Appendix C:

TRANSIT COMPONENT REPORT

WHITE PAPER

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422 CORRIDOR plus

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1 Introduction

The Transit Component of 422*plus* analyzed the reintroduction of passenger rail service between Reading / Wyomissing and Philadelphia on the Norfolk Southern (NS) and Southeastern Pennsylvania Transportation Authority (SEPTA) rail alignments along the Schuylkill River. The new commuter rail service would complement the Highway Capital Improvement Program by providing new connections between the communities along the US 422 corridor and to destinations like Conshohocken and Philadelphia.

422*plus* relies in part on previous studies of transit service in this corridor. Specifically, the potential configurations for the service are derived from previous studies including the 2005 *Schuylkill Valley Rail Assessment Study* (*SVRA*) and the 2009 *R6 Norristown Line Service Extension Study* (*R6 Study*). These studies considered several possible implementations of transit service between the Reading area and Philadelphia and examined the challenges of introducing passenger service on an active freight corridor. To give passenger trains access to the freight line, *422plus* assumes that the new Tolling Authority (Authority) and NS would develop a sharing agreement outlining service levels, access and maintenance fees, and necessary capital improvements.

The preferred configuration being advanced by *422plus* provides a one-seat ride between Reading / Wyomissing and Philadelphia at a base service level of seven (7) roundtrips (14 trains) per day. This recommendation is based on an extensive analysis that began with the comparison of four (4) configurations (two (2) alternatives and two (2) service levels) for service from Reading to Philadelphia. The one-seat ride, minimal service option was selected based on several factors including ridership levels, travel time, operating and capital costs, and the integration of operations with the area's freight and passenger systems. After the selection, further analysis was conducted to refine the preferred configuration and to assess the implementation of service as far as Wyomissing.

The following sections of this report detail the potential configurations and service patterns of the new passenger service that were studied; the process and results of the ridership and fare revenue analysis; the operating and maintenance (O&M) cost estimates; and the proposed transit capital improvement program.

2 Service Configurations

The Transit Component of 422*plus* initially evaluated service implementations between Philadelphia and the Reading area, analyzing four (4) potential configurations for the new service, consisting of two (2) alternatives at two (2) potential service levels. These configurations are based on the *SVRA* study, which provides the basis for the capital investments and service levels supported by NS, the host railroad.

2.1 ALTERNATIVES

Two (2) alternatives for commuter rail service between Philadelphia and the Reading area along the NS Harrisburg Line freight alignment were considered:

- Alternative 1: Diesel locomotive-hauled service from the Reading area to Norristown, with coordinated transfers to the SEPTA Norristown Line for service into Center City Philadelphia.
- Alternative 2: Dual-power locomotive-hauled service from the Reading area to Philadelphia, providing a one-seat ride over the existing SEPTA Norristown Line into Center City, terminating at 30th Street Station.

Both Alternatives would include new stations in the following six (6) locations:

- Reading
- Monocacy
- Pottstown
- Royersford
- Phoenixville
- Valley Forge

Alternative 1 would terminate at Norristown Transportation Center, while Alternative 2 trains would continue as an express service to Conshohocken, Temple University, Market East, Suburban Station, and 30th Street Station. More details about station configurations are provided in Section 6.1

Table 2.1-1: Travel Times by Alternative

	Alternative 1 Transfer Service	Alternative 2 One-seat Ride
Reading to Norristown	55 min	55 min
Pottstown to Norristown	32 min	32 min
Scheduled Transfer Time	6 min	(Continuous service)
Norristown to CC	42 min (SEPTA Norristown express)	37 min
Total - Reading to CC	103 min	92 min
Total - Pottstown to CC	80 min	69 min

As shown in *Table 2.1-1*, the one-seat ride in Alternative 2 provides a shorter trip to Center City Philadelphia than the transfer service in Alternative 1. Under the transfer configuration, riders would transfer to the SEPTA Norristown Line at Norristown Transportation Center, where a 6-minute transfer would be scheduled to an express train to Center City.

2.2 SERVICE LEVELS

For each transit alternative, two (2) potential levels of service, as originally defined in the *SVRA*, were analyzed:

- A minimal, start-up, service of seven (7) roundtrips per day, and
- A mature service of sixteen (16) roundtrips per day.

These service levels were modeled and analyzed during the *SVRA* and found acceptable by NS in maintaining their projected capacity needs when accompanied by certain infrastructure investments. NS has confirmed their acceptance of these service levels, provided that the previously identified transit capital improvements are implemented, as discussed in Section 6. The following table presents the service patterns associated with the two (2) service levels. The scenarios studied as part of 422*plus* focus on weekday service only, although service could be expanded to include weekends. Specific schedules based on these service patterns would be developed during railroad negotiations and will require close coordination with both SEPTA and NS to determine how these new trips will fit into the anticipated future schedules of both systems.

Table 2.2-1: Proposed Service Patterns

Minimal (Service Level A)		**Mature (Service Level B)**
Inbound AM peak: 3 trains Morning: 1 train Afternoon: 1 train PM Peak: 1 train Evening: 1 train	Outbound AM peak: 1 train Morning: 1 train Afternoon: 1 train PM Peak: 3 trains Evening: 1 train	AM Peak – 4 roundtrips Midday – 7 roundtrips PM Peak – 3 roundtrips Evening – 2 roundtrips
Total: 7 roundtrips per day		**Total: 16 roundtrips per day**

2.3 PREFERRED CONFIGURATION

The preferred configuration being advanced as a result of this study consists of a one-seat ride service between Reading and 30th Street Station in Center City Philadelphia. Intermediate stops would occur at new stations in Monocacy, Pottstown, Royersford, Phoenixville, and Valley Forge, as well as at several existing SEPTA stations: Norristown, Conshohocken, Temple University, Market East, and Suburban Station. Service under the preferred configuration would operate with seven (7) roundtrips per day focused on serving commuters during the peak periods.

3 Ridership Estimation

Ridership forecasts were developed using an expanded regional travel demand model incorporating both the DVRPC and Reading MPO travel demand model. The travel demand model is reflective of forecasts of population and employment growth along the US 422 corridor.

3.1 MODELED OPERATING PLAN

Each alternative and service level was analyzed using the expanded travel demand model for the project opening year (2015 model basis) and a forecast year (2035), resulting in eight (8) model scenarios as summarized in Table 3.1-1. The project opening year of 2015 is based on the opening year of the highway improvements associated with the Highway Capital Improvement Program; the implementation of transit service is expected to begin construction in 2015 for revenue service in 2018.

It should be noted that the travel demand analysis reflects service to Reading with park and ride access to the greater Reading area. Future study efforts will refine the combined DVRPC and Reading MPO area travel demand model and disaggregate potential travel demand for Wyomissing and Reading stations.

Table 3.1-1: DVRPC and Reading MPO Area Travel Demand Model Alternatives

Scenario	Alternative / Service Level	Analysis Year	Route
1-A-15	Alternative 1 Minimal[1]	2015	Reading to Norristown with transfer to SEPTA @ NTC
1-A-35		2035	
1-B-15	Alternative 1 Mature	2015	
1-B-35		2035	
2-A-15	Alternative 2 Minimal	2015	Reading to Center City as a one-seat ride
2-A-35		2035	
2-B-15	Alternative 2 Mature	2015	
2-B-35		2035	

3.2 TRAVEL DEMAND MODEL RESULTS

Table 3.2-1 summarizes the projected daily unique new riders for each alternative and service level by station. These values reflect the total new ridership associated with each of the six (6) new stations. Alternative 2, which provides service to some existing stations on the SEPTA Norristown Line would carry some riders traveling between existing SEPTA stations; however, these have not been included as they are primarily existing SEPTA riders.

[1] Two scenarios (Alternative 1, Minimal service in both model years) were not fully modeled, but instead were extrapolated from the results of the other scenarios in the interest of time and resources.

Table 3.2-1: Projected Daily Unique New Riders

Station	Alt 1A Transfer, Minimal		Alt 1B Transfer, Mature		Alt 2A One-seat, Minimal		Alt 2B One-seat, Mature	
	2015	2035	2015	2035	2015	2035	2015	2035
Reading	350	529	433	626	444	630	549	752
Monocacy	347	516	428	608	459	643	607	791
Pottstown	434	556	506	638	597	721	769	879
Royersford	477	715	554	801	651	834	826	1,033
Phoenixville	319	437	366	495	489	621	611	725
Valley Forge	518	876	594	968	634	896	728	1,037
Total	2,446	3,630	2,879	4,134	3,272	4,343	4,088	5,215

These results show that a one-seat ride would attract more ridership than a transfer service, and a Mature service level would attract more ridership than a Minimal service level. However, as projected ridership is more sensitive to eliminating the transfer than to the increase in the frequency of service, it is recommended that the one-seat ride alternative at a Minimal service level be advanced.

3.3 CONSIST SIZES / FLEET REQUIREMENTS

The length of train consists and the associated equipment requirements were estimated based on the projected travel demand. Train lengths must be set to provide adequate capacity to support the Peak Load: the total peak period passenger volume on the most-traveled segment of the line throughout the peak period. This represents the greatest number of riders who will need to be transported during the day, and serves as the basis for calculating the required train consist size. In all scenarios, this most-traveled segment occurred between Phoenixville and Valley Forge.

Table 3.3-1 summarizes the Peak Loads between Phoenixville and Valley Forge throughout the peak period.

Table 3.3-1: Peak Period Loads

	Alt 1A	Alt 1B	Alt 2A	Alt 2B
2015	559	574	728	742
2035	915	931	1,031	1,031

The new service would adopt the same loading standard as SEPTA Regional Rail: during the peak periods, on average enough capacity is provided for all passengers to have seats. The service would employ standard single-level passenger coaches with approximately 118 seats. Peak period service ranges from three (3) to four (4) peak trains, under Minimal and Mature service, respectively. Given the uncertainty in the model results, and the variation in demand to be expected during the peak period, a consist size of **four (4) cars per train** was applied across all alternatives and service levels. This will ensure adequate carrying capacity on the service both in the opening and future years.

4 Operations and Maintenance Cost Estimate

The costs to operate the transit service and maintain the associated equipment and infrastructure was estimated using an Operating and Maintenance (O&M) Cost Model developed for the study. The O&M cost development has been based on the assumption that SEPTA is the likely operator of the new service, in particular for Alternative 2 which provides integrated service over the existing SEPTA Regional Rail network.

4.1 O&M COST MODEL

A cost allocation model was developed to estimate the annual Operations and Maintenance (O&M) costs of the new US 422 corridor transit service. This type of cost model assumes that all expenses of operating and maintaining the service would be driven by service variables (revenue miles, revenue hours, etc). As service levels increase, costs will increase at a fixed rate, or unit cost, for every unit of service.

All of the O&M costs for the new service have been assigned to a cost item and allocated to either the operator or NS. Operator costs are those annual expenses paid by the newly created authority to the future operator. NS costs are those annual expenses paid by the authority to NS to cover the railroad's maintenance and other costs in allowing passenger service on their trackage. (Some NS O&M costs are actually fixed costs, rather than unit costs, as they will be paid as a fixed annual fee.)

The following table identifies the major cost items, the service variables driving those costs, and the allocation of those costs, either to the operator or NS, the host railroad.

Table 4.1-1: Cost Item and Allocation Summary

Cost Item	Allocation	Service Variable	Unit Cost
Vehicle Operations			
Engineers	Operator	Revenue Vehicle Hours	$41.83 / Rev Veh Hr
Head Conductors	Operator	Revenue Vehicle Hours	$39.45 / Rev Veh Hr
Asst Conductors	Operator	Revenue Vehicle Hours	$22.00 / Rev Veh Hr
Traction Power	Operator	Revenue Vehicle Miles (SEPTA)[2]	$0.99 / Rev Veh Mi (SEPTA)
Diesel Fuel	Operator	Revenue Vehicle Miles (NS)[2]	$2.20 / Rev Veh Mi (NS)
Dispatchers	NS	Fixed	$61,164.25
Train-mile Lease Fee (NS)	NS	Revenue Train Miles (NS)	$12.28 / Rev Train Mi
Vehicle Maintenance			
Veh Maintenance Parts	Operator	Revenue Vehicle Miles	$0.63 / Rev Veh Mi
Veh Maintenance Labor	Operator	Revenue Vehicle Miles	$0.81 / Rev Veh Mi
Veh Maintenance Fringe	Operator	Revenue Vehicle Miles	$0.66 / Rev Veh Mi
Infrastructure Maintenance			
Maintenance of Installed Improvements	NS	Fixed	Minimal: $73,094.33 Mature: $146,188.66
Property Rental (Stations)	NS	Number of New Stations	$9,430.71 / Station

[2] Some statistics are only measured across part of the line, depending on the track owner, NS or SEPTA.

Cost Item	Allocation	Service Variable	Unit Cost
SEPTA Power Infrastructure Maintenance	Operator	Revenue Vehicle Miles (SEPTA)	$0.62 / Rev Veh Mi (SEPTA)
SEPTA Track and ROW Maintenance	Operator	Revenue Vehicle Miles (SEPTA)	$2.46 / Rev Veh Mi (SEPTA)
Station Maintenance	Operator	Number of New Stations	$50,000 / Station
General Administration			
Overhead and Admin	Operator	Maximum Vehicles in Service	$116,888 / Peak Veh
Claims	Operator	Revenue Vehicle Miles	$0.07 / Rev Veh Mi
Clerical Positions	NS	Fixed	$50,317.46
Liability Insurance	NS	Fixed	Minimal: $3.3 million Mature: $3.7 million

The Unit Costs shown in *Table 4.1-1* were primarily derived from two (2) main sources, as follows:

1. Detailed O&M expenditure data from **SEPTA's Regional Rail Division** were used to develop the unit costs allocated to the operator. Regional Rail expenditures provide a reasonable estimate of future O&M costs for the new service, as SEPTA is a likely operator, of the proposed service.
2. **Norfolk Southern** provided information about other agreements with commuter rail operations on NS-owned tracks. The current agreement between NS and Virginia Railway Express (VRE), a commuter rail service similar in scope to that proposed for the US 422 corridor, provides one of the best examples.

4.2 OPERATING QUANTITIES AND COSTS

The following table summarizes the operating quantities for the key service variables that drive the O&M model, by alternative and service level for service from Reading to Philadelphia.

Table 4.2-1: Operating Quantities of Key Service Variables

	Alternative 1		Alternative 2	
	Minimal (A)	Mature (B)	Minimal (A)	Mature (B)
Round trips per day	7	16	7	16
Number of trainsets needed	3	5	3	5
Consist length	4	4	4	4
Revenue Vehicle Hours	16,363	37,400	27,221	62,220
Revenue Train Miles (NS)	146,406	334,642	146,406	334,642
Rev Veh Miles (NS)	732,029	1,673,208	732,029	1,673,208
Rev Veh Miles (SEPTA)	-	-	332,010	758,880
Rev Veh Miles	**732,029**	**1,673,208**	**1,064,039**	**2,432,088**
Peak Vehicles in Service	15	25	15	25
Number of New Stations	6	6	6	6

The following table summarizes the annual O&M costs (in 2010 dollars) for each Reading to Philadelphia configuration.

Table 4.2-2: Annual O&M Cost Summary (2010$)

	Alternative 1		Alternative 2	
	Minimal (A)	Mature (B)	Minimal (A)	Mature (B)
Operator				
Operations	$3.30 M	$7.54 M	$4.75 M	$10.86 M
Vehicle Maintenance	$1.54 M	$3.51 M	$2.23 M	$5.11 M
Infrastructure Maintenance	$.30 M	$.30 M	$1.32 M	$2.64 M
General Administration (Operator)	$1.80 M	$3.04 M	$1.83 M	$3.09 M
Subtotal	**$6.94 M**	**$14.40 M**	**$10.14 M**	**$21.69 M**
Norfolk Southern				
Trackage Fee, Dispatching, Clerical, Track Maintenance	$2.04 M	$4.42 M	$2.04 M	$4.42 M
Cost of NS-required Liability Insurance ($500M)	$3.30 M	$3.70 M	$3.30 M	$3.70 M
Subtotal	**$5.34 M**	**$8.12 M**	**$5.34 M**	**$8.12 M**
Total	**$12.28 M**	**$22.52 M**	**$15.47 M**	**$29.82 M**

4.3 ALTERNATIVE 2A TO WYOMISSING

The refined operating plan of the recommended configuration with service originating in Wyomissing adds just over two (2) track miles to the route and 16 minutes to the roundtrip run time. The resulting O&M costs for Alternative 2A with seven (7) roundtrips per day between Wyomissing and Philadelphia are shown in *Table 4.3-1*.

Table 4.3-1: Annual O&M Cost Summary (2010$)

	One-seat Ride Minimal service
Operator	
Operations	$5.08 M
Vehicle Maintenance	$2.31 M
Infrastructure Maintenance	$1.37 M
General Administration (Operator)	$1.83 M
Subtotal	**$10.60 M**
Norfolk Southern	
Trackage Fee, Dispatching, Clerical, Track Maintenance	$2.14 M
Cost of NS-required Liability Insurance ($500M)	$3.30 M
Subtotal	**$5.44 M**
Total	**$16.04 M**

5 Fare Revenue

A portion of the O&M Costs estimated in the previous section will be covered by the fare revenues collected on the new service. To determine how much of the O&M costs will be covered by fares and how much will need to be covered by other funds, an accurate estimate of fare revenue for each scenario is required. The following sections outline the fare revenue methodology and estimates.

5.1 FARE REVENUE METHODOLOGY

In order to estimate the fare revenue that would be collected under each scenario, the following methodology was used:

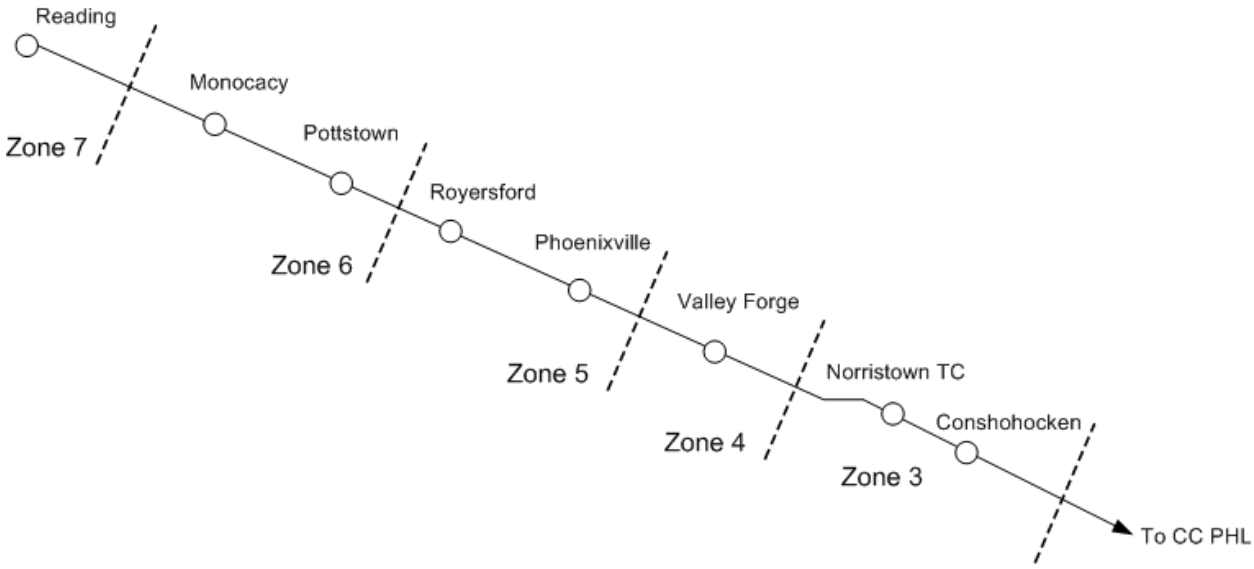
1. Establish a zonal fare structure to provide the base cash fare that each station-to-station trip would cost. These fares would vary by time of day (peak/off-peak) and direction consistent with the SEPTA Regional Rail fare structure.
2. Multiply the zone-to-zone fare matrices (peak and off-peak) by the model-estimated zone-to-zone ridership. This results in a total daily revenue figure, if all riders were to pay the base cash fare.
3. Annualize the total assuming no weekend service (255 service days).
4. Adjust the total for the discount between the base cash fare and the actual equivalent fare paid due to passes and other discounts.

5.1.1 Fare Structure

The proposed fare structure for the new service is based on the SEPTA Regional Rail fare structure, a distance-based system. SEPTA employs 5-mile wide fare bands, as measured from Center City Philadelphia for Zones 1 through 4, with another 10-mile band for Zone 5. As this structure would only reach as far as Limerick in Montgomery County, this fare zone structure has been expanded with two (2) additional 10-mile bands for Zones 6[3] and 7, as shown in *Figure 5.1-1*.

[3] SEPTA currently has a Zone 6 in the RRD fare structure, although this zone is used for out-of-state stations that would still fall within the Zone 5 band.

Figure 5.1-1: Station and Zone Map



The travel demand model provides station-to-station trip matrices for both the peak and off-peak periods. This allows estimated fare revenues to be calculated by multiplying the station-to-station trip matrix by a station-to-station fare matrix for the appropriate period. The following tables show the station-to-station base cash fares for the peak and off-peak periods. All fares are presented in 2010 dollars.

Table 5.1-1: Peak Station-to-Station Fare Matrix (2010$)

Between		Reading Area	Monocacy	Pottstown	Royersford	Phoenixville	Valley Forge	Norristown	Conshohocken	Temple U	Market East	Suburban	30th Street
	Zone	**7**	**6**		**5**		**4**	**3**		**CC**			
Reading Area	**7**	$3.25	$3.75		$4.50		$5.25	$6.00		$10.00			
Monocacy	**6**	$3.75	$3.25		$3.75		$4.50	$5.25		$8.75			
Pottstown													
Royersford	**5**	$4.50	$3.75		$3.25		$3.75	$4.50		$7.50			
Phoenixville													
Valley Forge	**4**	$5.25	$4.50		$3.75		$3.25	$3.75		$6.25			
Norristown	**3**	$6.00	$5.25		$4.50		$3.75	$3.25		$5.50			
Conshohocken													
Temple U	**CC**	$8.75	$7.50		$6.25		$5.50	$4.75		$4.00			
Market East													
Suburban													
30th Street													

Table 5.1-2: Off-peak Station-to-Station Fare Matrix (2010$)

Between		Reading Area	Monocacy / Pottstown	Royersford / Phoenixville	Valley Forge	Norristown / Conshohocken	Temple U / Market East / Suburban / 30th Street
	Zone	**7**	**6**	**5**	**4**	**3**	**CC**
Reading Area	**7**	$3.25	$3.75	$4.50	$5.25	$6.00	$8.75
Monocacy / Pottstown	**6**	$3.75	$3.25	$3.75	$4.50	$5.25	$7.50
Royersford / Phoenixville	**5**	$4.50	$3.75	$3.25	$3.75	$4.50	$6.25
Valley Forge	**4**	$5.25	$4.50	$3.75	$3.25	$3.75	$5.50
Norristown / Conshohocken	**3**	$6.00	$5.25	$4.50	$3.75	$3.25	$4.75
Temple U / Market East / Suburban / 30th Street	**CC**	$8.75	$7.50	$6.25	$5.50	$4.75	$3.50

The fares shown in these station-to-station matrices are the base cash fares assuming that all fares were purchased as single tickets before boarding the train. In actuality, many travelers purchase passes and other discounted fares for travel. These discounts to the traveler must be accounted for in the fare revenue calculations.

SEPTA Regional Rail ridership and fare data was used to estimate the current discount factor of **80.27%** to account for the purchase of passes and other discounted fares. This ratio means that during the course of a year, a transit operation like SEPTA Regional Rail could be expected to collect about 80% of the equivalent cash fare for every trip.

5.2 FARE REVENUE ESTIMATES AND OPERATING RATIOS

Combining the fare matrices established above with the station to station ridership results and applying the discounting factor and the annualization factor of 255 service days per year, results in the estimated fare revenue for each alternative as summarized in *Table 5.2-1*.

Table 5.2-1: Estimated Annual Actual Fare Revenues by Scenario

	Alt 1A	Alt 1B	Alt 2A	Alt 2B
2015	$ 2.14 M	$ 2.51 M	$ 3.79 M	$ 4.80 M
2035	$ 3.17 M	$ 3.60 M	$ 4.99 M	$ 6.03 M

The following table provides a summary of the operating costs, projected fare revenues, and the resulting operating deficit of each alternative and service level for a Reading to Philadelphia service. The farebox recovery ratio, the share of O&M costs covered by fares, can be expected to increase over time as ridership and fare revenue grows.

Table 5.2-2: Summary of Operating Costs and Revenues (2010$)

	Alternative 1				Alternative 2			
	Minimal (A)		Mature (B)		Minimal (A)		Mature (B)	
Total O+M Cost	$12.28 M		$22.52 M		$15.47 M		$29.82 M	
Modeling Year	*2015*	*2035*	*2015*	*2035*	*2015*	*2035*	*2015*	*2035*
Projected Fare Revenue[4]	$2.14 M	$3.17 M	$2.51 M	$3.60 M	$3.79 M	$4.99 M	$4.80 M	$6.03 M
Farebox Recovery Ratio	17.4%	25.8%	11.1%	16.0%	24.5%	32.2%	16.1%	20.2%
Operating Deficit	**$10.14 M**	**$9.11 M**	**$20.01 M**	**$18.92 M**	**$11.68 M**	**$10.48 M**	**$25.02 M**	**$23.79 M**

5.3 ALTERNATIVE 2A TO WYOMISSING

If the one-seat ride service is implemented to Wyomissing, some level of increase in fare revenues above the Reading estimates described previously may be realized, resulting from increased access to transit and due to some limited amount of local travel between Wyomissing and Reading. However, determining this potential increase will require additional travel demand analysis and a value cannot be assigned with the currently available information. A future study will need to further refine the combined DVRPC and Reading MPO area travel demand model to provide more disaggregate ridership information to support an assessment of additional fare revenue.

The following table summarizes the estimated operating costs and revenues of the preferred configuration to Wyomissing in the projected Opening Year.

Table 5.3-1: Operating Costs and Revenues for Preferred Configuration (2010$)

One-seat Ride Minimal Service to Wyomissing	
Total O+M Cost	$16.04 M
Projected Opening Year Fare Revenue	$3.97 M
Farebox Recovery Ratio	24.7%
Opening Year Operating Deficit	**$12.07 M**

The remaining operating deficit after fare revenues must be covered by a combination of state and local funding. Per current federal law toll revenues cannot be used for transit operations. Currently, PennDOT typically provides operating assistance for 85% of the operating deficit. The remaining 15% is supported from local sources, typically the counties.

[4] Fare revenues are based on Modeling Year ridership numbers, but given in 2010 dollars to compare with costs.

Assuming a similar arrangement for this service, the contributions by PennDOT and the counties are shown in *Table 5.3-2*. The county shares shown reflect a route-mile based distribution, as one possible method considered. The specific arrangement and cost sharing among the counties would be considered and agreed to as part of the formation of the Authority. Additionally, PennDOT's increase in operating assistance to the region must be verified.

Table 5.3-2: Summary of Opening Year Operating Subsidies (2010$)

One-seat Ride Minimal Service to Wyomissing			
Opening Year Operations Deficit			**$12.07 M**
PennDOT Share (85%)			$10.26 M
Counties' Share (15%)			$1.81 M
Subsidies	**Mileage**	**Share**	
Berks	17.5 mi	6.09%	$.74 M
Chester	5.1 mi	1.77%	$.21 M
Montgomery	20.5 mi	7.13%	$.86 M

*Note: Values for Opening Year 2018 are approximate due to a number of variables affecting growth between 2015 and 2035. Actual subsidies should fall within +/-20% of the indicated values.

6 Transit Capital Improvements and Costs

The proposed transit capital improvements to support the new service are based on those proposed in the *SVRA*, with the new Minimal and Mature service levels roughly corresponding to *SVRA*'s Stage 1 and Stage 2. These transit capital improvements were analyzed as part of a rail operations simulation conducted by NS, where the railroad verified that the proposed track and signal improvements to the system could provide the necessary capacity for both freight and passenger service.

The simulation conducted for *SVRA* by NS only included service as far as Reading and the detailed transit capital improvement plan described below mirrors this. A preliminary estimate of potential additional capital improvements and costs for service to Wyomissing is included in Section 6.5 and is subject to change through a new rail operations simulation to be performed in coordination with NS prior to project implementation.

The unit costs from the *SVRA* were updated the to reflect FY 2010 costs. The team has also made alterations to station configurations, fleet size and type, and some track work to support the current proposed alternatives. These new configurations are summarized in the following sections.

6.1 STATION LOCATIONS AND CONFIGURATIONS

The following sections describe the basic configuration of each station in terms of location, platform configuration and access, and parking. The majority of stations are located at or near former rail station sites in their respective towns; however, by and large these former stations have found new uses, so the original station buildings are not expected to be incorporated into the new stations themselves.

6.1.1 Reading

Location: Former station site, between Franklin and Chestnut streets
Platform Configuration: Single, high platform under existing station canopy along passenger-only track
Parking: Shared parking with BARTA garage will support both Minimal and Mature service (356 existing spaces, potential for 150 more to be constructed on top of garage)

6.1.2 Monocacy

Location: Former station site, west of Main Street
Platform Configuration: Two (2) low platforms with mini-high platforms (short portions of high platform access by ramps). Pedestrians use existing grade crossing to move between platforms.
Parking: For Minimal service in the opening year, construct 250 surface parking spaces on purchased property. Expansion for Mature service would add up to 200 surface spaces (450 total).

6.1.3 Pottstown

Location: Former station site, west of Hanover Street
Platform Configuration: Two (2) low platforms with mini-high platforms. Pedestrians use existing grade crossing to move between platforms.
Parking: For Minimal service in the opening year, construct 150-space garage and 125 surface spaces on shared public property. Expansion for Mature service would add up to 150 garage spaces (425 total spaces).

6.1.4 Royersford

Location: Former station site, north of Main Street
Platform Configuration: Two (2) high platforms, along passenger-only bypass tracks or gauntlet tracks. Pedestrians use existing grade crossing to move between platforms.
Parking: For Minimal service in the opening year, construct 250 surface parking spaces on purchased property. Expansion for Mature service would add up to 250-space garage, lose 100 surface spaces.

6.1.5 Phoenixville

Location: Former station site, east of Bridge Street
Platform Configuration: Single low platform with mini-high platform.
Parking: For Minimal service in the opening year, share 50 existing spaces adjacent to station, construct 200-space garage on shared property. Expansion for Mature service would add up to 100 spaces to garage.

6.1.6 Valley Forge

Location: Near Mancill Mill Road
Platform Configuration: For Minimal service, single high platform, along gauntlet track, platform accessed via overhead bridge. For Mature service, add new passenger-only track creating an island platform.
Parking: About 250-300 spaces to be constructed on property in development area

6.2 VEHICLES

Both alternatives rely on push/pull configuration train consists made up of a locomotive and passenger coaches. The Comet V passenger coach was identified, at a cost of $2 million, as a general modern single-level coach that would likely be purchased.

Alternative 1, the transfer service, would employ typical diesel-powered (diesel-electric) locomotives. The Massachusetts Bay Transit Authority in Boston recently ordered modern diesel-electric locomotives for $5.75 million each.

Alternative 2, the one-seat ride, would employ dual-powered locomotives, using diesel power from Reading to Norristown and SEPTA’s overhead catenary system for electric

power from Norristown to Center City Philadelphia[5]. The only dual-power locomotive currently in production for US markets is the ALP-45DP being acquired by NJ TRANSIT and AMT Montreal; these locomotives are estimated to cost about $9 million each.

6.3 TRACK AND YARD CONSTRUCTION

A series of track and signal improvements were proposed under the *SVRA* to improve operational flexibility and to increase capacity on the NS line to support the proposed passenger service. These improvements were analyzed and found acceptable by NS, and have been carried forward into *422plus* as the basis for track and signal investments of the transit capital improvement program. These improvements include:

Table 6.3-1: Track and Signal Improvements on NS

Minimal Service (A)	Mature Service (B) (additional to Minimal)
Second freight track in Reading (2 miles)	New passenger track through Valley Forge area (4 miles)
6 upgraded interlockings	6 upgraded interlockings 3 new interlockings
Bidirectional signaling added to one track for 11 miles	Bidirectional signaling added to two(2) tracks for 38 miles (9 miles without passenger service)

Some alterations to the *SVRA*-proposed track and signal improvements have been made. In particular, at the Valley Forge Station, where the NS right-of-way is constrained by the adjacent the Schuylkill River, track installation costs have been increased to account for track relocation for all of the NS tracks along the approach to Abrams Yard from the west. This will allow enough room for a new passenger-only track and for the Valley Forge Station platform.

Additionally, the maintenance facility in Reading proposed during the *SVRA* has been carried forward. An additional yard facility near Norristown was included in the estimate for Alternative 1, as the transfer service would require several trains to layover near Norristown during the midday for both service levels. Alternative 2 would also require trains to layover during the midday. However, as this service terminates at 30th Street Station, trains would layover in SEPTA's Powelton Yard.

Figure 6.5-1 provides schematics comparing the existing track and signal configuration on the NS Harrisburg Line to the modified configurations for Minimal and Mature service level improvements.

[5] An option for full electrification from Reading to Norristown was explored initially, but removed from consideration. Adding an overhead catenary system along the NS alignment from Reading to Norristown would be prohibitively expensive, both in terms of the power infrastructure itself and the changes to overhead structures necessary to provide the vertical clearances required by NS.

6.4 TRANSIT CAPITAL COST SUMMARY

Table 6.4-1 summarizes the costs of the transit capital improvement program to provide service from Reading to Philadelphia for each alternative and service level. Category line item costs are shown in 2010 dollars and are based on current construction costs. The total project cost is also shown in Year of Expenditure (YOE) dollars; this total is based on a year-by-year design and construction schedule, with construction beginning in 2015 and operations commencing in 2018. In addition to the Transit Capital Improvement Program, the total cost of the project includes an allowance for the purchase of access rights from NS; it is estimated that this payment could range from $100 million to $175 million for the Minimal and Mature services, respectively.

Table 6.4-1: Transit Capital Cost Summary

Cost Category		Alternative 1		Alternative 2	
		Minimal Service (A)	Mature Service (B)	Minimal Service (A)	Mature Service (B)
10	Guideway, Structures and Track	$24.6 M	$35.5 M	$24.6 M	$35.5 M
20	Stations	$55.7 M	$70.9 M	$55.7 M	$70.9 M
30	Support Facilities	$12.1 M	$13.6 M	$10.7 M	$13.2 M
40	Site Work & Special Conditions	$0.8 M	$2.5 M	$0.8 M	$2.4 M
50	Systems	$13.7 M	$26.9 M	$12.7 M	$26.9 M
	Construction Subtotal	**$106.9 M**	**$149.3 M**	**$104.6 M**	**$148.9 M**
60	Right of Way				
	Station Property	*$7.9 M*	*$8.1 M*	*$7.9 M*	*$7.9 M*
	NS Rights	*$100.0 M*	*$175.0 M*	*$100.0 M*	*$175.0 M*
	Right-of-way Subtotal	**$107.9 M**	**$183.1 M**	**$107.9 M**	**$182.9 M**
70	Rolling Stock	$63.8 M	$98.1 M	$80.0 M	$122.5 M
80	Professional Services/Soft Costs	$36.8 M	$55.5 M	$36.0 M	$55.4 M
90	Unallocated Contingency	$21.5 M	$31.1 M	$22.8 M	$33.5 M
	Total Project Cost (2010$)	**$336.8 M**	**$517.2 M**	**$351.3 M**	**$543.1 M**
	Total Project Cost (YOE$)	**$391.1 M**	**$596.2 M**	**$408.9 M**	**$628.2 M**

6.5 ALTERNATIVE 2A TO WYOMISSING

Implementing the preferred configuration, the one-seat ride to Wyomissing, presents some challenges in terms of the necessary transit capital improvements. As discussed, NS will only allow passenger service to be implemented if certain transit capital improvements are constructed to prevent operating impacts to their growing levels of freight traffic. This growth is of special concern in the area of Wyomissing Station, as freight traffic is especially heavy through Wyomissing Junction. Although this need for transit capital improvements has been considered in recent studies, the capital improvement plans used as the basis for this study only verified passenger service as far as Reading.

As this project advances, a future effort would develop, in close coordination with NS, an additional set of transit capital improvements to support service to Wyomissing as part of a new rail operations simulation to validate that these improvements provide adequate capacity and operating flexibility to support NS freight traffic and passenger trains.

A preliminary set of transit capital improvements and associated costs were prepared that are anticipated to be necessary to support service to Wyomissing. This preliminary plan can serve as a starting point for a future coordination and simulation effort with NS. The identified improvements include:

- Wyomissing Station, with a single high platform along a new passenger-only terminal track located south of the alignment and east of NS's Wyomissing Junction interlocking
- Grade-separated pedestrian access over the tracks to the shared parking area north of the alignment
- Bi-directional signaling from CP Center in Reading to Wyomissing Junction and a new crossover between Wyomissing Junction and the proposed Wyomissing Station to enhance operating flexibility

The schematics shown in Figure 6.5-1 show these proposed improvements near Wyomissing along with the other portions of the transit capital improvement plan.

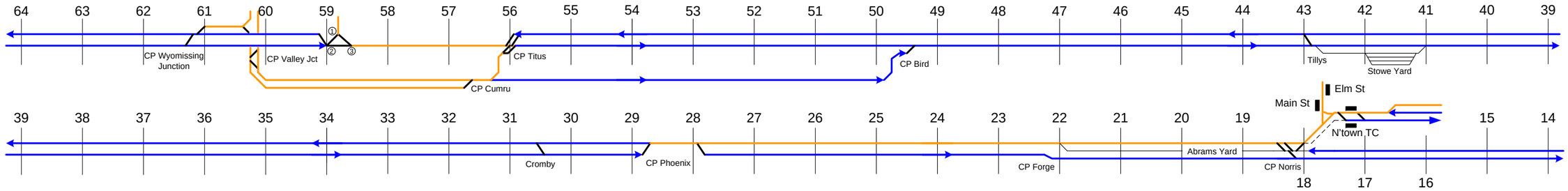
The total additional cost for these preliminary improvements is estimated to be approximately **$23.7 million** in year of expenditure dollars. This does assume that Wyomissing Station is built and opens on the same schedule as the rest of the line. The total year of expenditure capital cost to implement passenger rail service providing a one-seat ride from Wyomissing to Philadelphia at the Minimal service level of seven (7) roundtrips is estimated at **$432.6 million**, as shown in *Table 6.5-1*.

Table 6.5-1: Transit Capital Cost Summary – Wyomissing to Philadelphia Service

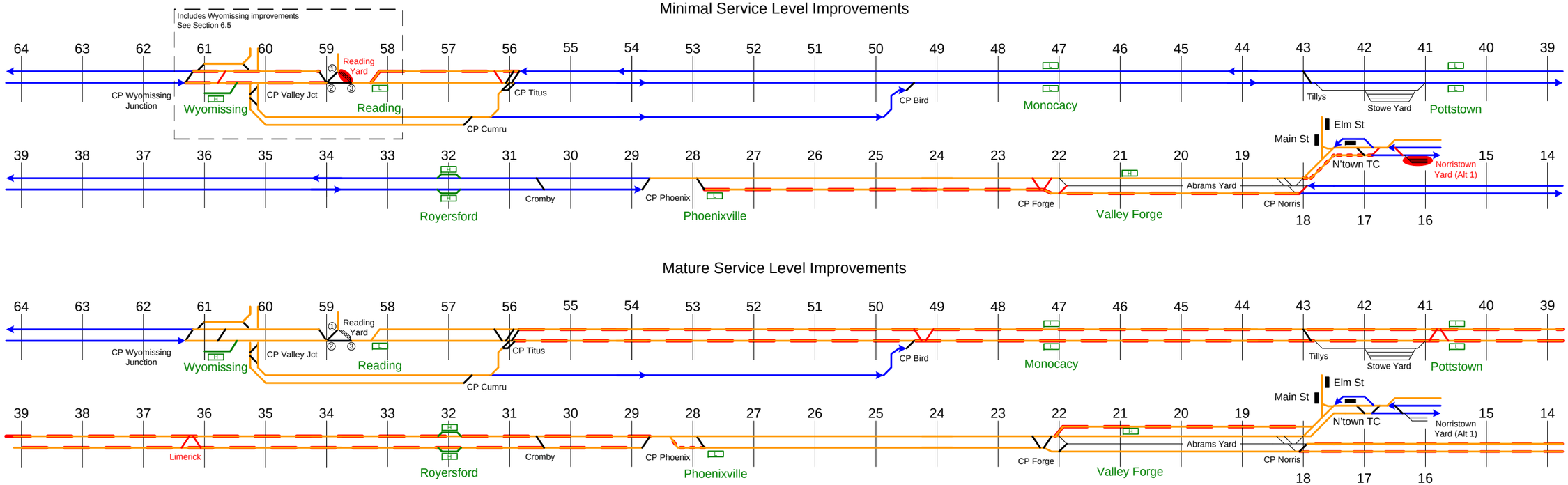
	Cost Category	One-seat Ride Minimal Service
10	Guideway, Structures and Track	$26.0 M
20	Stations	$63.9 M
30	Support Facilities	$10.7 M
40	Site Work & Special Conditions	$0.8 M
50	Systems	$16.3 M
	Construction Subtotal	**$117.8 M**
60	Right of Way	
	Station Property	*$7.9 M*
	NS Rights	*$100.0 M*
	Right-of-way Subtotal	**$107.9 M**
70	Rolling Stock	$80.0 M
80	Professional Services/Soft Costs	$40.3 M
90	Unallocated Contingency	$24.6 M
	Total Project Cost (2010$)	**$370.5 M**
	Total Project Cost (YOE$)	**$432.6 M**

Figure 6.5-1: NS Harrisburg Line – Track and Signal Configuration

Existing Configuration



Minimal Service Level Improvements



Mature Service Level Improvements

Single Direction Signaling (Rule 251)
Bi-directional Signaling (Rule 261) – Existing
Bi-directional Signaling (Rule 261) – New
Crossover (Existing)
Crossover (New)
New Station (High/Low Platform)
Station Track
SEPTA Station
Yard Track (all tracks not shown)
Out of Service Track

Notes:

① CP Oley ② CP Center ③ CP Walnut

- Numbered markers are NS mileposts
- The reconfiguration of Norristown TC shown is a planned SEPTA project. This study's capital improvements include elements not in the SEPTA plan, including the Norristown Yard (Alt 1) and reactivating the second track between Norristown and Abrams Yard.

7 Conclusions, Recommendations and Next Steps

After considering the estimated capital and O&M costs of the alternatives, as well as the forecast ridership and revenues, a strong preference for implementing Alternative 2 has been expressed, the one-seat ride service from Wyomissing to Philadelphia. This alternative provides riders with a direct trip into Center City Philadelphia and offers the best integration with the region's transit network, serving some of the major stations on the SEPTA Norristown Line.

While Alternative 1 does integrate into the regional system with a transfer at Norristown TC, the train movements necessary for the transfer option present an operational challenge. Alternative 2 does create challenges as well, requiring a close coordination of schedules between SEPTA, NS, and the new service.

The initial implementation of the service should be at the Minimal service level of seven (7) roundtrips per day. This start-up configuration would provide an initial peak-focused commuter service allowing regular ridership to build while limiting O&M costs. Furthermore, the capital costs associated with the Minimal service level represent an achievable investment given the financial plan for the new tolling authority.

7.1 SUMMARY OF NEXT STEPS

As discussed, several steps must be taken as the project advances that were not part of the scope or within the budget capabilities of 422*plus*. These next activities center on refining the analysis of service to Wyomissing and the verification of transit capital improvements over all of NS trackage.

1) The combined DVRPC and Reading MPO travel demand model should be refined to better capture travel within the Reading area and from Berks County to the rest of the region by disaggregating travel demand at Reading and Wyomissing.

2) Working closely with NS and using this study as a starting point, a set of transit capital improvements to support service to Wyomissing should be developed, with a goal of improving operational flexibility by creating alternate routes for freight traffic and moving the terminal operation at Wyomissing off the main tracks.

3) A new rail operations simulation should be conducted with NS to verify that these proposed transit capital improvements adequately support service to Wyomissing and/or identify other improvements. The passenger rail schedules underlying this simulation should be coordinated with both NS freight schedules and SEPTA Regional Rail schedules.