alternatives for changing or extending the Norristown rail service. Three were recommended for further analysis. These were extending electric service to Valley Forge, running diesel service west of Norristown with a transfer at NTC, and implementing electric service from Wyomissing to 30 th Street.	0 - 4	1,100 – 5,400 by 2025	\$33 M - \$325 M	\$2.1 M - \$11 M
2020 Reading to Philadelphia Passenger Rail Analysis	Examined single-seat service between Reading and Philadelphia with dual-powered locomotives and a dedicated third track between Norristown and Reading.	6 - 9	3,400 to 6,400 by 2030	approx. \$818 M	\$18 M - \$25 M

² Converted to 2020\$ using the CPI Calculator: www.bls.gov/data/inflation_calculator.htm.

³ Converted from Annual Ridership to Average Weekday Ridership by dividing by 255.

RIDERSHIP FORECASTS, SERVICE ALTERNATIVES, AND O&M ESTIMATES

This study developed high-level ridership estimates to define the potential demand for restored passenger rail service between Reading and Philadelphia based on existing land use and typical regional economic conditions.

Low and high range daily rider estimates were developed for forecast year 2030 for two types of service concepts: through service from Reading to Philadelphia (without a transfer at Norristown); and rail shuttle service between Reading and Norristown requiring a transfer to existing SEPTA rail services at the Norristown Transportation Center. Estimates for total daily riders for the through service concept range from approximately **3,400 to 6,400**. For the rail shuttle alternative requiring a transfer at the Norristown Transportation Service, the estimated daily ridership ranges from approximately **2,300 to 5,100** (see Table 2).⁴

Table 2. Low and High Range Daily Rider Estimates for Year 2030

	Inbound Commuters	Reverse Commuters	Total One-Way Riders ⁵	Avg Daily Riders ⁶
Service Without Transfer				
Low Range	1,488	205	1,693	3,386
High Range	2,799	413	3,212	6,424
Service With Transfer				
Low Range	980	153	1,133	2,266
High Range	2,189	363	2,552	5,104

Source: WSP

This effort also examined how different representative service plans might be deployed for through service and shuttle service, with consideration of how equipment might be utilized to execute them. **The representative service plans are illustrative and do not confirm that SEPTA has the infrastructural or operational ability to accommodate these specific alternatives under current conditions. Additionally, Norfolk Southern's (NS) freight traffic**

⁴ These ridership estimates are for passengers boarding or alighting on the Reading-to-Norristown portion of the corridor. Riders who exclusively travel on the Norristown-to-Philadelphia portion of the corridor are not included.

⁵ Due to rounding, the sum of inbound and reverse commuters may not equal total one-way riders.

⁶ Average daily ridership is double the total one-way ridership, based on the assumption that a rail commuter also makes their return trip by train.

and operating needs were not considered as part of the service planning efforts. This includes any capital infrastructure improvements required by NS for additional passenger service, and their resulting impacts on trip time and potential ridership.

Order of magnitude operating and maintenance (O&M) costs were developed for the representative service plans based on operating costs per vehicle revenue hour. Different operating rates were calculated for different networks which differed in whether their operations were electric, diesel, or dual-mode. A conservative estimate for O&M costs for each of the sample service plans was developed using a vehicle revenue hour rate of \$562, which reflects the operating costs of U.S. diesel commuter rail systems per data from the Federal Transit Administration’s National Transit Database. The estimated annual O&M costs range from **\$18 to \$25 million** in 2020 dollars (see Table 3).

Table 3. Service Plans and Estimated Annual O&M Costs

Service Plan	Weekday Roundtrips	Weekend/ Holiday Roundtrips	Annual Revenue Train Hours	Annual O&M Cost 2018\$	Annual O&M Cost 2020\$ ⁷
REA-PHL 2 Revenue Consists	6	6	7,738	\$17.4 M	\$18.2 M
REA-PHL 3 Revenue Consists	9	6	10,399	\$23.4 M	\$24.5 M
REA-NOR 2 Revenue Consists	12	7	7,747	\$17.4 M	\$18.2 M

Source: WSP

This analysis suggests that while restored passenger rail service to Reading has the potential to attract significant ridership volumes, further detailed analysis must be conducted related to equipment, infrastructure constraints, and operational limitations. Coordination between NS and SEPTA (or other identified operator) would be required to complete the more detailed operational and modeling studies necessary to determine how service might be accommodated on the corridor.

⁷Converted to 2020\$ using the CPI Calculator:
www.bls.gov/data/inflation_calculator.htm.

CAPITAL COSTS

This analysis developed high level capital cost estimates for restoring passenger rail service to Reading. These costs include equipment, track work on the portion of the corridor between Norristown and Reading, station facilities, as well as maintenance and storage facilities. These do not include ROW acquisition or infrastructure investments needed on the SEPTA-owned portion of the corridor. These costs do not reflect any additional improvements that would be identified through a future NS operational study of the corridor to accommodate passenger rail.

Recent equipment procurement costs were used to estimate rolling stock costs for passenger service to Reading. The procurement costs for new dual-mode equipment, for the representative service plans considered by this study, range from **approximately \$113 million** to **approximately \$145 million**. Additional analysis is needed to develop the final equipment plan, in order to ensure fleet adequacy. Typically, rail rolling stock procurements achieve savings by clustering orders to avoid small procurements resulting in higher per-unit costs. If possible, the project sponsor should consider a procurement partner to piggyback the small order on to a larger one.

A high-level infrastructure assessment was conducted of the NS portion of the ROW between Norristown and Reading as part of this study to identify the challenges and opportunities for implementing the service alternatives. This assessment identified the need to build a dedicated third track nearly the entire length of the corridor between Norristown and Reading to largely separate freight and passenger operations. A third track for passenger operations would accommodate ADA-compliant high-level platforms and allow NS operational flexibility on the remaining two tracks. This investment would enable reliable and mostly conflict-free operations and allow for future freight and passenger service growth. This includes a second track to be added through the Black Rock Tunnel to help alleviate bottleneck congestion. The estimated capital costs are **approximately \$510 million**. These estimates do not include ROW acquisition nor investments that may be necessary on the SEPTA portion of the corridor.

The existing conditions of historic station buildings and sites vary widely, from infrastructure that no longer exists, to infrastructure in disrepair, to facilities in private ownership, to circumstances of public ownership and adaptive reuse. The feasibility of acquiring or reusing the historic station locations was not assessed and will be impacted by ownership and acquisition issues as well as by site

suitability to accommodate contemporary infrastructure requirements. Station acquisition is therefore not reflected in the station cost estimates.

To estimate order-of-magnitude costs for station investments, three station facility packages were developed: one with minimal amenities (as the small package); a second with modest amenities (as the medium package); a third one with more extensive amenities (as the large package). Each of the station packages also includes costs for associated parking. The packages provide a preliminary, planning-level estimate of potential station costs and are not site specific. Each of the six markets was categorized as small, medium, or large based on the projected weekday boardings. The total estimated capital costs for the six station facilities is **approximately \$53 million**. These estimates do not include potential costs for land acquisition. Ultimately, station locations may incur greater costs due to site-specific physical or engineering constraints.

A new maintenance and storage facility will be required to serve the new service's rolling stock. Two existing SEPTA maintenance and storage facilities are within proximity of the Norristown Line and present potential opportunities for facility expansion: Overbrook Yard and Roberts Yard. These locations would minimize deadhead operating costs while providing co-location benefits through expanded or new facilities at these yards. A detailed site and operations assessment would need to be completed to understand the feasibility of these scenarios. High-level cost assessments were developed for a hypothetical addition to an existing maintenance facility and the addition of two storage tracks. These costs are not site specific. The estimated capital costs for a co-located maintenance facility are **approximately \$55 million** and for the storage yard are **approximately \$19 million**. These costs are reflective of new maintenance and storage facilities to accommodate Reading line equipment. There may be opportunities to work closely with SEPTA to reduce these costs pending the availability and capacity of existing maintenance and storage facilities.

Additional infrastructure and capital cost information is included in Appendix 4 of this report.

SAMPLE SERVICE AND INVESTMENT SCENARIOS

Total capital costs for restored service to Reading will vary on the equipment selected, the level of track work required, the station amenities, and the location of maintenance and storage facilities.

A sample investment package is presented here for a single-seat ride from Reading to Philadelphia with a relatively high-level of daily service. The estimated travel time between Reading and Philadelphia is 100-120 minutes depending on station stopping patterns between Norristown and Philadelphia. This service would provide a reliable travel time compared to the estimated 60-90 minute commute time by car during peak hours.⁸ The investment package includes capital cost estimates for track work, equipment, NTC upgrades, station facilities, and maintenance facilities. This sample investment package is not a recommended strategy but demonstrates how major cost components, dependent on type and level of service, impact total capital costs. This investment scenario represents a higher level of service: a single-seat ride is provided on dual-mode equipment from Reading to Philadelphia and a dedicated third track is added to the corridor between Norristown and Reading to greatly reduce potential freight conflicts. The total capital cost for the sample investment package is **approximately \$818 million** (see Table 4). It may be possible to offer service at lower capital cost by implementing the transfer service option which utilizes diesel equipment between Reading and Norristown, then passengers transfer to a connecting SEPTA train at Norristown. However, it is assumed here that single-seat service is the more desirable service option.

It must be noted that these capital costs do not include access fees that NS would require to utilize their ROW. It also does not include investments along SEPTA's Norristown corridor and Main Line to accommodate additional service. Existing congestion, particularly on SEPTA's Main Line to 16th Street Junction would require further evaluation to determine infrastructure needs. The capital costs are not inclusive of land acquisition that may be required for ROW or station facilities on the NS portion of the corridor.

⁸ Typical driving time from Google Maps for a trip departing at 7:30 am on a Wednesday in October. Driving time estimated prior to completion of US-422 bridge over the Schuylkill River and associated travel time improvements. Driving time is reflective of historic travel time data and does not consider COVID-19 impacts.

Table 4. Sample Investment Scenario

	Equipment	Max Weekday Roundtrips	Avg Daily Ridership	Annual O&M Costs (2020\$)	Track Work	Equipment	Station Facilities + NTC	Maintenance Facility + Storage	Total Capital Costs
Single-Seat Service REA-PHL	Dual-Mode (3 consists)	9	3,400 – 6,400	\$24.5 M	\$510.2 M	\$145.0 M	\$88.8 M	\$73.7 M	\$817.7 M

Source: WSP

OPERATIONS, APPROVALS, AND FUNDING

Implementing passenger rail service is wholly dependent on securing NS's consent to utilizing their corridor. Additionally, identifying a project sponsor to act as a legal entity in establishing and executing contracts is necessary, as is identifying capital funding and long-term, sustainable O&M funding.

In addition to capital investment, the restoration of passenger rail service between Reading and Philadelphia requires:

1. Agreement with Norfolk Southern to permit commuter rail service.
2. The identification of an operator to plan, operate, maintain, and support the service.
3. Acquisition of property for any remaining portions of the rail ROW not owned by NS, sponsor agency, or partner entity such as for stations, access roads, etc.
4. Infrastructure program to ensure the development of the support facilities necessary to enable service, such as stations, platforms, parking; track, turnouts, switches, and other necessary rail work; and maintenance and storage facilities.
5. Operations funding program to address labor, insurance, staffing, and internal and external coordination.

Establishing a legal framework with NS will be necessary and will require preliminary studies to understand the impact of passenger service on their system capacity, network infrastructure, dispatching, liability and indemnification, compensation, and consistency with business plans, among other topics. While the final set of studies may vary, the following topics are typically addressed at this project phase:

1. Capacity and Service Planning
2. Infrastructure Needs and Integration with Existing Rail Facilities
3. Environmental Reviews
4. Development of Access, Operations, Indemnification/Liability, and Compensation Agreements.

When commuter rail operators wish to establish service on existing freight corridors, there are three typical agreements: buying, leasing, or paying access fees. The mechanism of the use agreement would need to be negotiated with NS; however, NS has indicated an unwillingness to sell the ROW.

CAPITAL FUNDING

Capital funding and financing for the project may come from federal, state, local, and/or private programs. The viability of each potential source is dependent on the feasibility of the project, the availability of funding, eligibility requirements, and in many cases the degree to which the proposed capital investment compares favorably to other projects competing for limited funding.

FEDERAL

Potential funding sources are identified below; however, it is not guaranteed that the Reading rail service project would be eligible based on the final project characteristics, nor whether it would be competitive against other projects seeking funding. The programs listed below represent potential sources of funding. Eligibility must be coordinated between the project sponsor, the funding agency, and any pass-through organization that oversees or administers funds.

- US Department of Transportation (USDOT)
 - Better Utilizing Investments to Leverage Development (BUILD) program
 - Transportation Infrastructure Finance and Innovation Act (TIFIA) program
- Federal Railroad Administration (FRA)
 - Restoration and Enhancement (R&E) Grant program
 - Railroad Rehabilitation and Improvement Financing (RRIF) Program
- Federal Transit Administration (FTA)
 - Capital Investment Grant (CIG) Program (New Starts or Small Starts Programs)
 - Expedited Project Delivery Program (EPD)
- Federal Highway Administration (FHWA)
 - Congestion Mitigation and Air Quality Act (CMAQ) program
 - Surface Transportation Block Grant (STBG) program

STATE

In 2022, the Pennsylvania Turnpike Commission (PTC) funding for multi-modal transportation initiatives will dramatically decrease from \$450 million per year to \$50 million per year based on the expiration of Act 44. This

decrease in dedicated transit funding will impact the level of available state funding for transit capital needs.

LOCAL

The project sponsor would need to work with local municipalities and possibly the General Assembly to identify a program of local taxes and fees to contribute to the capital expenditures or debt service for the project.

These potential sources include:

- Property Taxes
- Income Taxes
- Sales Taxes
- Parking and Fuel Taxes
- Utility Taxes
- Toll Revenue Reallocation
- Business Activity Taxes
- License and User Fees
- Other taxes and fees

Approaches to capture tax revenue around station areas or other specific project-related geographies could represent an opportunity to redirect local tax value to a portion of the debt service for infrastructure investment but this would likely need to proceed in collaboration with a local taxing entity, economic development authority, or metropolitan planning organization.

PRIVATE

The project sponsor could potentially work with private entities to develop capital funding sources through such mechanisms as development fees or public private partnerships. In addition, Act 88 of 2012 enabled Public Private Transportation projects to advance under the direction of the Public Private Transportation Partnership Board (P3 Board) in coordination with PennDOT. Project sponsors may work with the P3 Board to determine eligibility for a P3 Transportation Project.

O&M FUNDING

It is vital for the service to establish long-term, sustainable O&M funding and financing. Similar to capital funding, there are federal, state, local, and private sources to consider.

FEDERAL

Federal support for O&M costs is more limited than for capital costs. However, nominal support may be obtained through FTA formula funding programs or FHWA's CMAQ program.

STATE

Starting on July 1, 2022, with the expiration of Act 44, the source for operating funds will shift from the Pennsylvania Turnpike to general funds, making the level of state support unpredictable.

LOCAL

Local funding options for O&M costs mirror those for capital costs. The project sponsor would need to work with local municipalities and possibly the General Assembly to identify a program of local taxes and fees. These potential sources include:

- Property Taxes
- Income Taxes
- Sales Taxes
- Parking and Fuel Taxes
- Utility Taxes
- Toll Revenue Reallocation
- Business Activity Taxes
- License and User Fees
- Other taxes and fees

PRIVATE

Partnerships or agreements with private stakeholders could provide additional funding to support rail operations along the corridor.

Additional operations, approvals, and funding information is included in Appendix 5 of this report.

NEXT STEPS

The process to advance passenger rail service through planning, design, procurement and construction, and operations could require up to 84 months. The initial steps where critical buy-in from the railroad owner, service operator, and funding agencies is secured can be time-consuming. It is possible for the project to not advance beyond these first steps if support is not obtained. Therefore, the final schedule for planning, construction, and service implementation may possibly take longer than anticipated.

1. Feasibility Assessment and Support of New Service

This initial step includes more detailed analysis of ridership data, population projections, and demographics to determine feasibility of service usage and financial requirements including construction, right-of-way access or acquisition, and sustainability of the service. Included in the activities would be identification of the proposed operator and the completion of operational analyses that they require.

2. Operational Feasibility Study by Norfolk Southern

Norfolk Southern requires an operational feasibility study to be conducted so that all potential impacts to freight operations can be identified and understood. This completed operational feasibility study performed by NS, or by their selected consultant, is a prerequisite to progress a project. NS will support only passenger project requests that have been fully studied and modeled.

This operational feasibility study assesses the capacity for passenger trains and freight trains to operate without delay or impact, while still allowing for routine maintenance. The project owner would need to work with NS to identify a timeframe and scope for these assessments.

In addition, the operational feasibility study must include the full-build scenario analysis, as well as any interim, phased operations of the proposed system. Accommodation must also be made for potential growth of future freight volumes that could affect freight operations and levels.

While NS will coordinate the completion of the operational feasibility study, the cost of the study (including NS's time) is typically the responsibility of the sponsoring entity. For planning purposes, NS will estimate study costs in

advance. Studies are detailed and specific and typically take more than a year to complete.

3. Obtain local support and determine funding sources

A project of this magnitude requires funding sources that can finance a multi-million-dollar capital effort while also supporting ongoing operational expenses. It is expected that more than one funding source would be required. If the service is expected to be integrated into an existing passenger service network, it would likely need to be sustainable as its own service. In order to qualify and prepare for public funding, it will be necessary for local public entities to commit funding. The timing to arrange those public funds could be significant as potential state or local support would need to compete with other transportation needs and demands for transit funding throughout the Commonwealth.

4. Preparation of Key Planning and Environmental Documents

An early activity of the project is to initiate preparation of environmental documents and project plans, including ridership estimates and the development of a service plan. Completion of environmental documents allows subsequent design and construction work to proceed based on an environmentally approved decision. The type of environmental analysis will be dictated by the type of funding to be used to build and operate the system and the environmental conditions observed. Once the level of environmental approval is determined in coordination with Pennsylvania resource agencies or a federal agency, estimates of durations can be more specifically developed.

5. Execution of a Memorandum of Understanding between some combination of owner, operator, and funding entity

Although not legally binding, a memorandum of understanding (MOU) specifies mutually accepted expectations between parties working together toward a common objective. MOUs between the property owners, the proposed operator, and the identified project sponsor who is arranging for the funding are typically prepared.

MOUs create guidelines for each participant as they contribute their efforts and resources toward important projects. The MOU may include details of NS's access fees for using the corridor, agreement to the type of service being planned (e.g., shuttle service or through service), identification of

needed infrastructure investments, and confirmation of the service operator as well as likely funding sources. The effort required to coordinate, develop, and negotiate an MOU among responsible parties would likely entail considerable time and may vary from a few months to several years.

The MOU for this project would outlast personnel or staff involved and provide a basis for those original goals. As the project develops into design, construction and operation phases, a more formal written agreement will be required to execute those activities.

6. Finalization of motive power determinations

A critical decision is whether the service will be diesel connecting to existing electric service in Norristown or dual-mode with equipment able to run the full route length from Reading to Center City Philadelphia. This decision must be finalized so that equipment procurement, a time-consuming process, can begin and so that the relevant engineering designs can be developed. Final decisions will be made with consideration given to cost, efficiency, maintenance availability, and operation. After the rolling stock and motive power propulsion type is determined, this step also includes the development of equipment specification and the initiation of the RFP process.

7. Development of 10% conceptual plans

Preparation of concept level plans will allow early approval of layout schemes and will be used as a basis for station location, signal schematics, locomotive requirements, and right-of-way acquisition needs. It will also allow for continued refinement of the capital cost components as better definition is given to various aspects of the project.

8. Finalization of station locations

In conjunction with the concurrent 10% concept level plans and ridership projections from previous tasks, parcels will be identified for station locations, parking and possible pick-up and drop-off points. It is possible that identified station locations may differ from the historic stations, because many have been purchased by private entities, no longer exist, or the historic building and parcel do not meet modern station design standards. Acquisition of parcels will also take place in this step.

Selection of station stops along the route will be determined by ridership potential, service planning and operational needs, site suitability, and acquisition potential. Once the station locations are identified, track design

relating to the platform locations can be advanced. In addition, other development related to the stations can be identified and coordinated with local municipalities.

9. Equipment procurement

After the RFP is finalized, the project sponsor will advertise the RFP and potential vendors will respond with bids for the additional equipment (motive power and coaches) needed to operate the new service. The project sponsor and service operator will select the locomotive and railcar vendor. Once a vendor is selected, the equipment procurement process is estimated to require three to four years. Consideration may be given to exercise available options on similar equipment orders placed by other agencies or lease equipment for utilization on a temporary or permanent basis.

10. Preliminary engineering – track & signal

Preliminary Engineering will commence as various project details are solidified. Based on the 10% conceptual design, final location of stations, signal and interlocking locations identified, and structure modifications scoped, 30% preliminary plans can be completed. Further refinement of the plans will allow for better definition of the capital cost estimates and reduction of the contingency percentage.

11. Permits and approvals

The project sponsor, acting as a legal entity, will enter into a formalized contract with NS to allow passenger rail service on the privately-owned right-of-way. The contract will set terms for access fees, insurance and liability expectations, and use limitations.

With 30% design plans completed, applications and permits can begin with various regulatory agencies and municipalities affected by the design. This activity can run concurrently with further design development and other project activities. Completion of this activity will continue the development of a better refined capital cost of the entire project.

Other approvals may be needed depending on the operator. For example, if SEPTA is the operator, a cost sharing arrangement with Montgomery, Chester, and Berks Counties may be necessary.

12. Final Design – track & signal

Contract plans and specifications for track, signals, and station infrastructure will be completed and advertised for award. Evaluations will be made prior to this activity to determine if a single contract or multiple contracts should be used. Construction will need to proceed in ways that avoid or minimize impacts to property owners, stakeholders, and communities along the corridor and, if necessary, a program of mitigations would be needed. Additionally, contract work will need to follow Norfolk Southern labor union regulations for construction activities within the operating right-of-way. A final capital cost estimate will provide final estimate project costs.

13. Construction

Staging, phasing, and constructability are critical to constructing within a narrow railroad right-of-way. Careful scheduling will help determine if portions of the corridor can be opened in phases or if the entire construction project to Reading needs to be completed.

14. Testing and Commissioning

Before any new passenger operation can be initiated, all service needs to be tested and operated to ensure safety, reliability and proper compliance with operating rules. Train crews need to be certified. This is especially true with the recent implementation of Positive Train Control requirements that will be included in this new service. Coordination with the existing SEPTA service between Norristown and Philadelphia brings an added element of complexity that will need to be evaluated.

15. Operation

The final step assumes service initiation. Maintenance activities will begin and continued attention to funding sustainability will be prime components of providing reliable service, continued growth, and ridership increases.

APPENDIX 1: ASSUMPTIONS USED FOR THIS ANALYSIS

Item	Item Assumption	Source
Operations		
Operator	SEPTA would serve as the operator (for analysis purposes)	Project Scope
ROW	Service will utilize historic and existing ROW between Norristown and Reading. Norfolk Southern's (NS) Harrisburg Line from Norris Interlocking to Reading Franklin Street Station. The NS Phoenixville Line ROW (Great Valley to Phoenixville) studied in the Phoenixville Main Line Passenger Rail Assessment (ca. 2008) will not be considered in this study.	Project Scope, NS Employee Timetable
Stations	2-seat ride, connecting service scenario features stations at the following locations: Norristown Transportation Center Valley Forge Park Phoenixville Royersford Pottstown Birdsboro Reading Franklin Street	ca. 1980 SEPTA Schedule

Item	Item Assumption	Source
Stations	1-seat ride scenario features stations at the following locations: 30th Street Suburban Jefferson Temple Conshohocken Norristown Transportation Center Valley Forge Park Phoenixville Royersford Pottstown Birdsboro Reading Franklin Street	ca. 1980 SEPTA Schedule, 2020 SEPTA Schedule
Service		
Frequency	Baseline service features 6-12 trains per weekday with similar or reduced service on weekends.	ca. 1980 SEPTA Schedule
	Weekday service spans much of the service day with a minimum of 2-3 peak direction, peak period trips.	ca. 1980 SEPTA Schedule
Travel Time	The baseline schedule features a 60- to 70-min travel time between Reading Franklin Street Station and Norristown Transportation Center. (This would mean a total travel time from Reading to 30th Street of approximately 100 to 120 minutes, depending on express or all-stop service after Norristown.)	ca. 1980 SEPTA Schedule, 2008 NS Harrisburg Div Employee Timetable
	The baseline schedule considers 39 min express service between Norristown Transportation Center and Philadelphia's 30th Street Station (assumes above station stop patterns).	ca. 1980 SEPTA Schedule, 2020 SEPTA Schedule
	The baseline schedule considers 45-50 min all-stops service between Norristown Transportation Center and Philadelphia's 30th Street Station.	2020 SEPTA Schedule

Item	Item Assumption	Source
Philadelphia Service	The project team assumes dual-mode locomotives are able and permitted to operate on SEPTA's system and through the Center City tunnel. Load bearing and fire and life safety considerations would need to be studied later in coordination with SEPTA.	
Equipment		
Trainset	1 dual-mode locomotive (ALP-45 DP locomotive or equivalent) or diesel locomotive (SC-44 locomotive or equivalent). Locomotive type and costs are informed by operating scenario (1-seat ride scenario versus 2-seat, connecting scenario).	WSP
	Minimum of 4 push-pull coaches (which includes 1 cab car).	WSP
	The project team assumes dual-mode locomotives are able and permitted to operate on SEPTA's system and through the Center City tunnel. Load bearing and fire and life safety considerations would need to be studied later in coordination with SEPTA.	
Fleet Requirements	The baseline operating scenario assumes a minimum of 3 trainsets in revenue service during peak periods and additional spare equipment. Spare equipment includes 2 locomotives and 4 coaches.	ca. 1980 SEPTA Schedule, WSP
Cost	Recent US transit agency locomotive procurements are sourced to identify an estimated cost range for new locomotives. Estimated costs consider procurement economies of scale.	
	Recent US transit agency push-pull and cab car procurements are sourced to identify an estimated cost range for new cars.	

Item	Item Assumption	Source
O&M Cost Assumptions		
SEPTA O&M Costs	SEPTA station, operating costs, and equipment maintenance costs are used as O&M cost references as available. National Transit Database O&M costs for diesel and dual-mode operations are used to estimate O&M costs for Reading Line. It is assumed ROW will continue to be owned by NS. Track inspections and maintenance will be performed by NS with maintenance funding assistance from SEPTA.	SEPTA, NS, NTD
Access Fees	Access fees are assumed for the NS corridor between Norristown and Reading. Amtrak access fees are not anticipated as operations will not involve Amtrak ROW.	
Capital Cost Assumptions		
Track	Estimated range of costs per mile are focused primarily on the Reading to Norristown corridor with a high-level discussion of possible improvements for the Norristown to Philadelphia portion of the corridor.	SEPTA has indicated concurrent efforts are underway to identify potential capital improvements that may enable greater system capacity and frequencies. A system-wide Rail Traffic Controller (RTC) model of the existing system has been developed.
OCS	Estimated range of costs per mile are included as an alternative.	
Station Staffing and Ticketing	Station sites do not assume any staffing. Costs for Ticket Vending Machines and Key Card readers are assumed at each station site.	
Stations and platforms	All new station sites assume train-length, high-level platforms compliant with ADA regulations. Estimated range of costs for station and platform facilities assume siding tracks consistent with NS regulations for high-level platforms.	SEPTA has indicated high-level platforms would likely be necessary if service is restored.

READING – PHILADELPHIA PASSENGER RAIL ANALYSIS

Item	Item Assumption	Source
Maintenance Facility	Maintenance facility modifications are required to service equipment.	SEPTA has indicated potential storage facilities might be available; SEPTA has indicated maintenance facilities would require modifications.
PTC	Assume that NS has installed PTC on the Reading to Norristown segment. Assume some PTC installation and setup costs to outfit SEPTA rolling stock with PTC equipment compliant with NS communications and technology. PTC equipment for both systems is likely required.	SEPTA SEPTA completed required PTC installation in 2017. The FRA reported on Dec 30 th , 2020 that PTC is operational on all required route miles including the NS Harrisburg Line.
Ridership Assumptions		
Methodology	Methodology is similar to Altoona-Pittsburgh project approach. Project team sourced representative corridors to determine appropriate mode split assumptions. Mode split rates from two corridors, MBTA's Worcester Line and MARC's Brunswick Line, are used to apply similar mode split rate assumptions to the proposed Reading stations. Reading to Philadelphia LEHD data are used to determine corridor travel flows. Representative corridor mode split values from the Worcester Line and Brunswick Line are applied to Reading to Philadelphia LEHD to calculate estimated corridor ridership.	Project Scope, revised methodology communication 5/27
Forecast Year	Ridership estimates assume a forecast year of 2030.	
Growth Rate	The assumed growth rate used to calculate 2030 corridor commute volumes and ultimately rail ridership is based on the annual linear change in volumes between 2007 and 2017 from LEHD LODES data.	

Item	Item Assumption	Source
Representative Mode Split Corridors	Framingham/Worcester Line (Boston): Length: 44 miles Description: MBTA line featuring large endpoint city (~181,000 residents; 4,700 persons/sq mi)	
	Brunswick Line (Washington, DC): Length: 74 miles Description: MARC line featuring long corridor	
Representative Mode Split Corridor Metrics	Population density. Reading: 9,000 persons/sq mi	US Census
	Sizable endpoint city. Reading: ~88,000 residents	US Census
	Similar distance and average speed. Reading baseline service: 59 miles, 35.4 mph	ca. 1980 SEPTA Schedule, 2020 SEPTA Schedule

APPENDIX 2: PREVIOUS RAIL SERVICE STUDIES TECHNICAL MEMORANDUM

APPENDIX 3: SERVICE ALTERNATIVES TECHNICAL MEMORANDUM

APPENDIX 4: INFRASTRUCTURE AND CAPITAL COSTS TECHNICAL MEMORANDUM

APPENDIX 5: SUMMARY OPERATIONS, APPROVALS, AND FUNDING TECHNICAL MEMORANDUM