Altoona – Pittsburgh Passenger Rail Study

Final Report

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prepared for:

pennsylvania
DEPARTMENT OF TRANSPORTATION

prepared by:

WSP

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Executive Summary

The Altoona – Pittsburgh Passenger Rail Study is an effort by the Pennsylvania Department of Transportation (PennDOT) to explore the feasibility of additional passenger rail service, in particular, commuter service between Altoona, PA, Pittsburgh, PA, including intermediate stops. The corridor is 117 route miles from Altoona to Pittsburgh has three intermediate stations (see Table 1).

Table 1. Stations and Distance

Station	Route Miles to Next Station	Route Miles to Pittsburgh
Altoona	39	117
Johnstown	37	78
Latrobe	10	41
Greensburg	31	31
Pittsburgh	--	--

Source: Amtrak, Pennsylvanian Schedule, Effective March 10, 2018

A high-level market assessment model was used to understand the potential demand for additional passenger rail service on Norfolk Southern's (NS) Pittsburgh Line between the two cities. Subsequently, preliminary operating plans were developed based on other recent passenger rail start-up service plans within the U.S. and existing Amtrak travel times. Additionally, high-level infrastructure costs were identified based on existing corridor and station conditions and considerations of preliminary operating plans. Current and future freight operations on the NS Pittsburgh Line were not evaluated as part of this study.

The total estimated one-way daily riders in a 2015 base year range from 531 – 840, and from 666 to 1,091 in 2040 (see Table 2). An estimated 60% of all potential riders originate or terminate at Greensburg, indicating a higher demand on the inner-most portion of the rail corridor closest to Pittsburgh. This high percentage of riders is likely attributed to the markets' proximity, higher population densities, and existing commuting patterns. Considering there is existing bus service between Latrobe, Greensburg, and Pittsburgh, it is likely that some potential passengers between these markets would shift modes from bus to rail.

Table 2. Low and High Ridership Estimates for 2015 and 2040

	2015 – Daily Riders			2040 – Daily Riders		
	Inbound Commute	**Reverse Commute**	**Total One-Way Riders**	**Inbound Commute**	**Reverse Commute**	**Total One-Way Riders**
Low Range	433	98	531	539	127	666
High Range	681	159	840	852	239	1,091

Source: WSP

The ridership model uses Pennsylvania's most recently available Statewide Travel Demand Model (PA TDM) from 2015, including the population and employment projections contained within, to develop low and high range estimates for daily riders for a 2015 base year and 2040. Commute trip data was compiled for 2015 using the Census Longitudinal Employer-Household Dynamics Origin-Destination Employment Statistics data and for 2040 using PA TDM data.

Two peer commuter rail case studies were used to estimate mode split – Minneapolis's Northstar Line and New Mexico's Rail Runner. These peer systems were identified based on their characteristics relative to the Altoona – Pittsburgh corridor, many of which are comparable and provide a combination of low and high comparative figures for consideration in ridership estimation efforts. Examples of varying characteristics include the shorter Northstar Line, which has higher start-up ridership and downtown employment density, and Rail Runner's long corridor, which has lower ridership and lower downtown employment density.

A high-level infrastructure assessment was completed to estimate the costs of infrastructure improvements necessary to implement additional passenger rail service. These capital improvements include station improvements to comply with ADA requirements and track modifications to facilitate additional service. The costs were based on PennDOT's 2014 Keystone West High Speed Rail Study. The projected capital costs in 2019 dollars is $3.7 billion dollars with a lower cost option estimated at $427 million. The lower cost option includes a subset of improvements focused on stations and curve modifications while the higher cost option considers additional track capacity

improvements. Additional costs for right-of-way acquisition, NS access fees, or environmental impacts and remediation were not considered as part of this effort. NS may ultimately require different or additional capital improvements which would impact the estimated capital costs. Operating expenses are not included in this estimate. The scope of this study did not include evaluation of NS freight operations; however the corridor is heavily used by NS for freight rail. The example service plans provided in this report do not account for freight traffic, which would likely impact the operations of passenger rail service.

This report supplements the previous 2014 Keystone West Study by focusing exclusively on the Altoona – Pittsburgh segment of the corridor. The infrastructure and ridership assessment put forth in this report is intended to inform PennDOT's potential next steps in the planning process for the Altoona – Pittsburgh corridor and broader Keystone West corridor.

Past Study Review

Over the past 15 years, there have been several studies examining the potential for increased passenger rail service west of Harrisburg. These studies varied from extending the existing Keystone[1] service to Pittsburgh, to implementing a commuter rail service between Pittsburgh and Latrobe, to adding another daily Pennsylvanian[2] train.

The previous studies along the Altoona-Pittsburgh corridor indicate that there is continued interest in expanded passenger rail service. However, they also identify significant challenges to implementing reliable service, namely that it is a highly-used freight corridor and that serious infrastructure investments would be required to accommodate freight needs as well as to make stations Americans with Disabilities Act (ADA) accessible.

While these studies evaluate different service frequencies and extents, there are some common takeaways noted amongst many of the studies.

- The corridor from Pittsburgh to Harrisburg is owned by Norfolk Southern (NS) and has heavy freight traffic. Slotting in passenger service trains may be difficult.
- There will likely be significant infrastructure investments needed to accommodate reliable passenger rail service on the heavily-used NS corridor.
- The Altoona Station currently has a platform on only one of the two main tracks, therefore passenger trains must cross over the other main track to serve them, creating more opportunity for conflicts and delays.
- ADA compliance is a concern at many stations along the corridor and upgrading these facilities is costly. Additionally, stations, platforms, and parking facilities are often owned and maintained by different entities.
- Push-pull equipment is critical to minimize crew times and layovers. Turning a train at Altoona would add about two to three additional hours of crew time.

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[1] The current Keystone service connects Harrisburg, Philadelphia, and New York City, as well as intermediate markets, via 13 daily round trips.

[2] The current Pennsylvanian service connects Pittsburgh, Harrisburg, Philadelphia, and New York City, as well as intermediate markets, via one daily round trip.

Service Alternatives

The estimated upper limits of potential rail ridership for the Altoona to Pittsburgh corridor, regardless of frequency, is 840 daily riders (or 1680 unlinked trips). It is likely that one or two daily roundtrip trains would not capture the highest possible number of commuters because of the relatively limited choices for departure and arrival times. Based on the peer start-up passenger rail systems, none of the services launched with fewer than three daily frequencies, suggesting that a range between three and six trains in the morning and afternoon peaks would be a recommended minimum start-up commuter service.

Other considerations for developing a start-up service schedule include crew and equipment requirements. For the purposes of this study, it was assumed that push-pull equipment would be used, thereby eliminating the need to turn the trains at the terminal stations, which maximizes the productive time of the equipment and crews. It was also assumed that crews would be limited to 10-hour shifts, excluding rest time.

A sample service schedule is shown in Table 3 using two train sets and three crews. Two trainsets are able to provide two trains in the peak hours between Altoona and Pittsburgh. If a third crew was hired, a mid-day round trip to Altoona could also be provided which would be a desirable feature for commuters who may need to return home early and provide an additional option for other travelers on this corridor. This hypothetical schedule was developed absent information on freight schedules over the corridor and thus would need to be modified if pursued in the future.

Table 3. Sample Start-Up Commuter Service Schedule, 2 Trainsets

1	2	2		Trainset		2	1	2
AA	**BB**	**CC**		**Crew**		**CC**	**AA**	**BB**
5:00	6:00	3:00	DP	Altoona	AR	2:31	7:31	8:31
5:58	6:58	3:58	↓	Johnstown		1:33	6:33	7:33
6:41	7:41	4:41		Latrobe		12:50	5:50	6:50
6:51	7:51	4:51		Greensburg	↑	12:40	5:40	6:40
7:31	8:31	5:31	AR	Pittsburgh	DP	12:00	5:00	6:00

Source: WSP

As an alternative comparison, four trainsets would be needed to provide four trains in the peak service hours.

Table 4 shows a sample service schedule with four trains in the peak hours which would require four crews. This schedule also shows how the equipment might be maximized to provide an additional roundtrip to Greensburg in the morning, which was the station with the highest inbound ridership. Moreover, if a fifth crew were hired, a mid-day roundtrip to Altoona could be offered.

Generally, each roundtrip peak hour service between Altoona and Pittsburgh requires a unique trainset and crew. Assuming a total roundtrip travel time of six hours, it is not possible for one crew to do two roundtrips in one day. Although the trainsets could feasibly also do a midday roundtrip after arriving in Pittsburgh during the morning peak, an additional crew would need to be hired to offer that service. Assuming freight operations would not be in conflict, one crew could operate from Altoona to Pittsburgh during the morning peak, then operate a roundtrip to Greensburg returning to Pittsburgh, and finally complete an afternoon peak trip from Pittsburgh to Altoona in one shift.

This sample schedule assumes a total roundtrip time to Greensburg is two hours. The additional service to Greensburg could be beneficial since that station had the highest inbound boardings. Table 5 shows the service frequencies and number of crew required based on two, four, or six train sets. This table does not exhaust possible service iterations, but demonstrates how equipment might be maximized through additional crews and additional service to Greensburg. Additionally, these sample service frequencies do not take future freight operations or projected ridership into consideration.

Table 4. Sample Start-Up Commuter Service Schedule, Four (4) trainsets

1	2	3	4	1	2		Trainset		1	2	3	1	4	2
AA	**BB**	**CC**	**DD**	**AA**	**EE**		**Crew**		**AA**	**EE**	**AA**	**BB**	**CC**	**DD**
5:00	6:00	6:30	7:00		3:00	DP	Altoona	AR		2:31 p	6:31	7:31	8:01	8:31
5:58	6:58	7:28	7:58		3:58	↓	Johnstown			1:33 p	5:33	6:33	7:03	7:33
6:41	7:41	8:11	8:41		4:41		Latrobe			12:50	4:50	5:50	6:20	6:50
6:51	7:51	8:21	8:51	9:21 a	4:51		Greensburg	↑	8:40	12:40	4:40	5:40	6:10	6:40
7:31	8:31	9:01	9:31	10:01	5:31	AR	Pittsburgh	DP	8:00	12:00	4:00	5:00	5:30	6:00

Source: WSP

Table 5. Service Alternatives Based on Trainsets and Crews

Number of Trainsets	**2**			**4**			**6**		
Service Alternative	A	B	C	A	B	C	A	B	C
Number of ALT-PGH Roundtrips	2	2	3	4	4	5	6	6	7
Peak	2	2	2	4	4	4	6	6	6
Midday	0	0	1	0	0	1	0	0	1
Additional GNB-PGH Roundtrips	0	1	1	0	1	1	0	1	1
Number of Crews	2	2	3	4	4	5	6	6	7

Source: WSP

Infrastructure and Capital Costs

The Altoona to Pittsburgh Passenger Rail Study included a high-level infrastructure assessment of the challenges and opportunities for implementing the service alternatives. This effort involved identifying the infrastructure requirements to implement the proposed service alternatives, as well as the proposed capital costs. *Operating costs were not estimated as part of this study.*

The infrastructure and capital costs were based on estimates determined in the 2014 Keystone West High Speed Rail Study,[3] with an 8% escalation to 2019 dollars.

The infrastructure investments identified included curve modifications, a curve bypass, adding freight bypass tracks, adding and renewing passing sidings, as well as adding a continuous third track along the entire corridor. In addition, it was assumed that each station, with the exception of Altoona, would require $2.5 million for state of good repair upgrades and ADA compliance modifications. Altoona station costs were derived from the 2014 Keystone West High Speed Rail Study, which only specified costs for this station, and range from $12.3 – $16.9 million incorporating station, track and signal improvements.

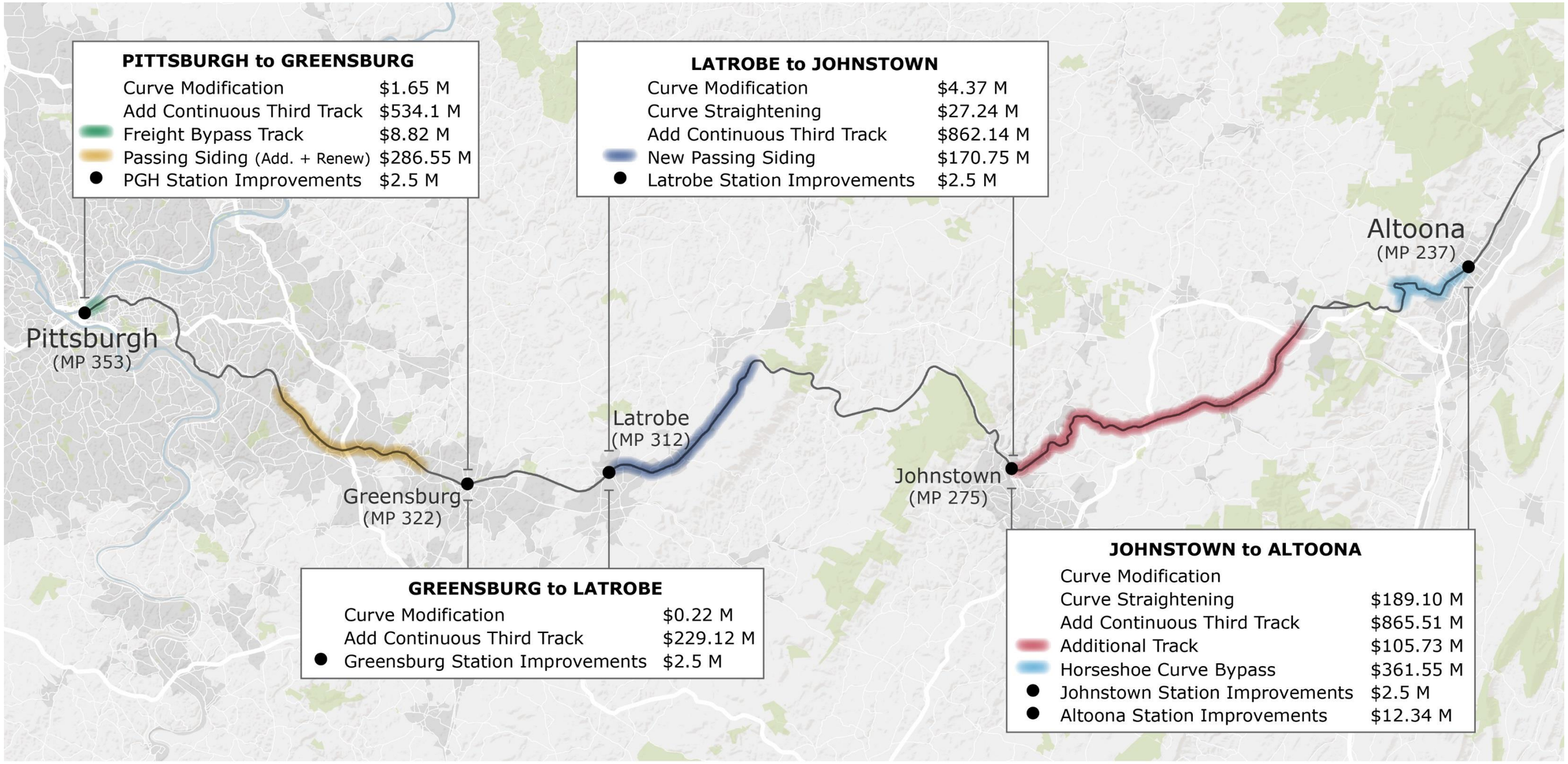
Based on the 2014 Keystone West High Speed Rail Study, the projected capital costs for the Altoona-Pittsburgh rail corridor are **$3.7 Billion** (2019$). If the third track were removed from the proposed work, the projected cost would be reduced to **$1.2 Billion** (2019$). Figure 1 provides a map of the Altoona-Pittsburgh rail corridor and a summary of the infrastructure improvements by location and type. The 2014 Study also developed a lower cost investment option of improvements selected based on being relatively lower cost, having minimal requirements for additional right-of-way, having fewer environmental impacts, and being easier to implement. This Lower Cost Option is estimated at **$427 Million** (2019$)**.**

Additional costs for right-of-way acquisition, NS access fees, or environmental impacts and remediation were not considered as part of this effort and would needed to be added to any of these estimates. Furthermore, NS may

[3] The 2014 Keystone West High Speed Rail Study was a joint study by PennDOT, the Federal Railroad Administration, Amtrak, and Norfolk Southern.

ultimately require different or additional capital improvements which would impact the estimated capital costs.

Figure 1. Altoona-Pittsburgh Rail Corridor Infrastructure Investments



Infrastructure Investments Total $3,672.49 M

Additional Track	$105.73 M	Horseshoe Curve Bypass	$361.55 M
Curve Modifications	$9.53 M	Passing Siding (Add & Renew)	$457.29 M
Curve Straightening	$216.33 M	Station Improvements	$22.34 M
Freight Bypass Track	$8.82 M	Third Track	$2,490.88 M

Conclusion & Potential Next Steps

The Altoona-Pittsburgh rail corridor is a heavily used freight-corridor owned by a freight railroad (Norfolk Southern) with existing limited passenger rail service, and a long history of local interest in expanding that passenger rail service.

The Altoona-Pittsburgh corridor differs from the peer start-up passenger rail operators examined in several key aspects. Two corridors were examined in detail to capture mode split inputs for the Altoona-Pittsburgh ridership estimates – the Northstar Line in Minneapolis, Minnesota, and the New Mexico Rail Runner serving Albuquerque and Santa Fe. While all three corridors have a terminal city of similar population magnitude (Pittsburgh is 300,000, Minneapolis is 420,000, and Albuquerque is 560,000),[4] the New Mexico Rail runner also serves Santa Fe, which is the state capitol and a tourist destination, suggesting it has another major ridership draw.

The Northstar Line and majority of the New Mexico Rail Runner route are comprised of shared corridors with freight traffic. Only a small portion of the New Mexico Rail Runner operates on exclusive right-of-way (ROW). Additionally, the right-of-way for the New Mexico Rail Runner is owned by the New Mexico DOT. Under state ownership, it is easier to implement passenger rail service and there is less of a need to negotiate operations with a freight operator. The Northstar Line differs in that it is significantly shorter at 40 miles, compared to 117 miles for the Altoona-Pittsburgh corridor. The shorter distance aligns with typical commuter rail service lines which tend to be under 50 miles long, while intercity passenger rail serves longer distance routes.

Compared to the peer operators, the Altoona-Pittsburgh line is projected to have less ridership. This study estimated that daily one-way ridership on the Altoona-Pittsburgh corridor would range from 531 – 840 in the near term and from 666 to 1,091 in 2040. These translate to a total daily ridership ranging from 1,062 – 1,680 in the near term and from 1,332 to 2,182 in 2040. The startup daily ridership for the Northstar in 2009 averaged 2,207 while the Rail Runner averaged 1,801 in 2006. Currently the Northstar line serves on average a daily ridership of 2,700 and the Rail Runner serves close to 2,800.

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[4] U.S. Census QuickFacts, Population estimates, July 1, 2017; Vancouver, BC, population from Statistics Canada, Census Profile, 2016.

Both of these lines are shorter in distance [the New Mexico Rail Runner is 97 miles long and the Minnesota Northstar is 40 miles long], and have higher current ridership than is estimated for Altoona-Pittsburgh in 2040.

Based on the estimated ridership patterns, about 60% of riders would travel between Greensburg and Pittsburgh. Another 13% of riders would travel between Latrobe and Pittsburgh, meaning that close to 75% of riders would originate and travel on just the first 41 miles of the 117-mile corridor. Westmoreland Transit currently serves Latrobe and Greensburg, so some of these estimate riders would likely be shifting from bus to rail.

Infrastructure investments to implement additional service along the corridor are significant. Based on the 2014 Keystone West High Speed Rail Study, the projected capital costs to add passenger service in 2019 dollars is $3.7 billion dollars, with a lower cost option estimated at $427 million. Norfolk Southern may ultimately require different or additional capital investments which could change this estimate. Furthermore, this does not include operating costs.

Should PennDOT want to consider additional passenger rail service between Altoona and Pittsburgh, PennDOT would need to work with local and regional stakeholders to identify a local sponsor to champion the process for project advancement. In addition to coordination with Norfolk Southern, this would also involve coordination with FTA and FRA to determine the corridor's eligibility for commuter and/or intercity passenger rail programs and funding. PennDOT does not currently have an identified funding source readily available to provide additional service west of Harrisburg; thus a distinct and reliable funding source would need to be identified to support additional service from Altoona-Pittsburgh.

An essential next step for considering additional passenger rail service on this corridor is for a project sponsor to enter into a contract agreement with Norfolk Southern to perform a detailed operations model to understand current and projected freight volumes and schedules and determine what capital improvements would be needed to avoid an impact to freight operations. It is important to emphasize that the sample schedule developed for this study does not consider Norfolk Southern's operating needs, or any capital improvements to the rail corridor that would increase capacity, speed, and/or safety.

Coordination with Amtrak will also need to be pursued. When examining additional passenger rail service, adding another daily frequency of the

Pennsylvanian operated by Amtrak may achieve at least some of the project sponsor goals. Since Amtrak already has an operating agreement with NS for the corridor, that may facilitate increasing service. Alternatively, there may be interest by other private passenger rail operators to provide service on this corridor. If this is desired by the Commonwealth, it will require an examination of potential opportunities for public-private partnerships and subsequent possible legislative changes to support a competitive procurement process.

A more precise market analysis will also be needed to establish the relationship between the number of trains provided and the resulting potential ridership market, as it was not possible for this high-level analysis to determine the relationship between the number of trains per day and resulting ridership. This could potentially include a benefit-costs analysis and a comparison to the expenses of operating the Westmoreland Transit bus service from Latrobe and Greensburg to Pittsburgh.

In conclusion, challenges to adding passenger service to the Altoona-Pittsburgh rail corridor are significant. The corridor is heavily used and owned by a freight railroad, infrastructure investments are costly, a funding source has not been identified, and ridership demand may be limited. However, passenger service currently exists on the corridor indicating existing demand and for many years local communities have remained interested in more passenger rail service. A project sponsor will need to be identified to advance more detailed study to parse out ridership demand, operational implications with Norfolk Southern, and operating costs.

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Appendix A: Previous Studies Summary

Altoona-Pittsburgh Passenger Rail Study

PREVIOUS STUDIES SUMMARY

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Overview

Passenger rail service to Pittsburgh peaked in the 1940s when 24 daily trains operated to Philadelphia. Subsequently, different services have operated on the corridor with declining frequencies. In 2005, the Pennsylvanian became the single daily train to service Pittsburgh along the Harrisburg and Altoona corridor. Since then, there has been interest from different stakeholders in increasing intercity service or adding commuter rail service to the corridor. To understand and learn from prior assessments of passenger rail service between Altoona and Pittsburgh, the Study Team reviewed previous studies of the corridor. These studies include:

- 2005 Keystone West Passenger Train Study; PennDOT and Norfolk Southern
- 2009 PRIIA Section 224 Pennsylvania Feasibility Studies Report; Amtrak
- 2009 Allegheny Valley Railroad and Norfolk Southern Commuter Rail Interim Study; Westmoreland Transit
- 2010 Altoona and Pittsburgh White Paper; Amtrak
- 2014 Increasing Service of the Pennsylvanian: Benefits and Costs; Pittsburgh Downtown Partnership
- 2014 Keystone West High Speed Rail Study; PennDOT, Federal Railroad Administration, Amtrak, and Norfolk Southern

While these studies evaluate different service frequencies and extents, there are some common takeaways noted amongst many of the studies:

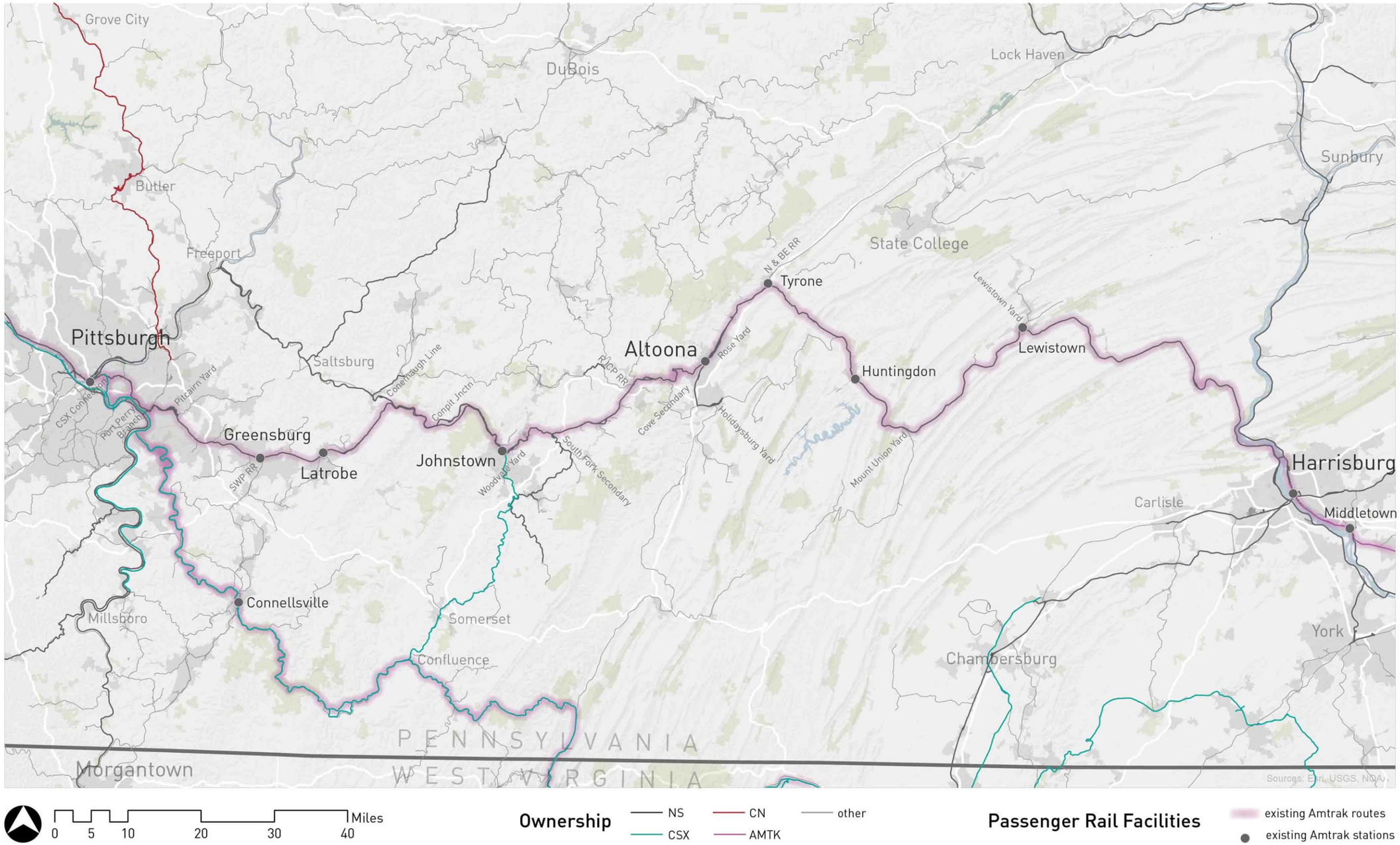
- The corridor from Pittsburgh to Harrisburg is owned by Norfolk Southern (NS). This corridor has heavy freight traffic and many of the NS trains are long and generally operate at speeds less than passenger trains. Slotting in passenger service trains may be difficult.
- There are likely to be significant infrastructure investments needed to accommodate reliable passenger rail service on the heavily-used NS corridor.
- The Altoona Station has a platform on just one of the two main tracks, meaning passenger trains must cross over the other main track to serve them, creating more opportunity for conflicts and delays. This could be mitigated by building a second platform. However, station improvements will need to be ADA compliant and would require the construction of overpasses or underpasses for passenger access.

- ADA compliance is a concern at many stations along the corridor. Further complicating potential updates is that the stations, platforms, and parking facilities along the corridor are owned by different agencies. The owning agencies are not always the parties responsible for maintenance.
- Push-pull equipment would minimize crew times and create more possibilities for layovers. At Altoona, there are two wye tracks nearby, but turning a train would add about two to three additional hours of crew time.
- The 2009 Westmoreland Transit Study estimated that in 2035 there would be 1,500 to 1,700 daily boardings on a commuter rail line from Johnstown and Latrobe to Pittsburgh. Other studies indicated that there was more ridership demand to eastern destinations, such as Harrisburg.

The previous studies along the Altoona-Pittsburgh corridor indicate that there exists continued interest in expanded passenger rail service. They provide helpful insight into different service levels and different stations considered. However, they also identify significant challenges to implementing reliable service, namely that it is a highly-used freight corridor and that serious infrastructure investments would be required to accommodate freight needs as well as to make stations accessible.

The following pages identify the geography of the Altoona-Pittsburgh rail corridor and summarize the reports reviewed, including the alternatives proposed, cost estimates, and relevant issues for consideration in this current effort.

Altoona – Pittsburgh Rail Corridor and Context



Title	Agency	Date	Cost	Alternatives Proposed	Relevant Issues to Consider

Keystone West Passenger Train Study	Norfolk Southern, PennDOT	2005	• Infrastructure improvements at a cost of $110.9 million in 2005$. This is equivalent to $146.6 in 2018$.
			• Did not estimate cost of additional passenger trains.
				• 2 additional roundtrips per day which must not interfere with freight operations, and faster existing Amtrak operations. Did not examine ridership estimates, but evaluated impacts to freight operations.
				• Identified four infrastructure improvements to mitigate negative impacts to freight (all values in 2005$):
				  ○ New track inside Pittsburgh Amtrak station enabling freight trains to bypass Amtrak trains loading/unloading passengers ($3.2 million)
				  ○ Double track the Port Perry Branch to create full double track bypass around Pittsburgh Amtrak Station and the Pittsburgh Line ($28.1 million)
				  ○ Addition of 4th main track on heavy grade between CP-C Johnstown and CP-MO near Cresson, creating two tracks for faster passenger and intermodal trains and two tracks for slower merchandise and coal trains ($66.5 million)
				  ○ Construction of additional main track between CP-Harris at the Harrisburg Station and CP Rockville at the Harrisburg Terminal to permit Amtrak trains to bypass congestion at the Harrisburg Yard and fueling facility ($13.1 million)
				• The study suggested an alternative to infrastructure investment which was reducing maximum authorized speeds, train schedules, and train priorities of Amtrak trains to levels that are equal to NS's highest priority intermodal freight trains. Amtrak trains would fit more readily in NS train flows.
					• Identified Harrisburg-Altoona-Pittsburgh corridor as one of the heaviest density lines in NS system (104 trains during 7-day period)
					• Most NS trains are long and heavy, extending up to 2 miles with speeds ranging from 10 mph to 60 mph
					• NS operates trains on the right-hand running rule. For eastbound Amtrak trains to serve the six stations on the Main Track No. 2, the Amtrak trains must cross over and run against the right-hand rule flow. These crossovers can result in train delays.
					  ○ Recommend making all stations accessible via ADA-compliant pedestrian overpasses or tunnels to both No. 1 and No. 2 tracks, so that both tracks are available for loading/unloading passengers.

Title	Agency	Date	Cost	Alternatives Proposed	Relevant Issues to Consider

PRIIA Section 224 Pennsylvania Feasibility Studies Report	Amtrak	2009	• One additional train from NYP-PGH (all in 2009$)
			  ○ Operating cost: $13.7 million
			  ○ Operating loss: $6.7 million
			  ○ Equipment cost: $88 million
			• One additional train from NYP-ALT (all in 2009$)
			  ○ Operating cost: $3.0 million
			  ○ Operating loss: $1.7 million
			  ○ Equipment cost: $40 million
				• Two alternatives were considered, Amtrak used their own models to calculate ridership and revenue forecasts, using FY2009 data as the baseline.
				• One additional train per day to/from PGH which replaces a Keystone train to/from NYP (arrive in PGH at 11:09 pm, depart PGH at 1:00 pm).
				  ○ Forecast: 144,400 additional annual riders
				  ○ Forecast: $6.7 million additional ticket revenue
				  ○ Forecast: 37.6 million additional passenger miles
				  ○ Total operating costs: $13.7 million[5]
				  ○ Farebox Recovery Ratio: 51%
				  ○ Equipment capital costs: $88 million
				  ○ New fulltime employees: 22
				• An extension of one Keystone train west of Harrisburg to Altoona. This would enable Altoona passengers to arrive in the morning at HAR, PHL, or NYP.
				  ○ Forecast: 36,000 additional annual riders
				  ○ Forecast: $1.2 million additional ticket revenue
				  ○ Forecast: 7.8 million additional passenger miles
				  ○ The Altoona service includes an Altoona Thruway Bus connection to/from State College, which would yield $56,000 and 6,000 riders, which are included in the forecasts.
				  ○ Total operating costs: $3.0 million[5]
				  ○ Farebox Recovery Ratio: 42%
				  ○ Equipment capital costs: $40 million
				  ○ New fulltime employees: 9
					• NS owns lines from Harrisburg to Pittsburgh
					• The route west of Harrisburg is mountainous and curvy
					• Trains operating west of Harrisburg use diesel locomotives which do not have the horsepower or acceleration of electric locomotives
					• Average of 39.8 NS freight trains between Harrisburg and Pittsburgh each day.
					• Of the nine stations on the PGH-HAR line, three have platforms on just one side necessitating train crossovers.
					• Stations must be provided which are ADA compliant
					• Amtrak does not own all the stations. NS owns most of the platforms but Amtrak is responsible for maintaining.
					• Extending service beyond Harrisburg requires providing onboard food service.

[5] Operating costs include expenses such as payment to the host railroad (in this case Norfolk Southern), fuel, train and engine labor, yard operations, transportation management and training, on-board services labor, and mechanical and station services.

Title	Agency	Date	Cost	Alternatives Proposed	Relevant Issues to Consider

Allegheny Valley Railroad and Norfolk Southern Commuter Rail Interim Study	Westmoreland Transit	2009	• Estimated capital costs for NS corridor in 2012$ were $85.3 million.
			• Estimated Annual O&M costs in 2012$ were $14.9 million.
				• This study examined alternatives for proposed commuter rail service on the Allegheny Valley Railroad (AVR) corridor and the Norfolk Southern (NS) corridors in Allegheny and Westmoreland Counties.
				• On the NS corridor, the study considered service alternatives for commuter rail between Latrobe and Pittsburgh, with intermediate stops at Greensburg, Jeannette, Irwin, and Trafford.
				• The proposed service was four trains about 30 minutes apart in the peak direction, with one reverse direction train, as well as one midday round trip. [Note: the service plan was developed without input from NS. NS did not comment on the feasibility of the service plan.]
				• The Southwestern Pennsylvania Commission (SPC) estimated 1,300 - 1,500 daily boardings on the NS commuter line in opening year 2012. They estimated 1,500 – 1,700 daily boardings in horizon year 2035.
				  ○ Stations common to all alternatives forecasted: Latrobe, Greensburg, Jeannette, Shadyside/S. Negley Avenue, Pittsburgh Penn Station
				  ○ Different alternatives included: Trafford, Irwin; Trafford and Irwin together
					• The study suggested the creation of a station in the Shadyside area of Pittsburgh to allow for bus connections to Oakland.
					• The MLK East Busway in Pittsburgh limits expansion possibilities on part of the NS line.
					• The study indicated a station at Irwin is difficult to locate. They suggested the need for additional study of this issue.
					• The study noted the limitations of the ridership demand model used and suggested that additional data collection and market analysis was needed.
					• The study suggested locating train storage and a maintenance facility five miles east of Latrobe near Derry. This is a former rail yard, located approximately at MP 308.
					• The study noted the lack of ADA access at Latrobe.
					• For several cities, the study identified alternative station locations. These cities include Jeannette (two alternatives), Irwin (three alternatives), and Trafford (three alternatives).
					• The study identified a location for a Shadyside station in the NS right-of-way immediately adjacent to the Port Authority of Allegheny County’s East Busway Station at S. Negley Avenue. The rail station platform would be limited to Track 1, due to the narrow right-of-way.
					• The ridership estimates suggested that Trafford is a vital station to make the line successful, but that Irwin may not generate enough trips to justify building a station.

Title	Agency	Date	Cost	Alternatives Proposed	Relevant Issues to Consider

Altoona and Pittsburgh White Paper	Amtrak	2010	N/A	• In considering providing additional service between PHL and PGH, this study examined the current conditions of the existing Altoona and Pittsburgh stations and what improvements would need to be made to them, as well as to tracks, station platforms, and train servicing and crew facilities.
				• Requiring overnight storage at Altoona Station
				  ○ Each option requires construction of or NS making available 800-1,000 feet of track with an access road.
				  ○ With an operating cab on just one end, if a train originates or terminates in Altoona, it needs to turn back. There are two existing wye tracks, but require 2-3 hours off additional crew time to utilize.
				  ○ Option 1: East of Altoona, store trains in Rose Yard. Crew and maintenance facilities need to be built.
				  ○ Option 2: West of Altoona there is a connection to the Cove Secondary track, but poor track condition limits train speeds to less than 10 mph. There is a highway crossing, so use of the track would require grade crossing protection
				  ○ If push-pull equipment were used, it would create other layover possibilities and reduce crew time for turning the train.
				• Overnight storage at Pittsburgh Station
				  ○ Minimal capital improvements needed to store on additional train at the station on Track 4, which is rented out to a private rail car owner.
				  ○ Turning the Pennsylvanian each night takes approximately one hour of crew time. With push-pull equipment, this wouldn't be required. The Pennsylvanian is stored on Track 3.
					• Additional capacity for passenger trains on existing lines is limited by significant freight operations.
					• Altoona station
					  ○ The station structure and parking facilities are owned and maintained by the Redevelopment Authority of Altoona.
					  ○ The platforms are owned by NS and Amtrak is responsible for them.
					  ○ Platform only on one side on main track #2
					• Pittsburgh Station
					  ○ The station structure is owned by Amtrak.
					  ○ The platforms are owned by Amtrak and NS; Amtrak is responsible for them.
					  ○ The parking facilities are owned by Amtrak and the Historic Landmarks Realty Growth Fund.
					• Studied noted anecdotal evidence that there is greater ridership demand from Altoona to Harrisburg than Altoona to Pittsburgh. They suggest that extending a Keystone train to Altoona might better meet passenger demand.

Title	Agency	Date	Cost	Alternatives Proposed	Relevant Issues to Consider
Increasing Service of the Pennsylvanian: Benefits and Costs	Pittsburgh Downtown Partnership	2014	• Capital costs for new train sets are estimated to cost $47 - $94 million. • Estimated annual operating deficit for the increased service is $4.2 million on top of the operating deficit of $3.8 million for the current service. This is the estimated state operating support.	• The report examines increasing the frequency of the Pennsylvanian to three daily round trips between Pittsburgh and New York City. The report estimates nearly 200,000 additional annual ridership, on top of existing ridership close to 220,000, and additional revenue of $10.5 million. • The report estimates total annual benefits worth $302 billion when accounting for savings in emissions, vehicular accidents, highway maintenance, and household savings.	• The report did not consider infrastructure improvements or system impacts. • Depending on the schedule, the additional frequencies may require Amtrak to buy either two or four additional train sets.

Title	Agency	Date	Cost	Alternatives Proposed	Relevant Issues to Consider

Keystone West High Speed Rail Study	PennDOT, FRA, Amtrak, NS	2014	• Alternative 2 costs
			  ○ ROW cost: $14 million
			  ○ Infrastructure cost: $9.9 billion
			  ○ Annual operating costs in 2035: $24 million
			  ○ Annual operating revenue in 2035: $14 million.
				• Study purpose to evaluate the possibility of decreasing travel times and increasing trip frequency between Harrisburg and Pittsburgh, while minimizing impacts to NS operations.
				• They considered 4 alternatives:
				1. Curve modifications in existing ROW
				ROW costs: $400,000;
				Infrastructure costs: $1.5 billion;
				Time savings: EB 9 min +; WB 5 min +
				2. Alt. 1 plus curve straightening and some new alignments at slow points
				ROW costs: $14 million;
				Infrastructure costs: $9.9 billion;
				Time savings: EB 35 min +; WB 29 min +
				3. Alt 1 & 2 plus addition of a continuous 3rd track
				ROW costs: $16 million;
				Infrastructure costs: $13.1 billion;
				Time savings: Same as Alt 2 plus additional from fewer freight conflicts and additional capacity
				4. All new electrified, two-track passenger train only, high speed alignment on southerly route similar to PA turnpike.
				ROW costs: $50 million;
				Infrastructure costs: $38.3 billion;
				Time savings not calculated
				• Alternative 4 was dropped because of cost and community impacts.
				• Alternative 2 was used to estimate ridership demand and an assumed service schedule of 2 daily roundtrips between HAR and PGH.
				In 2035, Alt 2 ridership is 80,000 greater on just Keystone West than no build, and 134,000 greater on the total Pennsylvanian line than no build. If bus connections are added to State College, there is an additional 5,000 – 10,000 riders.
				• Operating costs for Alternative 2 in 2035 was estimated to be $24 million and annual revenue was estimated to be $14 million, leaving an operating deficit of close to $11 million.
					• There is currently only once-daily passenger rail service
					• A lengthy (5½-hour) travel time
					• Lack of convenient multimodal travel options for underserved populations
					• Lack of amenities and intermodal connections at existing stations
					• No connecting service to State College—an area of high commuter population.
					• Varying topography, including mountainous areas, creates challenges for passenger rail.

Appendix B: Service Alternatives Report

ALTOONA – PITTSBURGH PASSENGER RAIL STUDY

SERVICE ALTERNATIVES REPORT

May 2019

pennsylvania
DEPARTMENT OF TRANSPORTATION

WSP

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EXECUTIVE SUMMARY

The Altoona-Pittsburgh Passenger Rail Study developed a high-level market assessment to understand the potential demand for additional passenger rail service on Norfolk Southern's rail corridor between Altoona and Pittsburgh.

Using Pennsylvania's most recently available Statewide Travel Demand Model (PA TDM) from 2015, including the population and employment projections contained within, low and high range estimates for daily riders were developed for a base year of 2015 and a forecast year of 2040. The base year and forecast year were set according to the available PA TDM data and are consistent with the PA TDM model. Total one-way daily riders (includes peak direction and reverse commute passengers) in 2015 range from **531 – 840**, and from **666 to 1,091** in 2040 (see Table 1).

Table 1. Low and High Ridership Estimates for 2015 and 2040

	2015 – Daily Riders			**2040 – Daily Riders**		
	Inbound Commuter	**Reverse Commute**	**Total One-Way Riders**	**Inbound Commuter**	**Reverse Commute**	**Total One-Way Riders**
Low Range	433	98	531	539	127	666
High Range	681	159	840	852	239	1091

Source: WSP

At a length of 117 miles, the rail corridor between Altoona and Pittsburgh lies between the distance of a traditional commuter rail line and typical intercity rail line. Accordingly, it was found that more than half of the inbound commuters would be boarding in Greensburg, which is 31 miles from Pittsburgh and of a more typical commuter rail distance. While Pittsburgh is the largest population and employment center along this rail corridor, there is also potential to consider reverse peak and/or mid-day service to Altoona or Greensburg from Pittsburgh. The model outputs did not suggest a large number of passengers commuting between intermediate stations on the corridor.

The effort also looked at considerations for developing a start-up service including crew and equipment requirements. *Conceptual service plans were developed in isolation of existing operations and consultation with the host*

railroad of Norfolk Southern. Assuming existing Amtrak *Pennsylvanian* travel speeds, **each roundtrip peak hour service between Altoona and Pittsburgh would require a unique trainset and crew.**

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

An essential next step for considering additional passenger rail service on this corridor would be to **enter into an agreement with Norfolk Southern to perform detailed operations modeling to identify the specific capital improvements needed by Norfolk Southern** on this corridor so as to not impact their freight rail operations. Additionally, a more precise market analysis would also be essential to establish the relationship between the number of trains provided and the resulting potential ridership market.

The study does not identify a potential operator of passenger rail service on the corridor. Local and regional stakeholders would need to identify a sponsor or champion to advance the project, which would also involve coordinating with the Federal Transit Administration if federal funding is considered. Additionally, PennDOT will continue to coordinate with Amtrak on their ongoing efforts to provide a second daily round trip of the *Pennsylvanian*.

INTRODUCTION

The purpose of this task was to complete a high-level market assessment to understand demand for additional passenger rail service on the Altoona-Pittsburgh corridor. This process involved using readily available data to determine commuter travel patterns as well as mode splits to develop reasonable estimates of likely ridership on a potential passenger rail service. Based on the range of estimated ridership demand, representative service plans were developed to demonstrate how that ridership demand could be met.

The analysis included a survey of past service and prior studies. There has been historical interest in passenger rail operations on this corridor, with some attempts at offering increased passenger rail service in the 1980s and with occasional studies examining the potential for new service. The project team also conducted a high-level market assessment of population and employment along the corridor, as well as the employment characteristics of the Pittsburgh station area.

A survey of other new commuter and intercity services enabled a comparison of common features, including corridor distance, service frequency, and ridership. Rail mode split was also calculated for select corridors as a basis for understanding potential ridership along the Altoona-Pittsburgh corridor. Actual mode splits observed in other markets with new commuter rail service were applied to the Altoona-Pittsburgh corridor to develop ridership demand estimates.

Finally, sample service plans were developed with an awareness of required equipment (i.e., number of train sets) and crew requirements. The service plans show how trains might be scheduled, but these were *developed in isolation from how freight operations might impact service*. Furthermore, while it is known that higher frequency service is more likely to capture more of the estimated potential demand, it is not possible at this detail of modeling to determine how much impact on ridership additional frequencies would have.

The study provides an initial assessment of the current and future rail ridership demand along the Altoona-Pittsburgh corridor.

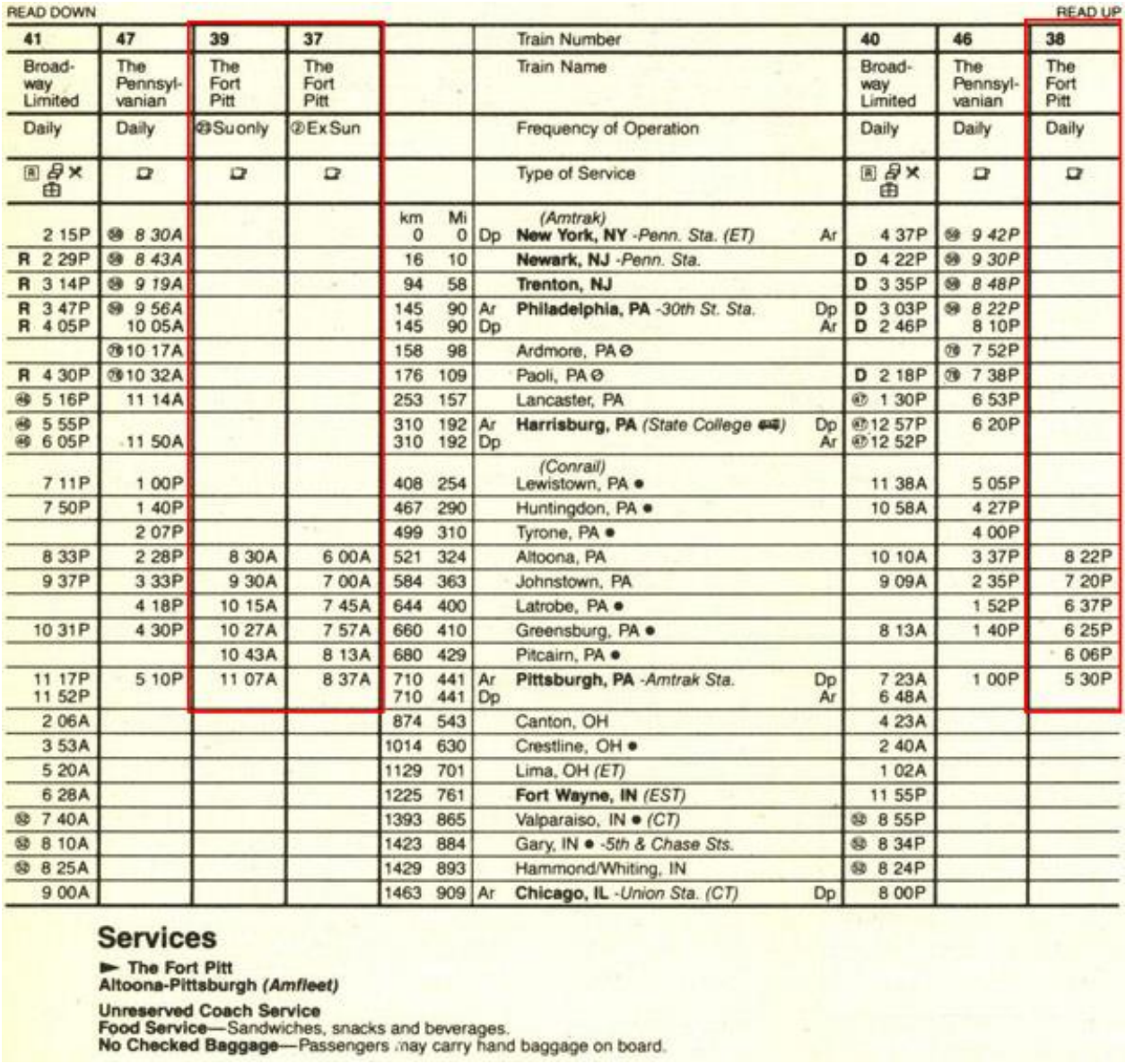
CORRIDOR HISTORY: PRIOR SERVICE AND STUDIES

The Altoona-Pittsburgh corridor, which is currently owned and used by freight railroad Norfolk Southern, has a history of passenger rail service. While Amtrak's *Pennsylvanian* service currently operates one daily round trip along the corridor, the agency previously operated a short-lived additional frequency from Altoona to Pittsburgh.

From April 1981 to January 1983, Amtrak operated the *Fort Pitt* service which operated in tandem with the *Pennsylvanian*, which at the time operated only on a Pittsburgh to Philadelphia route.[1,2] The westbound *Pennsylvanian*, after arriving in Pittsburgh in the evening, turned around east to Altoona. The following morning, that same trainset returned to Pittsburgh as a westbound *Fort Pitt*, then ran eastbound to Philadelphia as a *Pennsylvanian*.[2] The *Fort Pitt* stopped at Altoona, Johnstown, Latrobe, Greenburg, Pitcairn, and Pittsburgh, with one trip westbound each morning and one trip eastbound each evening. See the historic timetable Figure 1. Fort Pitt Schedule.

[1]Pittsburgh Post-Gazette, December 24, 1982, https://news.google.com/newspapers?nid=1129&dat=19821224&id=huUNAAAAIBAJ&sjid=nG0DAAAAIBAJ&pg=6904,6229361
[2]Revolvy, https://www.revolvy.com/page/Fort-Pitt-%28train%29

Figure 1. Fort Pitt Schedule



READ DOWN — READ UP

41	47	39	37		Train Number	40	46	38
Broad-way Limited	The Pennsyl-vanian	The Fort Pitt	The Fort Pitt		Train Name	Broad-way Limited	The Pennsyl-vanian	The Fort Pitt
Daily	Daily	㉓Su only	②Ex Sun		Frequency of Operation	Daily	Daily	Daily
2 15P	8 30A			km 0 / Mi 0	(Amtrak) Dp **New York, NY** *-Penn. Sta. (ET)* Ar	4 37P	9 42P	
R 2 29P	8 43A			16 / 10	**Newark, NJ** *-Penn. Sta.*	D 4 22P	9 30P	
R 3 14P	9 19A			94 / 58	**Trenton, NJ**	D 3 35P	8 48P	
R 3 47P R 4 05P	9 56A 10 05A			145 / 90 145 / 90	Ar **Philadelphia, PA** *-30th St. Sta.* Dp Dp Ar	D 3 03P D 2 46P	8 22P 8 10P	
	⑦⑩10 17A			158 / 98	Ardmore, PA ⊘		⑩ 7 52P	
R 4 30P	⑦⑩10 32A			176 / 109	Paoli, PA ⊘	D 2 18P	⑩ 7 38P	
㊾ 5 16P	11 14A			253 / 157	Lancaster, PA	㊼ 1 30P	6 53P	
㊾ 5 55P ㊾ 6 05P	11 50A			310 / 192 310 / 192	Ar **Harrisburg, PA** *(State College ㊽)* Dp Dp Ar	㊼12 57P ㊼12 52P	6 20P	
7 11P	1 00P			408 / 254	(Conrail) Lewistown, PA ●	11 38A	5 05P	
7 50P	1 40P			467 / 290	Huntingdon, PA ●	10 58A	4 27P	
	2 07P			499 / 310	Tyrone, PA ●		4 00P	
8 33P	2 28P	8 30A	6 00A	521 / 324	Altoona, PA	10 10A	3 37P	8 22P
9 37P	3 33P	9 30A	7 00A	584 / 363	Johnstown, PA	9 09A	2 35P	7 20P
	4 18P	10 15A	7 45A	644 / 400	Latrobe, PA ●		1 52P	6 37P
10 31P	4 30P	10 27A	7 57A	660 / 410	Greensburg, PA ●	8 13A	1 40P	6 25P
		10 43A	8 13A	680 / 429	Pitcairn, PA ●			6 06P
11 17P 11 52P	5 10P	11 07A	8 37A	710 / 441 710 / 441	Ar **Pittsburgh, PA** *-Amtrak Sta.* Dp Dp Ar	7 23A 6 48A	1 00P	5 30P
2 06A				874 / 543	Canton, OH	4 23A		
3 53A				1014 / 630	Crestline, OH ●	2 40A		
5 20A				1129 / 701	Lima, OH *(ET)*	1 02A		
6 28A				1225 / 761	**Fort Wayne, IN** *(EST)*	11 55P		
㊿ 7 40A				1393 / 865	Valparaiso, IN ● *(CT)*	㊿ 8 55P		
㊿ 8 10A				1423 / 884	Gary, IN ● *-5th & Chase Sts.*	㊿ 8 34P		
㊿ 8 25A				1429 / 893	Hammond/Whiting, IN	㊿ 8 24P		
9 00A				1463 / 909	Ar **Chicago, IL** *-Union Sta. (CT)* Dp	8 00P		

Services

► **The Fort Pitt**
Altoona-Pittsburgh *(Amfleet)*

Unreserved Coach Service
Food Service—Sandwiches, snacks and beverages.
No Checked Baggage—Passengers may carry hand baggage on board.

Source: Museum of Railway Timetables, 1982, http://www.timetables.org/full.php?group=19821031&item=0036

The Fort Pitt service carried an average of 30 passengers daily (approximately 11,000 annual passengers).[1] Similar to the Broadway Limited line, the Fort Pitt service operated under cost-sharing terms under section 403(b) of Amtrak law.[3] Prior to the start of service Amtrak projected

[3] Amtrak Press Release, April 9, 1980, http://digitalcollections.library.cmu.edu/awweb/awarchive?type=file&item=598806

that the *Fort Pitt* would serve 83,000 passengers a year, however low ridership and a state funding cut caused the service to end in 1983.[1] In 1983 dollars, the one way regular coach fare between Altoona and Pittsburgh was $16.40, and a roundtrip excursion fare between the cities was $25.00.[3] Considering inflation, the one-way fare and roundtrip excursion fare equates to $41.45 and $63.18 in 2019 dollars.[4] This indicates ticket pricing was not suited for daily commuter travel and tailored more for intercity travel.

Also in 1981, for a short time, PennDOT and Conrail operated a commuter line service between Greensburg and Pittsburgh, known as the *Parkway Limited*, with two morning frequencies and two afternoon frequencies. The service had strong ridership when it opened, with a high of 600 daily boardings, but it quickly fell to less than 200 and the service was cancelled after eight months.[5]

There has been interest over the past couple decades in understanding the potential for adding more passenger rail service to the corridor. These studies have examined adding an additional Pennsylvanian frequency[6] (which is currently being analyzed by PennDOT, Amtrak, and Norfolk Southern), extending Keystone service west of Harrisburg,[7] and adding commuter rail service between Pittsburgh and Latrobe.[8]

CURRENT CONDITIONS

PITTSBURGH STATION AREA CHARACTERISTICS

Pittsburgh's Pennsylvania Station is located at the northern edge of Pittsburgh's central business district (CBD), also known as the Golden Triangle. Due to the geography and other physical barriers around downtown

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[4] U.S. Inflation Calculator, 2019, https://www.usinflationcalculator.com/
[5] Pittsburgh Press, Nov 14, 1981, https://news.google.com/newspapers?id=CBovAAAAIBAJ&sjid=e10EAAAAIBAJ&dq=parkway-limited&pg=6847%2C7417835
[6] 2009 PRIIA Section 224 Pennsylvania Feasibility Studies Report; Amtrak
[7] 2005 Keystone West Passenger Train Study; PennDOT and Norfolk Southern
[8] 2009 Allegheny Valley Railroad and Norfolk Southern Commuter Rail Interim Study; Westmoreland Transit

Pittsburgh, the CBD is the easiest and most convenient area to access from the train station by foot or by transit. While the geographic area of the CBD is small (0.64 square miles), the employment density is quite high. Within the designated CBD (as defined by the City of Pittsburgh) there are approximately 80,000 total jobs – a density of 125,000 jobs per square mile.[9] As of 2004, Pittsburgh's CBD ranked 6th in the country in jobs per square mile and 25th in the country for total jobs in the city proper.

Focusing on the station itself and the surrounding area, roughly 50,000 jobs lie within half a mile of the station, 95,000 jobs within 0.75 miles, and 110,000 jobs within one mile.[9] While the majority of the jobs in these buffer areas lie within the central business district, a small portion of these jobs are located on the opposite sides of the Allegheny River, Monongahela River, or I-579 from the train station – all of which are significant physical barriers.

The second largest and densest employment area in Pittsburgh behind the CBD is Oakland. This neighborhood is growing into a major innovation center anchored by the University of Pittsburgh, Carnegie Mellon University, and the University of Pittsburgh Medical Center. While not immediately adjacent to the Pittsburgh – Altoona rail corridor, the center of Oakland is located roughly 1-1.5 miles from the rail line itself. With a new intermediate station and adequate last-mile connectivity, the Oakland neighborhood has the potential to serve as another major employment destination with 52,000 workers.

Pittsburgh has traditionally been an anchor of the western Pennsylvania economy and continues to serve as a major employment and economic center in the region. Despite wavering industry sectors and the postwar decline of many U.S. cities, Pittsburgh has largely maintained historic job counts within the city proper. In 2015, the City of Pittsburgh was home to an estimated 277,000 jobs compared to 294,000 jobs in 1958, shortly after Pittsburgh's population peak in 1950. In the Golden Triangle specifically there were an estimated 107,000 jobs in 1958 compared to 80,000 in 2015.[10]

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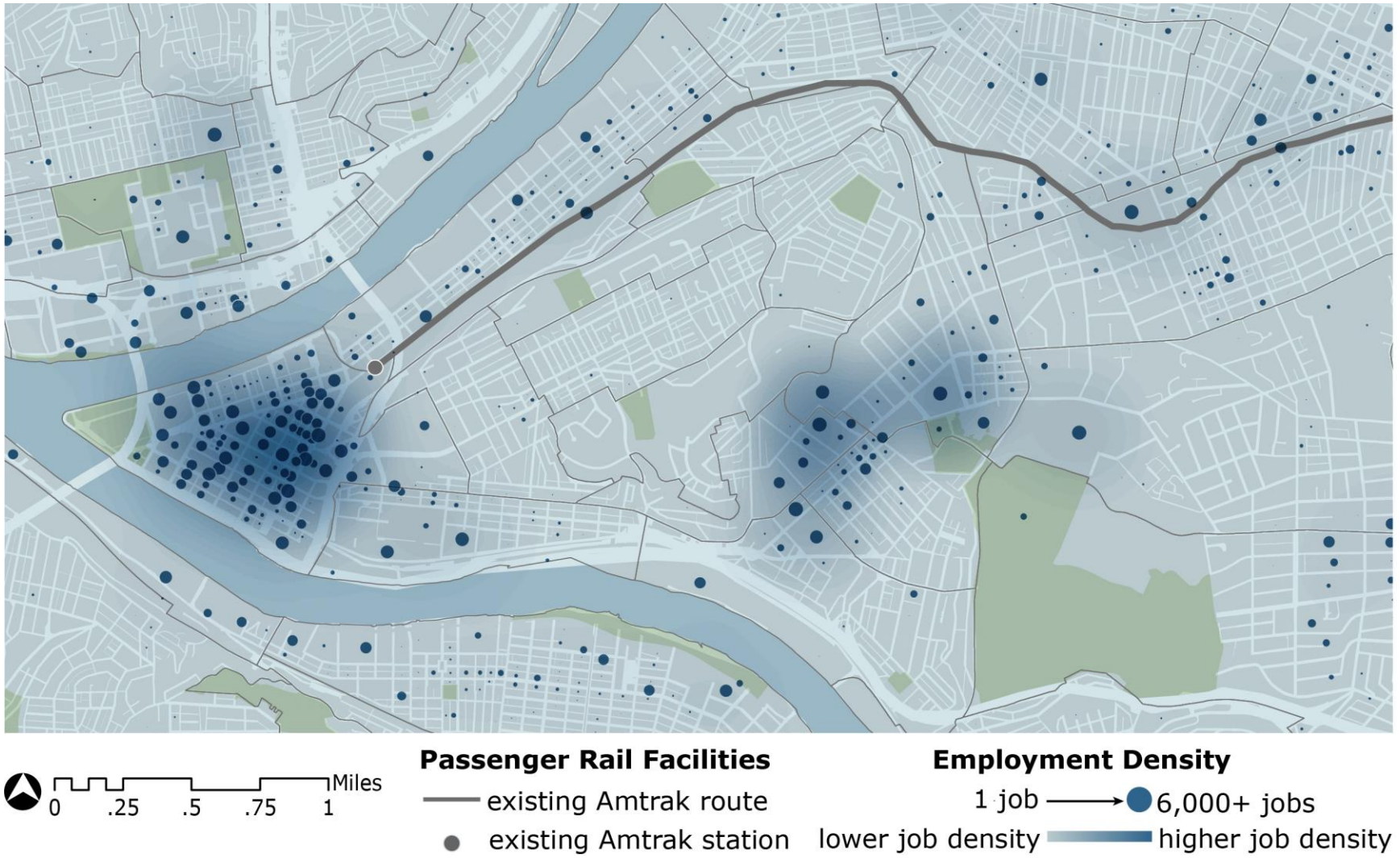
[9] US Census Bureau, LEHD, 2015

[10] Nullspace. August 5, 2011, https://nullspace2.blogspot.com/2011/08/hold-em-like-they-do-in-texas-plays.html

Figure 2. Downtown Pittsburgh Employment Density



Source: US Census Bureau, LEHD, 2015

EXISTING INTERCITY BUS SERVICE

The Altoona – Pittsburgh corridor is currently served by Greyhound intercity bus service and several intermediate markets on the corridor are served by Westmoreland Transit routes. The Greyhound intercity bus service is partially subsidized by PennDOT and operates between Pittsburgh and Harrisburg with intermediate stops in Greensburg, Latrobe, Johnstown, and Ebensburg. Two roundtrips are operated per day with inbound trips departing Altoona at 2:30 PM and 9:20 PM and arriving in Pittsburgh at 6:10 PM and 12:55 AM, respectively. Outbound trips from Pittsburgh depart at 9:20 AM and 1:05 PM and arrive in Altoona at 12:50 PM and 4:40 PM., respectively. The existing timing and frequency of the route does not accommodate traditional commuting trips into Pittsburgh as the route primarily serves the intercity bus market. As such, the existing ridership is quite modest as conveyed in Table 2 below. For comparison, Table *3* presents Amtrak's daily round-trip Pennsylvanian service ridership, which serves many of the same markets with a schedule that also does not accommodate traditional commuting trips into Pittsburgh.

PennDOT also subsidizes intercity bus service operated by Fullington between Harrisburg and Pittsburgh, and State College and Pittsburgh. These routes serve the US 119 corridor through DuBois, Punxsutawney, Indiana, and other municipalities and do not serve the Altoona to Pittsburgh corridor directly.

It is important to note that PennDOT currently collects total boardings and alightings at each stop for the entirety of subsidized intercity bus routes. Thus, not all boardings and alightings are originating or terminating on the Altoona – Pittsburgh corridor.

Table 2. Altoona-Pittsburgh Intercity Bus Ridership, FY 2016-2017

Market	Bus Boardings*	Bus Alightings*	TOTAL*
Pittsburgh	8,815	9,611	18,426
Greensburg	449	765	1,214
Latrobe	334	323	657
Johnstown	926	1,267	2,193
Ebensburg	279	145	424
Altoona	2,613	2,160	4,773
TOTAL	13,416	14,271	27,687

*Boardings or alightings may not originate or terminate within the Altoona to Pittsburg corridor
Source: PennDOT BPT Intercity Bus Ridership, FY 2016-17

Table 3. Altoona-Pittsburgh Amtrak Pennsylvanian Ridership, FY 2017

Market	Total Rail Boardings and Alightings
Pittsburgh	145,362*
Greensburg	13,634
Latrobe	4,246
Johnstown	21,916
Ebensburg	N/A
Altoona	21,705
TOTAL	206,863

* Includes Capitol Limited boardings and alightings
Source: Amtrak FY 2017 Fact Sheet Commonwealth of Pennsylvania

While the timing of Greyhound's intercity services does not accommodate traditional weekday commuting to Pittsburgh, Westmoreland Transit primarily serves the weekday commuter market from Latrobe, Greensburg, and several other intermediate stops to Pittsburgh on three routes and provides Saturday service on a fourth route.

Westmoreland Transit is also subsidized by PennDOT and provides existing bus transit service along the western portion of the corridor in the Greensburg and Latrobe station areas. Table 4 below depicts service characteristics of the four Westmoreland Transit routes that serve the overlapping rail markets of Greensburg, Latrobe, and Pittsburgh.

Table 4. Westmoreland Transit Service Characteristics and Ridership, FY 2017-2018 Annual Ridership

Route	Origin	Destination	Days of Week	Daily Roundtrips	Total Annual Route Ridership
1F (flyer)	Greensburg	Pittsburgh	M-F	9	167,700
2F (flyer)	Latrobe	Pittsburgh	M-F	3	46,096
4	Greensburg	Pittsburgh	M-F	6	26,143
4S	Greensburg	Pittsburgh	Saturday	2	1,585

Source: Westmoreland Transit Authority, March 2019

All four routes primarily serve the commuter market to/from Pittsburgh based on schedules, service frequencies, and route alignments. Travel times between Greensburg and Pittsburgh are approximately 1 hour and 30 minutes. Travel times between Latrobe (Arnold Palmer Airport) and Pittsburgh are approximately 1 hour and 40 minutes.

Detailed boarding and alighting data by stop in the Greensburg and Latrobe station areas (defined by a 10-mile buffer around existing stations) were collected from Westmoreland Transit for all four routes to establish existing transit patronage. For FY 2018-2019, the estimated number of daily boardings in the Latrobe and Greensburg station areas is 110. The estimated number of daily alightings is 78.[11]

Additional intercity bus service also exists beyond the Altoona-Pittsburgh corridor serving the State College area. The twice-daily PennDOT-subsidized Greyhound intercity bus route continues to State College enroute to Harrisburg. Megabus provides four daily roundtrip express services between Pittsburgh, State College, and New York City.

EXISTING RAIL SERVICE – THE PENNSYLVANIAN

SCHEDULE AND ROUTE

The Altoona - Pittsburgh corridor is currently served by Amtrak's *Pennsylvanian,* which is a state supported service. The Pennsylvanian offers one daily trip in each direction between Pittsburgh and New York City. The Pennsylvanian serves 17 stations between Pittsburgh and New York City:

[11] Westmoreland Transit Authority, FY 2018-2019

1. Pittsburgh
2. Greensburg
3. Latrobe
4. Johnstown
5. Altoona
6. Tyrone
7. Huntingdon
8. Lewistown
9. Harrisburg
10. Elizabethtown
11. Lancaster
12. Exton
13. Paoli
14. Philadelphia (30th St)
15. Trenton, NJ
16. Newark, NJ (Penn Sta)
17. New York City, NY (Penn Sta)

The Altoona - Pittsburgh portion of the corridor is 117 route miles and takes approximately 2 hours and 30 minutes to travel by train, based on Amtrak's current schedule. Table 5 shows the distance between stations on the corridor. Driving time between Altoona and Pittsburgh typically takes between two and three hours during peak hours.[12]

Table 5. Station Distance

Station	Route Miles to Next Station	Route Miles to Pittsburgh
Altoona	39	117
Johnstown	37	78
Latrobe	10	41
Greensburg	31	31
Pittsburgh	--	

Source: Amtrak, Pennsylvanian Schedule, Effective March 10, 2018

The *Pennsylvanian* departs Altoona at 5:13 pm and arrives in Pittsburgh at 7:59 pm, which enables a connection to the Chicago-bound *Capitol Limited* departing Pittsburgh at 11:48 pm. Heading eastbound the Washington-bound *Capitol Limited* arrives in Pittsburgh at 5:05 am, allowing a connection to the *Pennsylvanian* which departs Pittsburgh at 7:30 am and arrives in Altoona at 10:01 am. (see Table 6).

[12] Google Maps, Sample Driving Time Search on February 27, 2019 for March 6, 2019 Travel

Table 6. Existing Pennsylvanian Schedule, March 2018

To Pittsburgh Train #43		**Station**		**To New York** Train #42
10:51 AM		New York Penn		4:56 PM
12:12 PM		Philadelphia 30th Street		2:55 PM
2:26 PM	read down	Harrisburg	read up	12:53 PM
5:13 PM		Altoona		10:01 AM
6:10 PM		Johnstown		9:03 AM
6:51 PM		Latrobe		8:20 AM
7:02 PM		Greensburg		8:10 AM
7:59 PM		Pittsburgh		7:30 AM

Source: Amtrak, *Pennsylvanian* Schedule, Effective March 10, 2018

FARES

The Altoona to Pittsburgh segment of the *Pennsylvanian* features ten unique station pairs between five stations. Individual station pair fares are priced by Amtrak and informed by ridership demand and operating costs. Fare pricing is also determined by Amtrak's ticket refund, change, and cancellation terms and conditions, with tickets providing maximum change or cancellation flexibility costing more than tickets providing minimum change or cancellation flexibility. Amtrak's coach fares are largely based upon three "fare buckets" – saver, value, and flexible. Saver fares are offered on most trains two weeks in advance of travel and feature the most restricted refund/change/cancellation policies, value fares are Amtrak's standard coach fares that are priced according to demand and seat availability and feature moderately restricted refund/change/cancellation policies, and flexible fares are the most expensive coach fares that feature the greatest refund/change/cancellation flexibility.

Amtrak's existing fares are consistent with station pair distances, with higher fares for longer trips and lower fares for shorter trips. Altoona to Pittsburgh features the highest one-way station pair fares ranging from a saver fare of $22 to a flexible fare of $56.[13] Greensburg to Latrobe features the lowest one-way station pair fares ranging from a value fare of $6 (saver fare unavailable) to a flexible fare of $11 (see Table 7).[13]

[13] Amtrak, Sample Fares Searched on January 23, 2019 for February 15, 2019 Travel

Table 7. Pennsylvanian Sample Station Pair Fares, Jan 2019

City Pair	Distance (mi)	Saver	Value	Flexible
Greensburg - Latrobe	10		$6	$11
Pittsburgh - Greensburg	31		$11	$22
Latrobe - Johnstown	37	$11	$14	$27
Johnstown - Altoona	39	$11	$11	$28
Pittsburgh - Latrobe	41	$11	$14	$27
Johnstown - Greensburg	47	$12	$16	$31
Latrobe - Altoona	76	$17	$22	$44
Pittsburgh - Johnstown	78	$16	$21	$41
Greensburg - Altoona	86	$17	$22	$44
Pittsburgh - Altoona	117	$22	$29	$56

Source: Amtrak, Sample Fares Searched on January 23, 2019 for February 15, 2019 Travel

Table 8. Pennsylvanian Ticket Fares per Mile, Jan 2019

City Pair	Distance (mi)	Saver	Value	Flexible
Greensburg - Latrobe	10		$0.60	$1.10
Pittsburgh - Greensburg	31		$0.35	$0.71
Latrobe - Johnstown	37	$0.30	$0.38	$0.73
Johnstown - Altoona	39	$0.28	$0.28	$0.72
Pittsburgh - Latrobe	41	$0.27	$0.34	$0.66
Johnstown - Greensburg	47	$0.26	$0.34	$0.66
Latrobe - Altoona	76	$0.22	$0.29	$0.58
Pittsburgh - Johnstown	78	$0.21	$0.27	$0.53
Greensburg - Altoona	86	$0.20	$0.26	$0.51
Pittsburgh - Altoona	117	$0.19	$0.25	$0.48

Source: Amtrak, Sample Fares Searched on January 23, 2019 for February 15, 2019 Travel

RIDERSHIP

In FY2018, the ridership for passengers boarding or alighting at a station on the Altoona - Pittsburgh portion of the *Pennsylvanian* was 13,000, which is approximately 35 passengers per day. This ridership, however, does not necessarily reflect commuter potential due to a limited timetable and higher costs per trip. The current *Pennsylvanian* schedule is not conducive to commuting. The limited frequencies do not accommodate employees who might live in Altoona or other intermediate towns and who work in Pittsburgh. Furthermore, the fares are higher than traditional commuter rail fares for someone who may want to use the train on daily basis.

MARKET ANALYSIS

To assess the demand for additional passenger rail service between Altoona and Pittsburgh, a market analysis was conducted to develop an understanding of existing conditions along the corridor. Market analysis data gathered include current and projected population and employment, as well as the relative densities for each station area and other communities. These numbers are also inputs to the rail ridership demand model and are based on population and employment inputs used in the Pennsylvania Statewide Travel Demand Model (PA TDM). The PA TDM is used due to its comprehensive inputs which include state demographic, socioeconomic, and travel behavior data.

The PA TDM uses socioeconomic data from national sources that are further refined based on local expertise. The PA TDM is intended to complement existing Metropolitan Planning Organization (MPO) models, while providing a means to evaluate major corridors and projects of statewide significance. The PA TDM includes inputs from Pennsylvania's Traffic Monitoring System (TMS) and the Roadway Management System (RMS). These systems provided valuable information in the development of the model, including roadway functional classification, number of lanes, and traffic count information. The model also compliments other systems at PennDOT by providing future average annual daily traffic (AADT) that is based on changes in population and employment. The model incorporates a volume refinement technique based on the National Cooperative Highway Research Program Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design (NCHRP 255). This adds additional merit to the model outputs, and promotes efficiency by incorporating these refinements directly into the TDM.

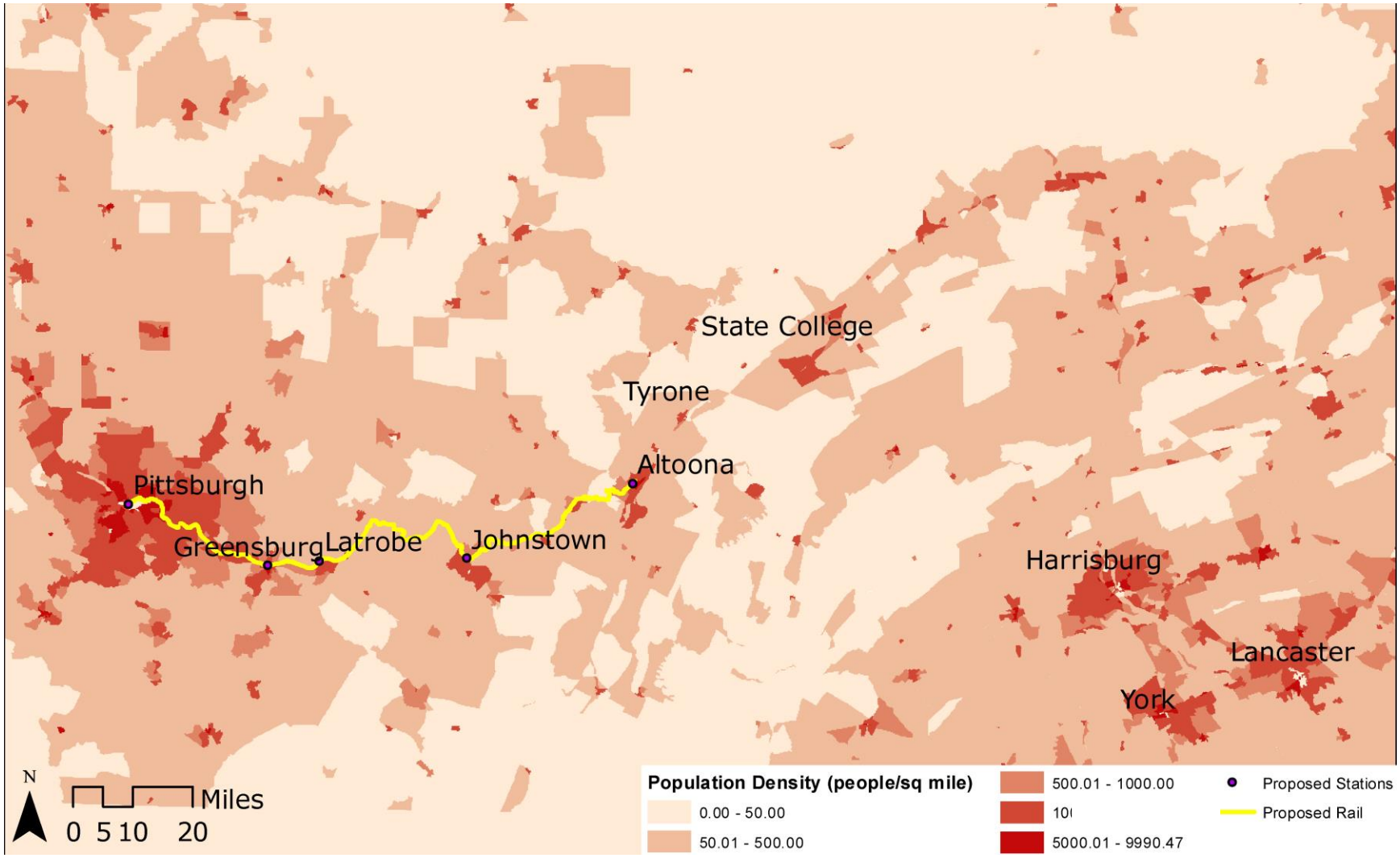
POPULATION DENSITY

The Traffic Analysis Zones (TAZs) with the highest population density are in downtown Pittsburgh, with 9,914 people per square mile. Altoona's downtown also has a TAZ with a population density higher than 5,000 people per square mile. As the closest existing station to Pittsburgh, Greensburg has a larger area with population densities higher than 500 people per square mile. The population densities of downtown Latrobe, Johnstown, Tyrone, and State College are all higher than 1,000 people per square mile,

and the population density of the suburban areas along the Amtrak corridor range from 50 to 500 people per square mile.

Figure 3 shows the population density of TAZs along the corridor. While population density is one factor that can influence the demand for a passenger rail corridor, other considerations include service frequency, fares, corridor distance, and competitiveness with driving time.

Figure 3. Population Density by TAZ, 2012



Source: PA TDM

Table 9 illustrates the population change of a 10-mile radial area, or catchment area, around each existing station from 2012 to 2040. In addition to the current stations between Altoona and Pittsburgh, the analysis also included TAZs in Tyrone and State College given the typically larger catchment area of a terminal station, in this case, Altoona. The Tyrone and State College geographic areas are also included in the study area due to their significant student population and the presence of Pennsylvania State University – potential drivers of non-commute trips. Of all study areas considered, the State College area is estimated to have the highest projected population increase at 28,332. The populations of Johnstown, Altoona, and Tyrone are projected to decrease between 2012 and 2040.

Table 9. Station Catchment Area Population Projections 2012-2040

Study Area	2012	2040	Change	% Change
Pittsburgh	1,140,184	1,312,453	172,269	15.11%
Greensburg	110,915	133,637	22,722	20.49%
Latrobe	28,857	32,659	3,802	13.18%
Johnstown	97,510	90,431	-7,079	-7.26%
Altoona	105,933	104,068	-1,865	-1.76%
Tyrone*	10,195	10,144	-51	-0.50%
State College*	120,649	148,981	28,332	23.48%

* Tyrone and State College are included in the Altoona Station catchment area
Source: PA TDM

EMPLOYMENT DENSITY

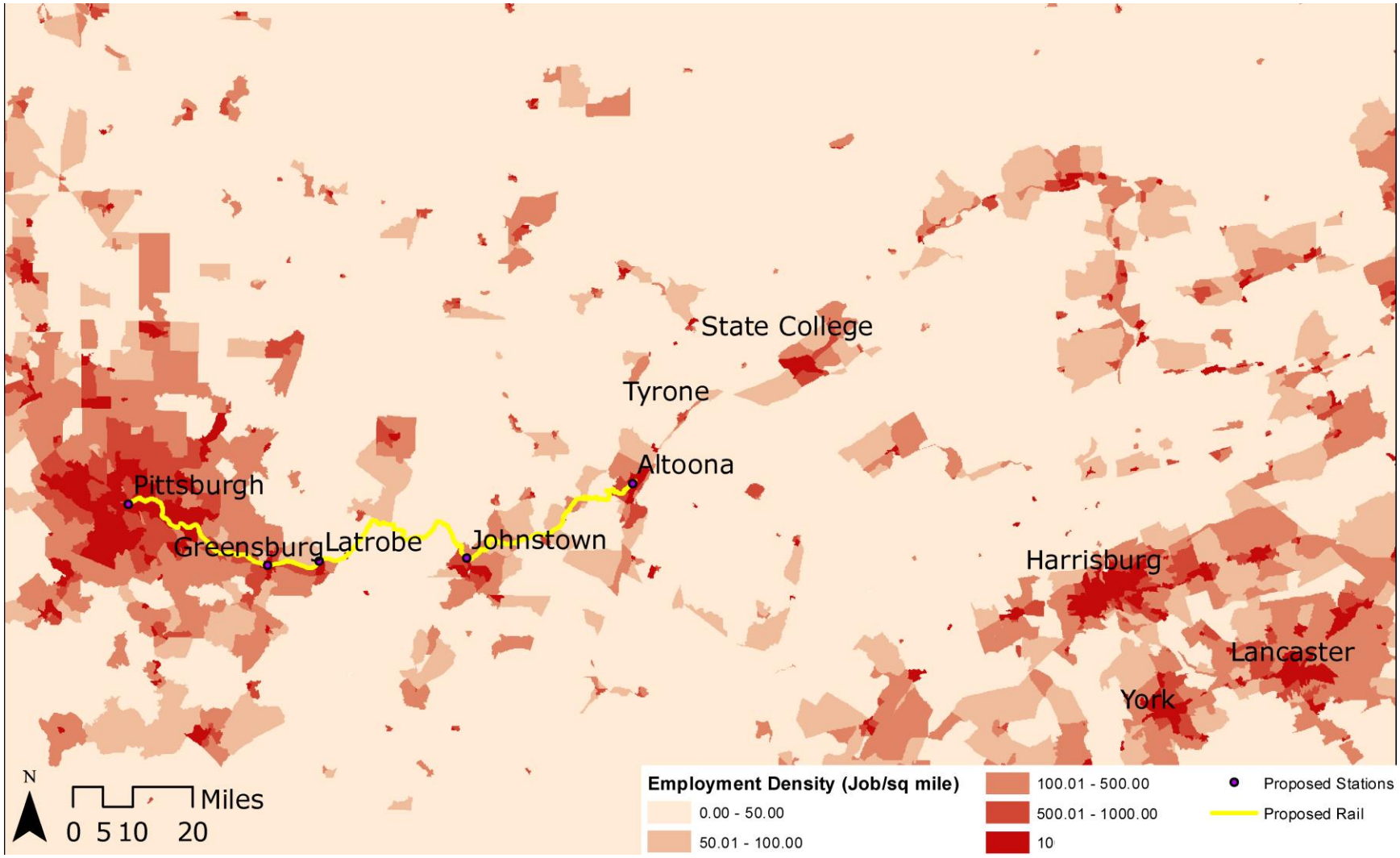
As shown in Table 10, between 2012 and 2040, the total number of jobs is estimated to increase throughout the study area. All of the station areas except Johnstown are projected to have an increase of over 20% in this timeframe. Projected employment increases along the corridor are greater than the projected increase of population along the corridor. Pittsburgh is the largest job market with the largest absolute number of jobs projected. The highest percentage increase in employment is in State College, with a projected increase of 29.2% from 2012 to 2040. Figure 4 shows the employment density of TAZs along the corridor, with the densest employment areas found closest to the downtown areas, much less dispersed than the population density.

Table 10. Employment Projections, 2012-2040

Study Area	2012	2040	Change	% Change
Pittsburgh	821,594	1,049,208	227,614	27.70%
Greensburg	76,379	92,258	15,879	20.79%
Latrobe	9,929	12,407	2,478	24.96%
Johnstown	46,282	49,956	3,674	7.94%
Altoona	47,120	59,494	12,374	26.26%
Tyrone	4,071	5,149	1,078	26.48%
State College	70,846	91,543	20,697	29.21%

Source: PA TDM

Figure 4. Employment Density by TAZ, 2012



Source: PA TDM

PEER START-UP PASSENGER RAIL SYSTEMS

From a historic perspective, the rise of automobile ownership and auto-oriented suburbs led to the decline of passenger rail travel in the United States, with a gradual loss of commuter rail systems in the years following World War II. Beginning in the 1970s and continuing today, renewed interest in existing rail infrastructure has become popular as communities seek to ease increasing traffic congestion on major thoroughfares connecting suburban communities to a primary central business district. The Altoona-Pittsburgh corridor's *Parkway Limited* and *Fort Pitt* were two of these upstart services in the 1980s. However, described previously, both services ultimately ceased operations due to low ridership and high operational costs.

A number of new commuter and intercity rail systems have initiated service throughout the United States over the past two to three decades, with a subset of these systems identified as relevant peer systems to the Altoona-Pittsburgh corridor based on similar corridor characteristics. Peer systems identified serve similar employment markets to that of Pittsburgh with systems that serve much larger and denser central business districts, like New York, Chicago, and San Francisco excluded.

A wide variety of system information was gathered for sixteen peer corridors to serve as a peer review and reference resource, helping the project team draw corollaries between various characteristics of existing commuter rail operations throughout the country and the Altoona-Pittsburgh corridor. Many of the systems share similar histories to that of the Altoona-Pittsburgh corridor, including several new service operations that are a revival of former commuter rail service.

The peer operator information compiled (Appendix A) consists of two types of operations – traditional commuter rail operations and Amtrak regional train operations. Traditional commuter rail operations are sponsored by a local or state transit agency and, at a minimum, provide multiple weekday peak-hour and peak-direction departures. Amtrak regional train operations are operated by Amtrak and typically feature fewer frequencies and less commuter-oriented service (i.e., peak-hour, peak-direction service) than traditional commuter rail. The peer system analysis identified similarities and differences between the peer systems and the Altoona-Pittsburgh corridor, looking at characteristics such as route length, number of daily trains, and right-of-way ownership.

Typically, traditional commuter rail lines in the United States serve corridors 20 to 40 miles in length, connecting a primary city with dense employment characteristics with suburban communities. The longest traditional commuter rail corridor from this peer analysis with comparable demographic characteristics to that of the Altoona-Pittsburgh corridor is the New Mexico Rail Runner at 97 miles. Amtrak regional train corridors are longer than traditional commuter rail corridors, featuring lengths that are greater than the Altoona-Pittsburgh corridor.

Comparatively, the Altoona-Pittsburgh corridor, at 117 miles, lies somewhere between a traditional commuter rail line and an Amtrak intercity rail line.

Traditional commuter rail lines feature varying frequencies with the most basic of services provided by Virginia Railway Express's Fredericksburg Line in the Washington, D.C. area and the Music City Star in Nashville with four and five weekday peak-hour peak-direction trains, respectively. More robust services are offered by Austin's Capital MetroRail and the Bay Area's Sonoma-Marin Area Rail Transit (SMART) with a peak of 18 and 17 weekday roundtrips, respectively, with additional weekend service.

Similar to potential commuter rail on the Altoona-Pittsburgh corridor, most traditional commuter rail lines are anchored by one primary city or large employment market that is connected to several smaller suburban communities and outlying park-and-ride stations. However, among peer system operators, New Mexico Rail Runner service and SMART are anchored by two or more primary cities. The Altoona-Pittsburgh corridor contains one primary city, Pittsburgh; however it differs from most of the other identified peer systems with a lower population than the other cities' primary city populations.

Amtrak regional train corridors feature lower ridership than traditional commuter rail lines. This is likely a product of lower service frequencies and schedules intended to serve several different trip types beyond traditional commuter trips. Amtrak regional train corridors also differ from traditional commuter rail lines as they typically feature multiple primary cities unlike the Altoona-Pittsburgh corridor.

Each of the peer systems feature various freight movements and volumes on at least some portion of the passenger rail corridor. Corridors owned by a public agency or passenger rail operator are primarily used for passenger rail services, feature the lowest freight volumes, and feature the greatest

scheduling/dispatching autonomy for passenger rail services. Corridors owned by freight railroads are primarily used for freight rail services and feature freight volumes commensurate to their respective classification – Class I owned corridors featuring the highest freight volumes (BNSF Railway, Canadian Pacific, CSX, Norfolk Southern) followed by Class II owned corridors (Florida East Coast Railway, Pan Am Railways) and short line owned corridors (Nashville & Eastern Railroad). The Altoona-Pittsburgh corridor is owned by Norfolk Southern and experiences very high freight volumes.

Two of the peer system operators were selected to use as mode split comparisons for the rail ridership demand methodology, explained in the following section. The New Mexico Rail Runner was selected due to its length (97 miles) which was the closest to the Altoona-Pittsburgh corridor length (117 miles). The rail corridor is owned by New Mexico DOT. The Minneapolis Northstar Line is much shorter in length (40 miles), but was selected as an aggressive comparison for mode split because it had relatively high ridership for a start-up service. The Northstar corridor is owned by BNSF Railway, a freight rail company. The primary station of the Northstar Line, downtown Minneapolis's Target Field, also has a higher station area employment density than that of Altoona-Pittsburgh's primary station of Pittsburgh (approximately 140,000 and 110,000 jobs within a 1-mile radius of the station, respectively). Both the Rail Runner and the Northstar are the only existing commuter rail services in their markets, similar to a potential Altoona-Pittsburgh service. While Minneapolis (pop. 420,000) and Albuquerque (pop. 560,000) are more populous cities than Pittsburgh (pop. 300,000), they are all mid-sized American cities.

There are other differences between the two comparison services and Altoona-Pittsburgh, which means they are not perfect parallel systems. As such, these systems bracket the characteristics of the Altoona-Pittsburgh corridor, providing a combination of low and high comparative figures for consideration in ridership estimation efforts. The Rail Runner right-of-way is exclusively owned by the New Mexico DOT, making service planning easier because freight is not a significant consideration. However, the Northstar right-of-way is owned exclusively by BNSF, similar to the Altoona-Pittsburgh corridor's exclusive Norfolk Southern ownership.

The Rail Runner also serves two relatively major markets, Albuquerque and Santa Fe, while Altoona-Pittsburgh only serves one. While Santa Fe is a

relatively modest market (pop. 84,000), it is a larger market than Altoona (pop. 44,000), and a tourist destination. Compared to Pittsburgh, the job market of Albuquerque (35,000 jobs within a 1-mile radius of the station) is smaller than that of Pittsburgh (approximately 110,000 jobs within a 1-mile radius of the station). Additionally, both the Rail Runner and the Northstar have higher frequency weekday service than would be likely on the Altoona-Pittsburgh corridor (eleven and six weekday roundtrips, respectively).

Additional information on peer operators and system characteristics are conveyed in Appendix A.

RAIL RIDERSHIP DEMAND METHODOLOGY

STATION SUB-AREA IDENTIFICATION

To get a better understanding of the travel patterns along the corridor and to analyze the PA TDM in a more direct and manageable way, sub-areas or capture areas were identified for each existing station.

Sub-areas were determined at the TAZ level to maintain consistency with the PA TDM. All of the TAZs that intersect the 10-mile station buffers were identified as the service coverage area. A 10-mile buffer was used to define the commuter catchment area because it was assumed that most commuters would be willing to drive ten to fifteen minutes to access a rail station, or approximately 10 miles. Additionally, the Greensburg and Latrobe stations are about 10 miles apart, so if a larger buffer were used, then overlapping catchment areas would occur.

For commuters traveling into Pittsburgh from the Latrobe station, it was assumed commuters would only drive in the direction of travel to take the train or very short distances in the reverse direction to take the train, thus the TAZs between Latrobe and Greensburg are assigned to the Greensburg sub-area.

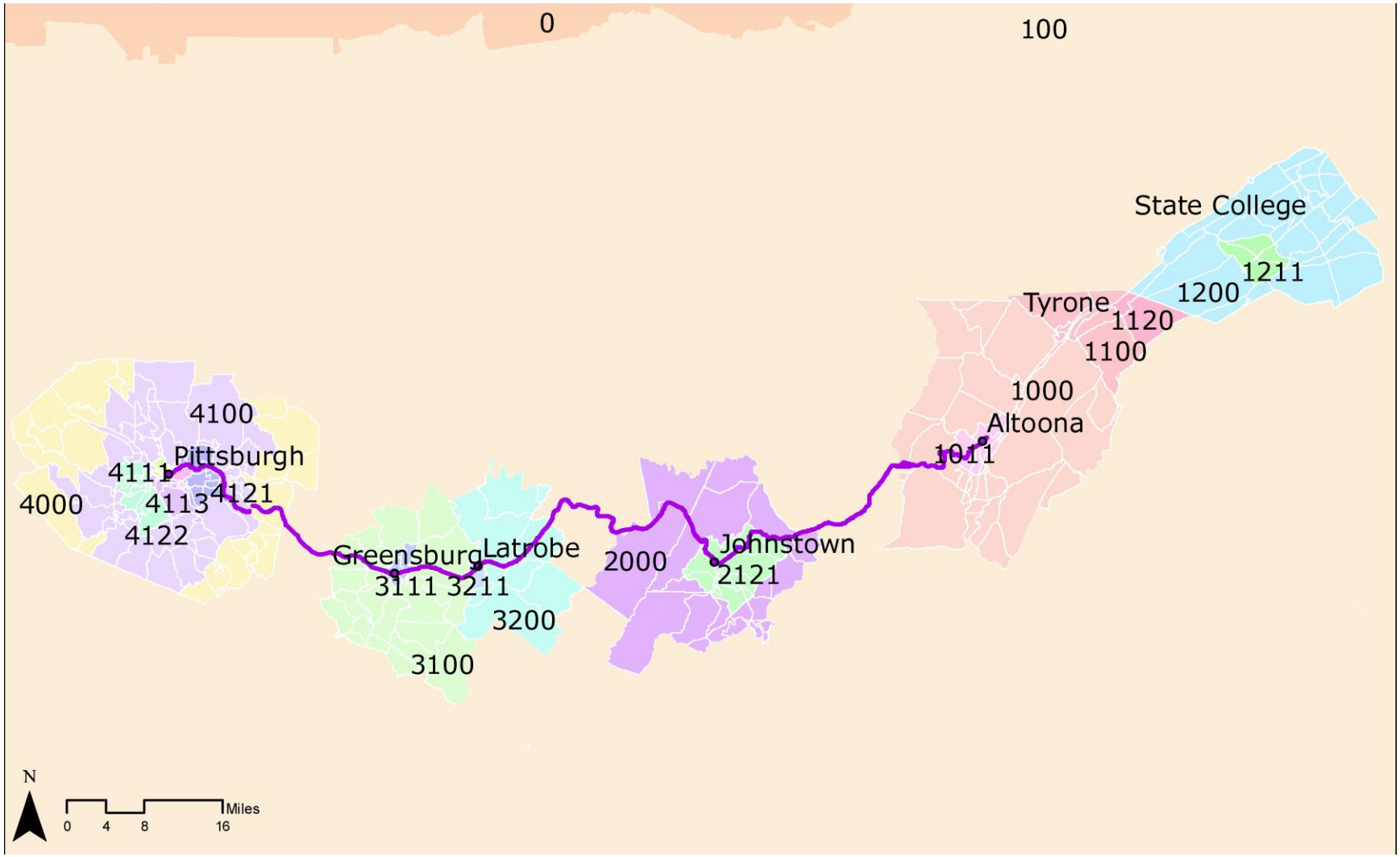
In the Altoona sub-area, Tyrone and State College were also included with Altoona as the terminal station for the service and thus draw from a larger geographic region to more fully capture the potential for additional non-commute trips that could be generated from a terminal station. This area also includes existing connecting bus service, a significant college student population in State College, and the I-99 corridor. By including these TAZs, the corridor's ridership estimates are intended to evaluate the demand of

connecting services or park-and-ride facilities to serve these additional areas.

Sub-areas were then identified within each station coverage area considering population and employment density. For Greensburg, Latrobe, Johnstown, and Altoona, the denser downtown areas around the stations are identified as one sub-area. For Pittsburgh, the downtown area was divided into five sub-areas based on urban characteristics, transit coverage, and job distribution. TAZs outside downtown Pittsburgh were assigned as sub-areas with transit service and sub-areas without transit service to the station.

Sub-areas and descriptions are shown in Figure 5 and Table 11.

Figure 5. Corridor Sub-Areas by TAZ



Source: WSP

Table 11. Corridor Sub-Area Definitions

Station	Areas	Sub-area ID	Sub-areas (based on TAZs)
Altoona	Altoona	1011	Altoona town center
		1000	Altoona 10-mile buffer
	Tyrone	1100	Tyrone
		1120	connecting area to SC
	State College	1211	town center
		1200	10-mile buffer
Johnstown	Johnstown	2111	center
		2121	town area
		2000	10-mile buffer
Greensburg	Greensburg	3111	town center
		3100	10-mile buffer
Latrobe	Latrobe	3211	town
		3200	10-mile buffer outside Greensburg
Pittsburgh	Pittsburgh	4111	station area
		4112	city area across the river
		4113	south city
		4121	east city
		4122	west city
		4100	10-mile buffer
		4000	outer area

Source: WSP

Pittsburgh is the largest job market destination along the corridor, with 23,473 auto commuters currently coming from Greensburg, Latrobe, Johnstown, and Altoona areas. Greensburg is the second largest job market destination, with about 1.9% of those commuters coming from the Johnstown and Altoona areas, and 10.3% commuters coming from Pittsburgh.[14] Table 12 provides details on how many people are commuting to the different markets from selected areas outside of the particular employment area.

[14] US Census Bureau LEHD, 2015

Table 12. Employment Auto Commuter Flows by Corridor Sub-Area, 2015

Market	Number of Workers (Jobs)	Number of Workers Commuting from Corridor Sub-Areas to Market	Percent of Workers Commuting from Corridor Sub-Areas to Market
Pittsburgh	788,935	23,473	3.0%
Greensburg	68,299	14,599	21.4%
Latrobe	24,331	7,831	32.2%
Johnstown	40,076	3,167	7.9%
Altoona	45,590	2,506	5.5%
Tyrone	3,453	75	2.2%
State College	166,828	1,584	2.4%

Source: US Census Bureau LEHD LODES, 2015; PA TDM

According to the 2015 Census Longitudinal Employer-Household Dynamics (LEHD) Origin-Destination Employment Statistics (LODES), Greensburg has the most residents commuting to other sub-areas with 32.4% of all residents commuting to areas outside the Greensburg sub-area. Of these commuters, 23.8% of are working in the Pittsburgh, Johnstown, or Altoona areas. 11,431 residents of Pittsburgh reverse commute to one of the station sub-areas. Approximately 9.8% of the residents of Altoona commute to work in sub-areas along the corridor west of Altoona. From Tyrone, 9.0% of the residents commute to Pittsburg, Greensburg, Latrobe or Johnstown. State College has the lowest percentage of residents commuting to other sub-areas west of Altoona at 2.3%.[14,15] Table 13 summarizes the residential commute flows by sub-area along the corridor.

[15] PA TDM

Table 13. Residential Commute Flows by Corridor Sub-Area, 2015

Residence	Number of Employed Residents	Number of Residents Commuting to Other Corridor Sub-Areas	Percent of Residents Commuting to Other Corridor Sub-Areas
Pittsburgh	655,195	11,431	1.7%
Greensburg	63,750	20,628	32.4%
Latrobe	24,269	9,676	39.9%
Johnstown	40,549	5,847	14.4%
Altoona	43,485	4,258	9.8%
Tyrone	4,242	381	9.0%
State College	44,981	1,014	2.3%

Source: US Census Bureau LEHD LODES, 2015; PA TDM

MODEL INPUTS

The model uses the 2015 LODES data for the origin-destination commute trip assumption. The origins and destinations of the trips are grouped into the defined sub-areas of each proposed station shown in Figure 5 and Table 11. Table 14 below shows the LODES data matrix for the Altoona to Pittsburgh corridor with station sub-areas aggregated.

Table 14. Commute Trips, 2015

		Place of Employment				
		Altoona – Tyrone - State College	Johnstown	Latrobe	Greens -burg	Pittsburgh
Place of Residence	Altoona – Tyrone - State College	61,832	1,191	160	485	3,817
	Johnstown	1,545	21,811	932	810	2,560
	Latrobe	176	454	7,688	6,292	2,754
	Greensburg	408	393	5,485	24,369	14,342
	Pittsburgh	2,036	1,129	1,254	7,012	529,491

Source: US Census Bureau LEHD LODES, 2015; PA TDM

It is important to note that the LODES data only provides current work trip data. The PA TDM was utilized for future work trip and non-work trip estimations along the corridor.

The PA TDM is a person-trip based travel demand model that estimates all Pennsylvania trips including all intrastate and interstate trips by automobile.

It can be used for analyzing the freight market, developing revenue forecasts, linking demographic changes to the transportation system, and creating reliable multi-modal performance measures. Local public transit, intercity bus, and rail trips are not included in the model. The validation of the PA TDM checked for trip generation, trip distribution, and trip assignment.

The PA TDM generates person-trip tables at the TAZ level based on the productions and attractions of each TAZ for short and long distance trip purposes. These were used to calculate future work trip and non-work trips for the rail ridership demand model. For LEHD LODES data, 2015 is the most recent year data available. The PA TDM uses 2012 as the current year and 2040 as the future projection. The PA TDM does not take into account telecommuting or other potential changes in future commuting behavior.

The person origin-destination (OD) trip table from the PA TDM contains short distance OD trip tables for three purposes: home-based work, home-based other, and non-home-based trips for both 2012 and 2040. For long distance trips, the trips are further categorized by three purposes: business, tourism, and other. The average trip lengths used in short distance trips in the PA TDM are much shorter than the proposed rail corridor and were thus not suitable to use directly in the rail ridership demand model to show the OD work trips among each station.

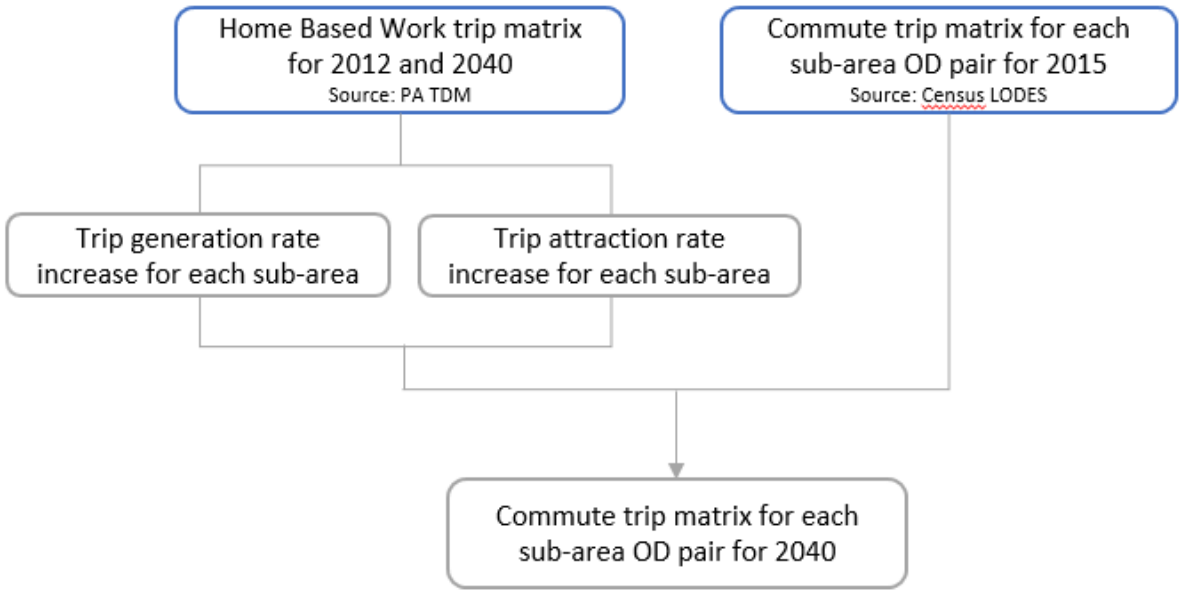
The current (2012) and future (2040) OD table from the PA TDM was used to calculate the increased trip generation rates between each station-area TAZ and was applied to the 2015 LODES data to estimate the future work trip projections for each defined station sub-area (see Table 15). The PA TDM trip generation rates are calculated by tabulating short distance OD trip tables for home-based work, home-based other, and non-home-based trips and long distance trips for business, tourism, and other purposes. Due to the length of the Altoona-Pittsburgh corridors, short distance and long distance OD trips from the PA TDM are used. A flow chart depicting the calculation and projection of future work trips is shown in Figure 6.

Table 15. Work Trip Projections, 2040

		Place of Employment				
		Altoona – Tyrone - State College	Johnstown	Latrobe	Greensburg	Pittsburgh
Place of Residence	Altoona – Tyrone - State College	66,355	983	148	756	3,553
	Johnstown	1,287	16,698	786	1,257	2,284
	Latrobe	201	463	9,667	11,980	3,222
	Greensburg	506	437	8,008	50,622	18,154
	Pittsburgh	2,374	1179	1,549	13,525	617,377

Source: PA TDM

Figure 6. Future Commuter OD Flow Chart



Source: WSP

The PA TDM OD data tables were also used to calculate trip generation and attraction ratios between non-work trips and work trips (i.e., for each work trip generated/attracted by the sub-area, how many non-work trips were generated at the same time). The rates were then applied to the 2015 LODES data to estimate the total number of non-work trips for each sub-area OD pair for 2015 and 2040. However, this methodology did not result in

sufficient references to infer the mode split rate of non-work trips to make a projection of non-work rail ridership. Therefore, the non-work trip matrix calculated from the PA TDM was not used in the rail ridership demand model. Instead, an overall non-work trip ratio from the New Mexico Rail Runner case study was applied to the overall estimation. The Rail Runner non-work trip ratio was used as proxy because the corridor length is more similar to the length of Altoona-Pittsburgh, and thus may have similar non-work trip patterns. This case studies of peer systems are discussed in the following section.

PEER CASE STUDY - MODE SPLIT ASSUMPTIONS

A key input in the ridership model is the travel behavior or mode choice assumptions, also known as the mode split. Characteristics that influence the mode split of a particular area include income, car ownership, competitiveness of travel time, commute length, parking availability and cost, proximity to transit, frequency, population density, and employment density among others. Considering the primary factors of proximity to transit, frequency, employment density, commute length, and travel time competitiveness, similar peer commuter rail corridors were identified to inform mode split rates for the Altoona-Pittsburgh corridor.

Mode split rates for each origin-destination pair are based on distances and were informed by mode splits of the identified peer commuter rail corridors and similar origin-destination pair distances. Using ACS Journey to Work 5-year estimates, comparable mode split rates were gathered from station area census block groups for two peer commuter rail corridors – the Northstar of Minneapolis and the Rail Runner of New Mexico. To capture different mode split rates within each station area to reflect transit-use propensity trends (residents closest to stations being the most likely to use the service), mode split rates for block groups that intersect a 1-mile station buffer area were calculated independently from mode split rates for 10-mile station buffer areas. Mode split assumptions derived from the Northstar Line and Rail Runner also assume a potential Altoona-Pittsburgh service would also feature commuter rail-like operational characteristics such as reliability and fare pricing.

NORTHSTAR – MINNEAPOLIS

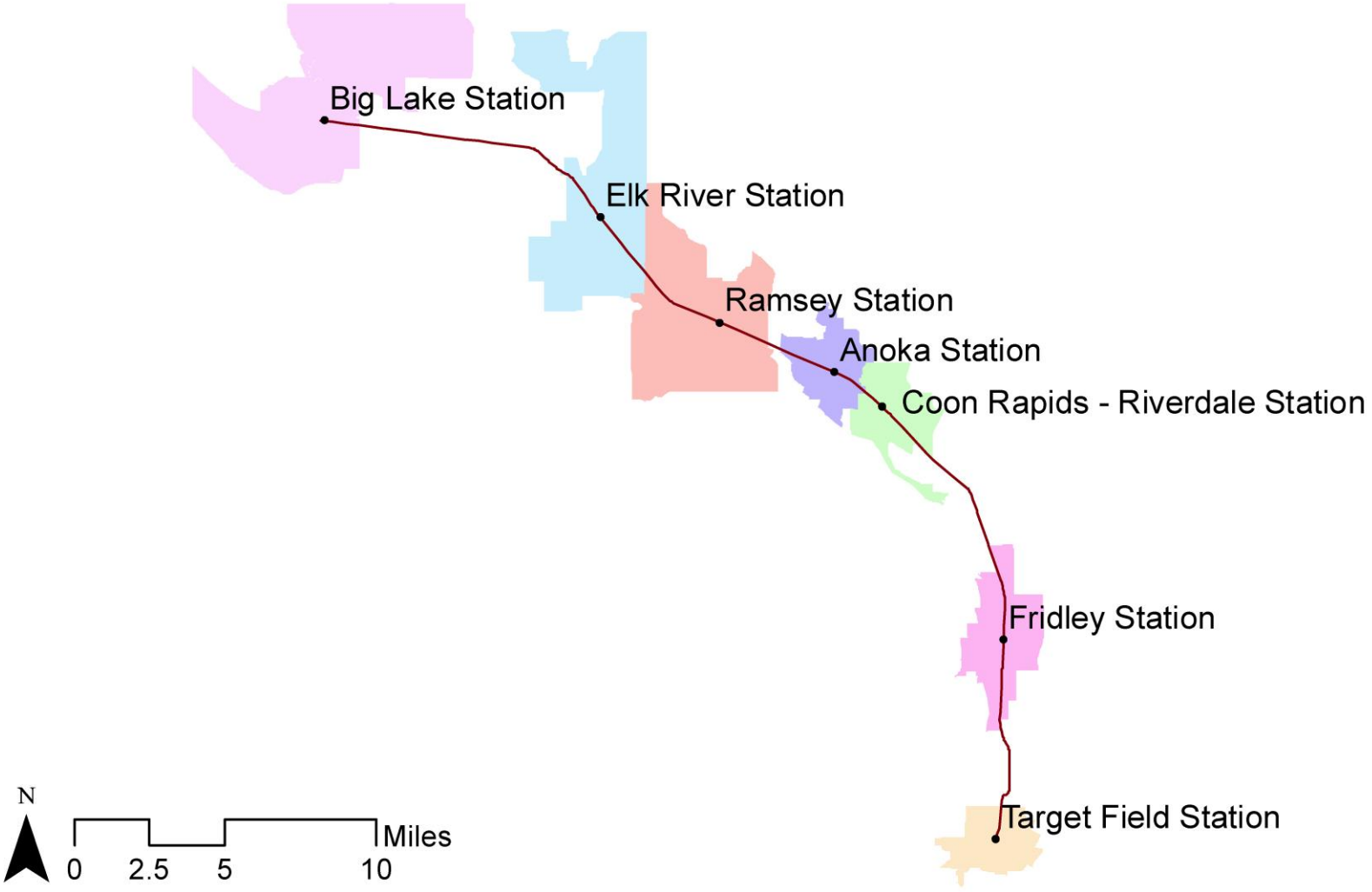
The Northstar Line offers service between Big Lake and downtown Minneapolis (Target Field Station), stopping at stations in Elk River, Ramsey,

Anoka, Coon Rapids and Fridley. Service started in 2009 and offers 6 roundtrips per day on weekdays. The total length of the Northstar corridor is 40 miles with a scheduled travel time of 52 minutes. Rail service is competitive with an estimated driving time of 40 to 60 minutes during peak hours.[12]

Figure 7 shows census block groups that intersect with a 1-mile station buffer area.

Table 16 shows a trip matrix of commuters traveling along the Northstar corridor in the identified station area census block groups (those intersecting a 1-mile station buffer area).

Figure 7. Northstar Corridor Sub-Areas – 1-Mile Buffer Areas



Source: WSP

Table 16. Northstar OD Ridership Matrix – Areas Within 1-Mile of Corridor

Station	Target Field	Fridley	Riverdale	Anoka	Ramsey	Elk River	Big Lake	Sum	Rail Riders	% of All	% of commuters travelling to station >10 miles away from originating station
Target Field		132	30	28	4	12	5	211	31	14.7%	39.2%
Fridley	1,159		110	120	29	17	9	1,444	0	0.0%	0.0%
Riverdale	810	302		511	95	58	8	1,784	72	4.0%	5.7%
Anoka	479	154	453		96	67	4	1,253	70	5.6%	9.9%
Ramsey	446	96	213	348		105	14	1,222	139	11.4%	25.0%
Elk River	373	76	120	222	93		66	950	0	0.0%	0.0%
Big Lake	231	33	58	113	62	200		697	80	11.5%	16.1%

Source: U.S. Census LEHD LODES, 2015

For residents living within 10 miles of the major job market (in this case, residents of the Fridley station area), reportedly no commuters travel by the train. Per this reporting, commuters traveling less than ten miles from home are choosing other modes than commuter rail for their daily travel. The estimated mode split rate from each station was adjusted to the percentage of commuters traveling to stations more than 10 miles away to reflect a more accurate estimate of a commuter's willingness to travel via commuter rail based on market distances. The 10-mile rail corridor buffer area contains 189,860 workers commuting to Minneapolis. The total number of unique train riders in this area is 1,683 (not classified by trip type). Thus, the mode split rate for the corridor's 10-mile buffer area therefore is approximately 1%.

The Ramsey station area has the highest mode split rate at 25.0% and is located approximately 20 miles from downtown Minneapolis. The second highest mode split rate is 16.1% from the Big Lake station area, located 40 miles from the system's primary station in downtown Minneapolis. The highest mode split rate of outbound trips was 39.2% from Target Field Station, indicating that residents living in downtown Minneapolis are more likely to reverse commute than any other station areas.

The mode split is important because this was used as an input in estimating ridership on the Altoona-Pittsburgh corridor. For the purposes of Altoona-Pittsburgh estimate assumptions , the Big Lake station area mode split rates are used for the Greensburg station area due to its similar distance from the corridor's primary station of Pittsburgh. A greater mode split is also placed on outbound mode split rates from the Pittsburgh station compared to other stations on the corridor as a result of the Northstar Line findings.

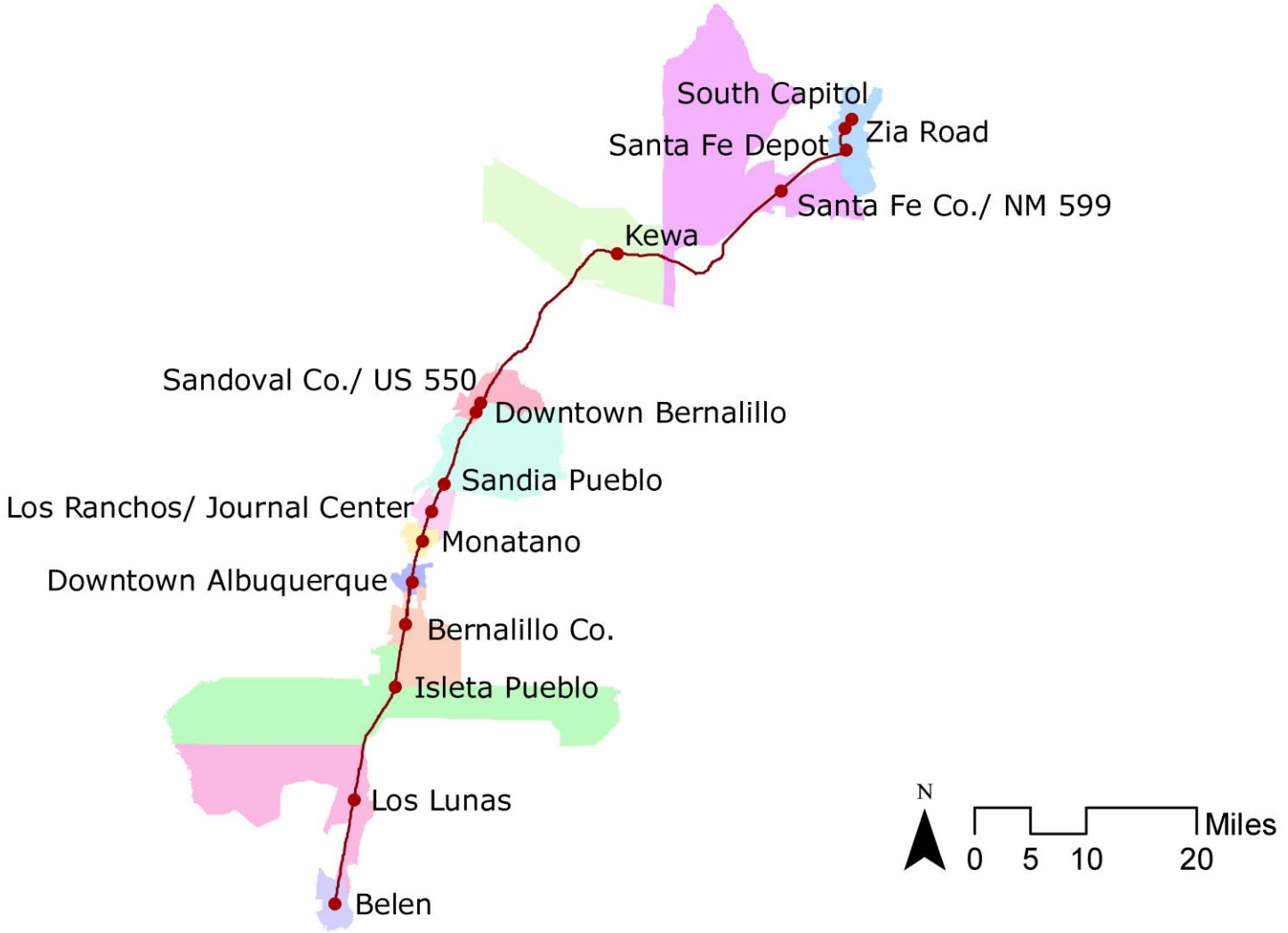
RAIL RUNNER – NEW MEXICO

The New Mexico Rail Runner Express is a commuter rail system serving the metropolitan areas of Albuquerque and Santa Fe, New Mexico. Service began in 2006 and currently operates with 11 weekday roundtrips. The total length of the Rail Runner corridor is 97 miles. The distance between the route's primary cities/markets of Albuquerque and Santa Fe is approximately 60 miles with a scheduled travel time of 1 hour and 41 minutes. The rail service is approximately 40 minutes longer than the estimated driving time between the endpoints (55 mins to 75 mins).[12]

Figure 8 shows the census block groups that intersect the 1-mile station buffer areas along the corridor. Stations that are immediately adjacent are merged into one area.

Table 17 and Table 18 show the trip matrix of commuters traveling along the Rail Runner corridor in the identified station area census block groups (those intersecting a 1-mile station buffer area).

Figure 8. Rail Runner Corridor Sub-Areas – 1-Mile Buffer Areas



Source: WSP

Table 17. Rail Runner OD Ridership Matrix – Areas Within 1-Mile of Corridor

Station	Belen	Los Lunas	Isleta Pueblo	Bernalillo Co.	Downtown Albuquerque	Montano	Los Ranchos	Sandia Pueblo	Bernalillo -US 550	Kewa	NM 599	Santa Fe	Sum
Belen		267	10	110	125	86	221	12	7	0	3	77	918
Los Lunas	188		43	310	494	225	484	30	29	1	12	118	1934
Isleta Pueblo	9	28		177	215	85	156	11	6	0	3	34	724
Bernalillo Co.	8	29	14		442	140	328	19	16	0	0	35	1031
Downtown Albuquerque	9	36	22	301		317	801	62	46	0	14	139	1747
Montano	10	9	12	127	681		729	47	33	0	5	95	1748
Los Ranchos	6	23	6	140	757	389		88	40	0	7	106	1562
Sandia Pueblo	4	10	2	35	196	72	210		69	1	13	54	666
Bernalillo-US 550	10	31	6	72	313	146	410	111		2	24	172	1297
Kewa	10	1	2	NA	13	11	23	8	30		12	64	174
NM 599	2	4	3	25	59	45	117	NA	14	3		1875	2147
Zia-South Capitol-Santa Fe Depot	10	28	6	105	230	125	277	9	38	4	642		1474

Source: U.S. Census LEHD LODES, 2015

Table 18. Rail Runner OD Ridership Matrix Summary – Areas Within 1-Mile of Corridor

Station Name	Sum	Train Commuters	% of All Trips	% of Inbound Trips to Albuquerque	% of Outbound Trips	Adjusted % of Inbound Trips to Both Job Markets
Belen	918	19	2.07%	3.5%		-
Los Lunas	1934	107	5.53%	7.1%		-
Isleta Pueblo	724	28	3.87%	4.4%		-
Bernalillo Co.	1031	7	0.68%		5.8%	-
Downtown Albuquerque	1747	14	0.80%		4.3%	-
Montano	1748	25	1.43%		11.8%	-
Los Ranchos	1562	55	3.52%		13.2%	-
Sandia Pueblo	666	0	0.00%	0.0%		-
Bernalillo-US 550	1297	80	6.17%	8.5%		7.0%
Kewa	174	15	8.62%	31.9%		9.3%
NM 599	2147	0	0.00%	0.0%		0%
Zia-South Capitol-Santa Fe Depot	1474	13	0.88%	1.8%		-

Source: U.S. Census LEHD LODES, 2015

Along the Rail Runner route, there are four stations serving the major job market of Albuquerque: Bernalillo, Downtown, Montano and Los Ranchos. Inbound trips are defined as commuters travelling to the Albuquerque area stations from both legs (north and south) of the route. Outbound trips are defined as commuters travelling from stations in the Albuquerque area to other stations.

Considering the presence of Santa Fe, a second primary city and job market along the corridor, it is assumed that commuters living along the south leg of the route mostly commute to Albuquerque, and commuters on the north leg of the route travel to both job centers. Thus, for Bernalillo-US 550 and Kewa stations, inbound mode split rates were adjusted to include commute trips to both job markets.

For inbound trips, the highest mode split rate is 9.3% at Kewa station, which is about 30 miles to both Albuquerque and Santa Fe. For the remaining stations, the Rail Runner station mode split rates are more modest than those of the Northstar Line.

Due to the lower values of the Rail Runner station mode split rates, the Rail Runner information compiled was used for much of the mode split rate assumptions in the low range ridership estimate for the Altoona-Pittsburgh corridor. Rail Runner stations featuring similar distances from the primary station and similar station area densities to that of the Altoona-Pittsburgh stations inform the specific mode split rate assumptions that were used.

POTENTIAL COMMUTE TRIPS

Mode split rates from the Northstar and Rail Runner case studies were applied in the Altoona-Pittsburgh rail ridership demand model to make future ridership projections for the proposed service in both low and high range ridership scenarios. Mode split rates were applied based on the following assumptions:

- Downtown or 1-mile station sub-areas have the highest rail mode split rate of the entire station sub-area. The farther from the station, the lower the rail mode split rate;
- The rail mode split rate between two immediately adjacent station sub-areas is 0%. This considers the greater convenience of driving between such areas rather than taking the train;

- Pittsburgh is the largest job market of the corridor and for any origin station, thus the mode split rate of trips to Pittsburgh is the highest;
- The high range scenario uses the most aggressive rail mode split rate assumptions to capture the highest possible range of ridership as shown in Table 19; the more modest ridership scenario uses the most conservative rail mode split rate assumptions to estimate a more conservative possible range of ridership as shown in Table 20;
- For the inbound trips, the highest rail mode split rates from Northstar are applied to the most comparable market pairs in the high range scenario. The lowest rail mode split rates from Rail Runner are applied to the most comparable market pairs in the low range scenario;
- For the outbound trips, the highest rail mode split rate from Rail Runner is applied to the most comparable OD pairs. The low range scenario for mode split does not provide outbound (reverse commute) ridership estimates, which aligns with the baseline service plans developed for this study that do not assume any reverse commute service.

Table 19 and Table 20 present the resulting high and low range mode split rate assumptions that were used in the rail ridership demand model.

Table 19: Altoona to Pittsburgh Rail Mod Split Rate Assumptions - High Range

Stations	**Altoona – Tyrone - State College**		**Johnstown**		**Latrobe**		**Greensburg**		**Pittsburgh**	
	High	Low	High	Low	High	Low	High	Low	High	Low
Altoona – Tyrone – State College			2%	1%	2%	1%	2%	1%	2%	1%
Johnstown	2%	1%			5%	1%	7%	1%	7%	1%
Latrobe	2%	0%	5%	0%			1%	0%	16%	1%
Greensburg	2%	0%	5%	0%	1%	0%			16%	1%
Pittsburgh	2%	1%	6%	0%	13%	0%	13%	1%		

Source: WSP

Table 20. Altoona to Pittsburgh Rail Mode Split Rate Assumptions – Low Range

Stations	Altoona – Tyrone - State College		Johnstown		Latrobe		Greensburg		Pittsburgh	
	High	Low	High	Low	High	Low	High	Low	High	Low
Altoona – Tyrone – State College			2%	1%	2%	1%	2%	1%	2%	1%
Johnstown	2%	1%			2%	1%	2%	1%	2%	1%
Latrobe	2%	0%	4%	0%			1%	0%	4%	1%
Greensburg	2%	0%	4%	0%	0%	0%			4%	1%
Pittsburgh	2%	1%	4%	0%	4%	0%	4%	0%		

Source: WSP

POTENTIAL NON-COMMUTE TRIPS

Non-commute trips are estimated by calculating the difference between the total daily ridership as reported by Rail Runner and the total number of one-way trips represented in ACS Journey to Work data in the 10-mile station buffer areas. Of the 1,325 rail commuters (as determined by ACS data), it is assumed all users take two trips per day for a total of 2,650 trips per day. Thus, total non-commute trips were estimated to be roughly 5% of the total number of trips (2,780). Considering limited available information on mode split rates as it applies to non-commute commuter rail trips, a 5% non-commute trip estimate was assumed in the Altoona-Pittsburgh rail ridership demand model. This assumption resulted in approximately 50 non-commute trips each day which roughly aligns with the daily number of passengers (approximately 35) currently riding the *Pennsylvanian* between Altoona and Pittsburgh.

Table 21 conveys an estimated summary of non-commute trips.

Table 21. Non-Commute Trips

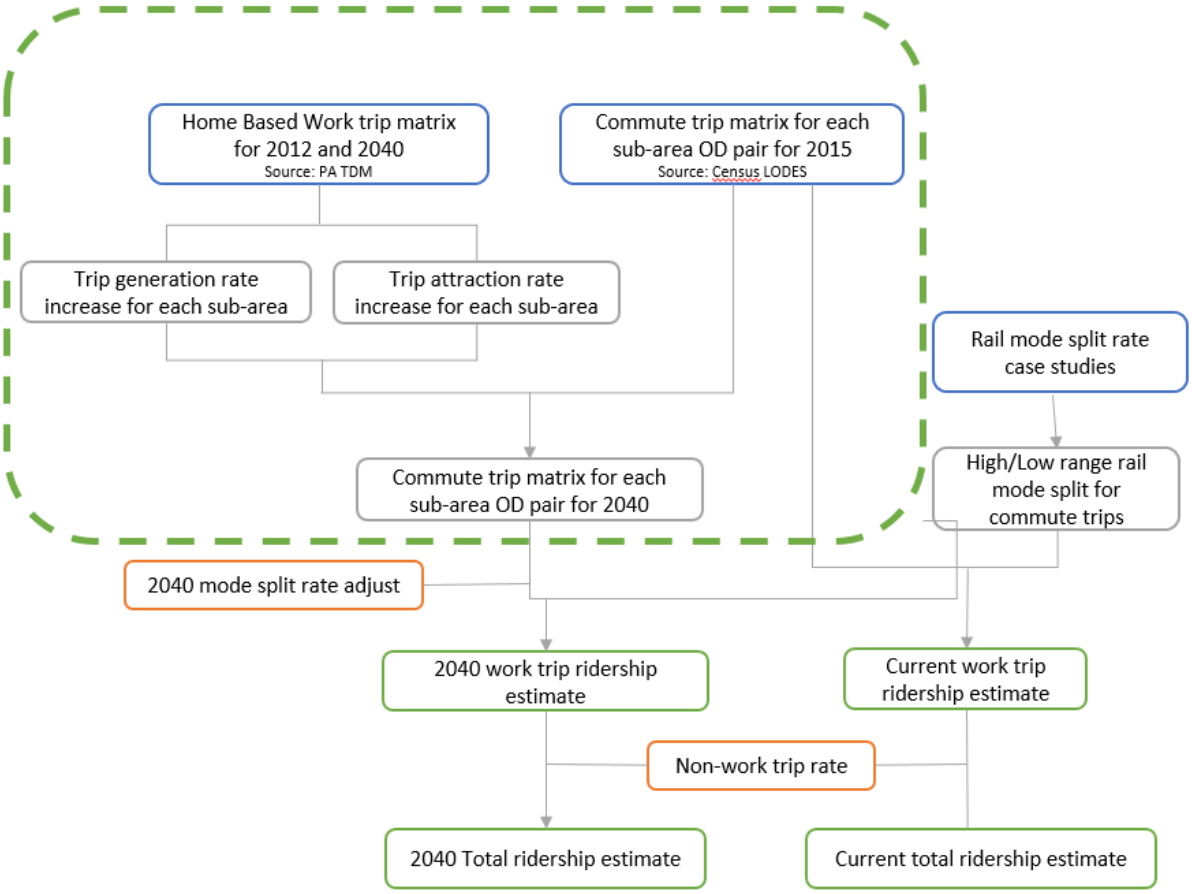
Rail	Total Ridership	Total Commute Ridership	% of Non-Commute Ridership
Rail Runner	2780	2650	5%

Source: WSP

MODEL STEPS

The rail ridership demand model takes the current and future commuter origin-destination matrix and a few adjustment factors as inputs, and estimates the high and low range of rail ridership for the proposed service. Mode split rates from the case studies were applied to the current and 2040 total work trips for each sub-area OD pairs. A mode split rate increase of 10% for each OD pair was assumed between 2012 and 2040 as the service becomes more established over time, based on typical ridership trends for new start rail projects. Figure 9 summarizes this process in a flow chart.

Figure 9. Rail Ridership Demand Model Structure Flow Chart



Source: WSP

OUTPUTS/RESULTS

Based on commuting data available in the U.S. Census and in the PA TDM, and actual mode splits derived from other start-up commuter lines, the

current (ca. 2015) ridership demand for commuter rail is estimated to be in the range of 530 to 840 daily riders (total unlinked or one-way trips would double this value). In 2040, this range grows to 670 to 1100 potential riders (see Table 22).

While the rail ridership demand model does not provide a direct linkage between ridership and the number of daily roundtrips needed to serve it, there is an indirect relationship between the amount of train service provided and the ability to reach maximum ridership potential (i.e., the high range of this scenario). This infers that if the service is convenient in terms of schedule, frequency, and accessibility, it will be more likely to capture a greater number of passengers versus a service that is less convenient.

Table 22. Low and High Ridership Estimates for 2015 and 2040

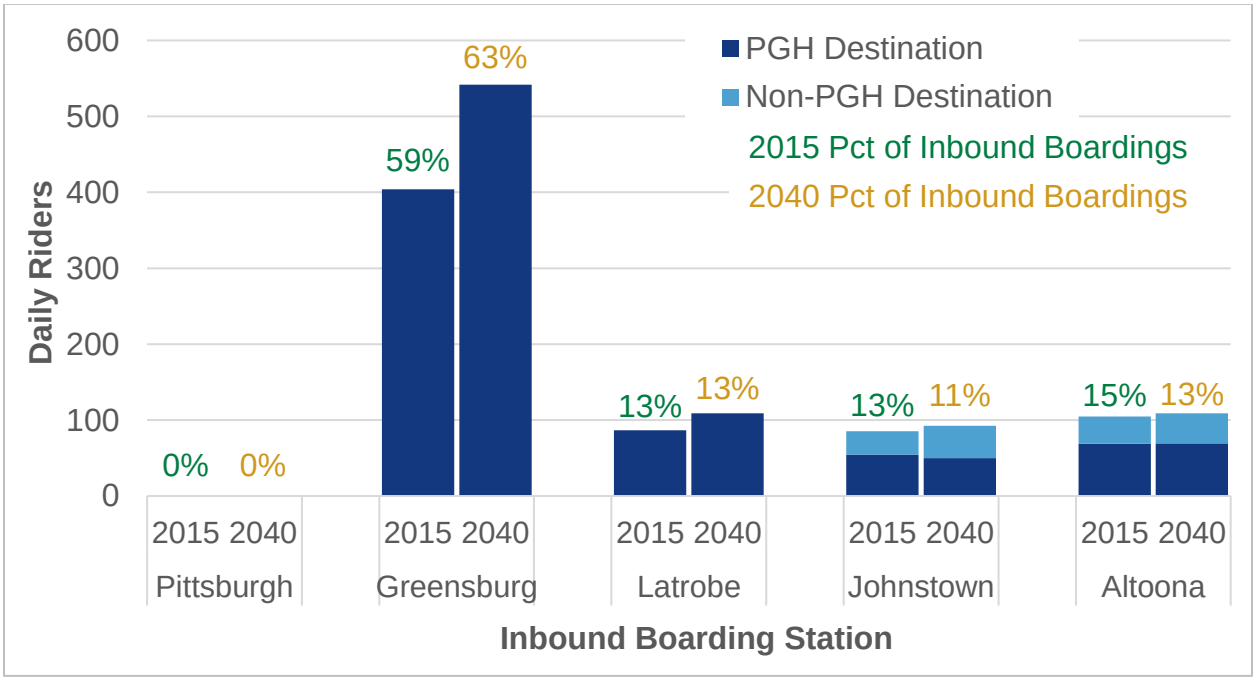
	2015 – Daily Riders			**2040 – Daily Riders**		
	Inbound Commuter	Reverse Commute	Total One-Way Riders	Inbound Commuter	Reverse Commute	Total One-Way Riders
Low Range	433	NA	433	539	NA	539
High Range	681	159	840	852	239	1091

Source: WSP

In both the low and high range scenarios, more than half of the estimated inbound corridor ridership is from people boarding in Greensburg and alighting in Pittsburgh. This is also the portion of the corridor with existing bus service to Pittsburgh, indicating a likely mode shift of some passengers from bus to rail. In the high ridership scenario, Altoona accounts for 15% of total inbound commuters, while Johnstown and Latrobe account for another 13% each, in the 2015 demand estimate. In the 2040 high scenario estimate, Greensburg accounts for 64% of inbound commuters (see Figure 10).

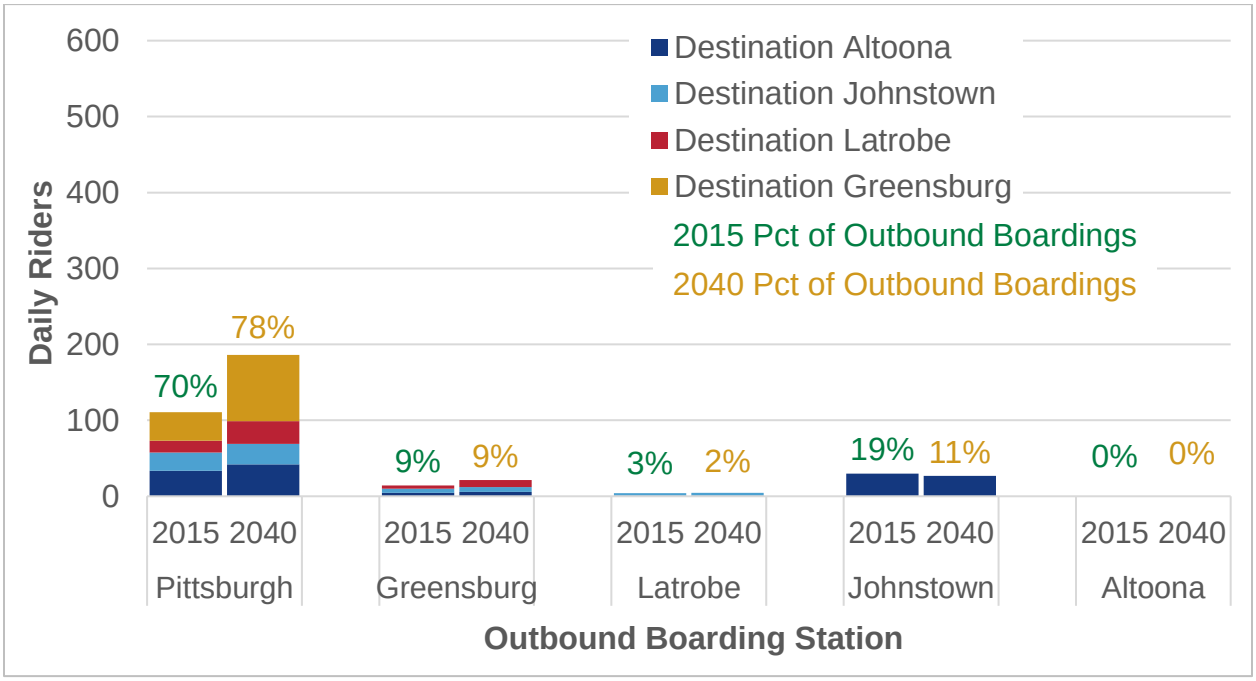
Potential outbound riders in the low and high scenario for current and future estimates account for approximately 18% to 22% of all riders. These riders are only captured if an outbound service is offered. Pittsburgh is the largest boarding station. In 2015, Altoona is the greatest destination (68 riders) while in 2040, Greensburg is the greatest destination (87 riders). Figure 11 presents these outbound trips by origin and destination.

Figure 10. 2015 & 2040 Inbound Riders by Boarding Station, High Scenario



Source: WSP

Figure 11. 2015 & 2040 Outbound Riders with Destination Station, High Scenario



Source: WSP

The ridership demand estimated for specific station pairs on the Altoona to Pittsburgh corridor were consistent with previous research and characteristics of existing commuter rail systems in the United States. Traditionally, rail ridership is strongest for commuter rail trips that are approximately 35 miles in length or less. At 31 miles, the Greensburg to Pittsburgh station pair features the highest ridership estimate ranging from 312 daily riders in the low scenario and 542 daily riders in the high scenario in the 2040 estimates (see Table 24). Similarly, the 41-mile Latrobe to Pittsburgh station pair features a comparatively high ridership estimate ranging from 54 daily riders in the low scenario to 109 daily riders in the high scenario (2040 estimates).and Table 24 present the 2015 low and high scenarios ridership OD by station.

Of note, this is the portion of the corridor that currently has commuter-oriented bus transit service to Pittsburgh provided by Westmoreland Transit. While there is Greyhound service on the corridor, current timetables indicate the service is not oriented towards traditional commute trips to Pittsburgh. As presented in Table 4, the daily ridership for the three Westmoreland Transit bus routes is higher than what is projected in the model. This is because the bus ridership numbers represent ridership for the entire route, not just that within the train station catchment areas. Westmoreland Transit also provides a greater number of buses than what would be expected for a start-up train service.

Table 23. 2015 Origin-Destination Daily Ridership by Station (Low and High Scenario Outputs)

		Alighting Station					
		Altoona	Johnstown	Latrobe	Greensburg	Pittsburgh	
Boarding Station	Altoona		23	3	10	65 – 69	Inbound Toward Pittsburgh
	Johnstown	30		12 - 14	13 – 17	36 – 55	
	Latrobe	1	4		0	42 – 87	
	Greensburg	5	5	4		228 – 404	
	Pittsburgh	33	24	16	38		
		Outbound Toward Altoona					

Note: Outbound ridership is only for high scenario outputs.
Source: WSP

Table 24. 2040 Origin-Destination Daily Ridership by Station (Low and High Scenario Outputs)

		Alighting Station					
		Altoona	Johnstown	Latrobe	Greensburg	Pittsburgh	
Boarding Station	Altoona		21	3	16	65 – 69	Inbound Toward Pittsburgh
	Johnstown	27		13 – 15	21 – 27	35 – 50	
	Latrobe	1	4		0	54 – 109	
	Greensburg	6	6	9		312 – 542	
	Pittsburgh	42	27	30	87		
		Outbound Toward Altoona					

Note: Outbound ridership is only for high scenario outputs.
Source: WSP

SERVICE PLANNING & EQUIPMENT

The estimated upper limits of potential rail ridership for the Altoona to Pittsburgh corridor, regardless of frequency, is 840 daily riders (or 1680 unlinked trips). It is likely that one or two daily roundtrip trains would not capture the highest possible number of riders because of the relatively limited choices for departure and arrival times. Based on the peer start-up passenger rail systems, none of the services launched with fewer than three daily frequencies, suggesting that a range between three and six trains in the morning and afternoon peaks would be a recommended minimum start-up commuter service.

Other considerations for developing a start-up service schedule include crew and equipment requirements. For the purposes of this study, it was assumed that push-pull equipment would be used, thereby eliminating the need to turn the trains at the terminal stations, which maximizes the productive time of the equipment and crews. It was also assumed that crews would be limited to 10-hour shifts, excluding rest time. Possible train delays related to capacity constraints, dispatching, equipment failures, or other potential causes are not considered in the development of the below sample schedules.

A potential sample service schedule is shown in Table 25 using two train sets and three crews. Two trainsets are able to provide two trains in the peak hours between Altoona and Pittsburgh. If a third crew were hired, a mid-day round trip to Altoona could be provided which would be a desirable feature for commuters who may need to return home early. This hypothetical schedule was developed absent information on freight schedules over the corridor and thus would need to be modified if pursued in the future. Any future schedule would also require Norfolk Southern’s consent as the owner of the rail corridor.

Table 25. Sample Start-Up Commuter Service Schedule, 2 Trainsets

1 AA	2 BB	2 CC		Trainset Crew		2 CC	1 AA	2 BB
5:00	6:00	3:00	DP	Altoona	AR	2:31	7:31	8:31
5:58	6:58	3:58	↓	Johnstown		1:33	6:33	7:33
6:41	7:41	4:41		Latrobe		12:50	5:50	6:50
6:51	7:51	4:51		Greensburg	↑	12:40	5:40	6:40
7:31	8:31	5:31	AR	Pittsburgh	DP	12:00	5:00	6:00

As an alternative comparison, four trainsets would be needed to provide four trains in the peak service hours. Table 26 shows a sample service schedule with four trains in the peak hours which would require four crews. This schedule also shows how the equipment might be maximized to provide an additional roundtrip to Greensburg in the morning, which was the station with the highest inbound ridership. Moreover, if a fifth crew were hired, a mid-day roundtrip to Altoona could be offered.

Generally, each roundtrip peak hour service between Altoona and Pittsburgh requires a unique trainset and crew. Assuming a total roundtrip travel time of six hours, it is not possible for one crew to do two roundtrips in one day. Although the trainsets could feasibly also do a midday roundtrip after arriving in Pittsburgh during the morning peak, an additional crew would need to be hired to offer that service. It would be possible for one crew to operate from Altoona to Pittsburgh during the morning peak, then do a roundtrip to Greensburg returning to Pittsburgh, and finally completing an afternoon peak trip from Pittsburgh to Altoona in one shift. This assumes a total roundtrip time to Greensburg is two hours. The additional service to Greensburg could be beneficial since that station had the highest inbound boardings.

Conceptual service alternatives and the necessary trainsets and crews required are shown in Table 27.

Table 26. Sample Start-Up Commuter Service Schedule, 4 trainsets

1	2	3	4	1	2		Trainset		1	2	3	1	4	2
AA	**BB**	**CC**	**DD**	**AA**	**EE**		**Crew**		**AA**	**EE**	**AA**	**BB**	**CC**	**DD**
5:00	6:00	6:30	7:00		3:00	DP	Altoona	AR		2:31	6:31	7:31	8:01	8:31
5:58	6:58	7:28	7:58		3:58	↓	Johnstown			1:33	5:33	6:33	7:03	7:33
6:41	7:41	8:11	8:41		4:41		Latrobe			12:50	4:50	5:50	6:20	6:50
6:51	7:51	8:21	8:51	9:21	4:51		Greensburg	↑	8:40	12:40	4:40	5:40	6:10	6:40
7:31	8:31	9:01	9:31	10:01	5:31	AR	Pittsburgh	DP	8:00	12:00	4:00	5:00	5:30	6:00

Source: WSP

Table 27. Alternatives based on Trainsets and Crews

Number of Trainsets	**2**			**4**			**6**		
Alternative	A	B	C	A	B	C	A	B	C
Number of ALT-PGH Roundtrips	2	2	3	4	4	5	6	6	7
Peak	2	2	2	4	4	4	6	6	6
Midday	0	0	1	0	0	1	0	0	1
Additional GNB-PGH Roundtrips	0	1	1	0	1	1	0	1	1
Number of Crews	2	2	3	4	4	5	6	6	7

Source: WSP

CONCLUSION

The purpose of this market assessment effort was to establish a range of potential ridership estimates and service levels to allow PennDOT to determine whether additional passenger rail service on the Altoona-Pittsburgh corridor is sustainable.

Any further analysis and discussion of service would need to be coordinated with the railroad owner, Norfolk Southern. This should be done together with a review of the infrastructure and capital costs report to provide a more comprehensive picture of what would be needed to provide additional passenger rail service on the existing rail corridor between Altoona and Pittsburgh. Norfolk Southern's current and future freight traffic and operating needs were not included as part of the efforts for either task.

Utilizing a methodology employed for prior high-level forecasting efforts, mode split rates for peer start-up commuter and intercity rail services were applied to develop a range for potential ridership from low (conservative) to high (more aggressive). As the largest attractor on this corridor, the primary focus of the rail service modeled is peak inbound trips to Pittsburgh. There is also potential to consider reverse peak and/or mid-day service to Altoona or Greensburg from Pittsburgh.

The following conclusions are of most value from this effort:

- The forecasted ridership range for 2015 of 530 to 840 riders is lower than that of the two peer systems used to determine mode splits, but above that of several Amtrak intercity and other commuter rail services that were considered as part of the broader analysis of new commuter and intercity rail services in the US.
- Most passengers would board the train in Greensburg and Latrobe and are headed to Pittsburgh. Greensburg and Latrobe, at 31 and 41 miles from Pittsburgh, are commensurate with reasonable commuter rail distances. Altoona and Johnstown, at 117 and 78 miles from Pittsburgh, are at the longer end of what is considered a reasonable commuter rail distance.

- Potential service plans were developed ranging from two to six trainsets and two to seven crews, with a reasonable range of between three and six round trip trains per day to provide start-up service.

NEXT STEPS

An essential next step for considering additional passenger rail service on this corridor is for a project sponsor to enter into a contract agreement with Norfolk Southern to perform a detailed operations model to understand current and projected freight volumes and schedules and determine what capital improvements would be needed to avoid an impact to freight operations. It is important to emphasize that the schedules in Table 25 and Table 26 do not consider Norfolk Southern operating needs, or any capital improvements to the rail corridor that would increase capacity, speed, and/or safety.

A more precise market analysis will also be needed to establish the relationship between the number of trains provided and the resulting potential ridership market, as it was not possible for this high-level analysis to determine the relationship between the number of trains per day and resulting ridership.

Should PennDOT consider additional passenger rail service between Altoona and Pittsburgh, PennDOT would need to work with local and regional stakeholders to identify a local sponsor to champion the process for project advancement. In addition to coordination with Norfolk Southern, this would also involve coordination with FTA and FRA to determine the corridor's eligibility for commuter and/or intercity passenger rail programs.

APPENDIX A: COMPARISON OF NEW COMMUTER AND INTERCITY RAIL LINES

System/Line	Primary City	Primary City Population (2017 Estimate)[16]	Route Characterization	Length (Route Miles)	Number of Stations	Days of Service	Trips per Weekday (Roundtrips)	Average Speed (mi/hr)[17]	Year Started	Avg Daily Startup Ridership	Avg Daily Current Ridership	System Owner	Operator	ROW Owner	Start-Up Capital Costs[18]
Amtrak Heartland Flyer	Ft. Worth, TX; Oklahoma City, OK	Ft. Worth: 874,168 Oklahoma City: 643,648	Urban - Rural - Urban	206	7	Daily	1	51.07*	1999	180	195	Amtrak	Amtrak	BNSF Railway (100%)	
Amtrak Piedmont	Charlotte, NC; Raleigh, NC	Charlotte: 859,035 Raleigh: 464,758	Urban - Suburban - Rural-Suburban - Urban	173	9	Daily	4[19]	54.63*	1995		405	Amtrak	Amtrak	Norfolk Southern (100%)	
Amtrak Northeast Regional - Virginia Service to Lynchburg	Washington, D.C.	693,972	Rural/Suburban - Urban	173	6	Daily	1	46.76*	2009	345[20]	521[21]	Amtrak	Amtrak	Norfolk Southern (95%); CSX (4%); Amtrak (1%)	
Amtrak Downeaster	Boston, MA; Portland, ME	Boston: 685,094 Portland: 66,882	Suburban - Urban	145	12	Daily	5	43.5*	2001	753	1,530	Northern New England Passenger Rail Authority (Manager)	Amtrak	Pan Am Railways (76%); MBTA (24%), Pan Am Railways	
Altoona - Pittsburgh	**Pittsburgh, PA**	**Altoona: 44,098 Pittsburgh: 302,407**	**Rural - Suburban - Urban**	**117**	**5○**	--	--	**42.3 - 46.5△**	--	--	--	--	--	**Norfolk Southern (100%)**	
New Mexico Rail Runner	Albuquerque, NM Santa Fe, NM	Albuquerque: 558,545 Santa Fe: 83,776	Suburban - Urban/ Suburban - Rural - Urban/ Suburban	97	15	Daily	11	38.28	2006	1,801	2,780	New Mexico Department of Transportation; Rio Metro Regional Transit District	Herzog Transit Services	New Mexico DOT (100%)	$385 million (2008$)
Amtrak Hiawatha	Chicago, IL; Milwaukee, IL	Chicago: 2,716,450 Milwaukee: 595,351	Urban - Rural - Suburban - Urban	86	5	Daily	7	57.98*	Legacy - Amtrak began operating in 1971	N/A	2,213	Amtrak	Amtrak	Canadian Pacific (78%); Metra (21%); Chicago Union Station Terminal (1%)	
MARC - Brunswick Line	Washington, D.C.	693,972	Rural - Suburban - Urban	74	19	Daily	9; 3 to WV	38.21+	Legacy - MARC began operating in 1983	N/A	8,138	MARC	Bombardier Transportation	CSX (99%); Amtrak (1%)	

*Average speed calculated based on published timetables and route length.

+These are average system speeds for VRE and MARC published by the Federal Transit Administration.

○Assumes utilization of existing Amtrak stations.

△Average speed calculated based on published timetables and route length. The eastbound *Pennsylvanian* travels at an average speed of 46.5 mph. Westbound service is currently 42.3 mph.

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[16] U.S. Census QuickFacts, Population estimates, July 1, 2017; Vancouver, BC, population from Statistics Canada, Census Profile, 2016.

[17] Federal Transit Administration, 2017 Service, https://www.transit.dot.gov/2017-service; For Amtrak operated services, average speed is calculated from published schedules.

[18] The startup capital costs for the various rail lines reflect different startup conditions, including varied needs for investment in equipment, track, and stations.

[19] 4 total roundtrips (including Carolinian), 3 Piedmont roundtrips; FY 2017.

[20] Annual ridership of 126,000 divided by 365 to estimate daily ridership.

[21] Annual ridership of 190,000 divided by 365 to estimate daily ridership.

System/Line	Primary City	Primary City Population (2017 Estimate)[16]	Route Characterization	Length (Route Miles)	Number of Stations	Days of Service	Trips per Weekday (Roundtrips)	Average Speed (mi/hr)[17]	Year Started	Avg Daily Startup Ridership	Avg Daily Current Ridership	System Owner	Operator	ROW Owner	Start-Up Capital Costs[18]
Brightline	Miami, FL; Fort Lauderdale, FL; West Palm Beach, FL	Miami: 463,347 Fort Lauderdale: 180,072 West Palm Beach: 110,222	Urban – Suburban	67 (240 w/ext. to Orlando)	3	Daily	16	54.32*	2018	991[22]	N/A	All Aboard Florida	All Aboard Florida	Florida East Coast Railway (100%)	Estimated $3 billion (includes extension to Orlando)
Virginia Railway Express - Fredericksburg Line	Washington, D.C.	693,972	Suburban - Urban	60	13	Wkdy Only	4	32.29+	1992	2,799	9,500	VRE	Keolis	CSX (100%)	
Shore Line East	New Haven, CT	131,014	Suburban - Urban	45	9	Daily	18	45.42*	1990	833	2,100	ConnDOT	Amtrak	Amtrak (99%); ConnDOT (1%)	
West Coast Express	Vancouver, BC	631,486	Suburban - Urban	43	8	Wkdy Only	5	34.40*	1995		9,890	TransLink	Bombardier Transportation	Canadian Pacific (100%)	
Sonoma-Marin Area Rail Transit (SMART)	San Rafael, CA; Petaluma, CA; Santa Rosa, CA	San Rafael: 59,070 Petaluma: 60,870 Santa Rosa: 175,269	Suburban	43	10	Daily	17	38.51*	2017	2,700	N/A	SMART	SMART	SMART (100%)	Currently $430 million
Northstar Line	Minneapolis, MN	422,331	Suburban - Urban	40	7	Wkdy Only	6	38.41	2009	2,207	2,700	Metro Transit	Metro Transit	BNSF Railway (100%)	$320 million (approx. 2008$)
Music City Star	Nashville, TN	667,560	Suburban - Urban	32	7	Wkdy Only	5	25.79	2006	383	1,103	Tennessee Department of Transportation	Tennessee Regional Transportation Authority	Nashville and Eastern Railroad (100%)	$41 million (2006$)
Capital MetroRail	Austin, TX	950,715	Suburban - Urban	32	9	Daily	18	23.66	2010	1,600	2,900	Capital Metropolitan Transportation Authority	Herzog Transit Services	Capital Metro (100%)	$105 million (2010$)

*Average speed calculated based on published timetables and route length.

+These are average system speeds for VRE and MARC published by the Federal Transit Administration.

[22] Daily ridership calculated from total ridership in the first 6 months of service being 180,870.

Appendix C: Infrastructure and Capital Costs Report

ALTOONA-PITTSBURGH PASSENGER RAIL STUDY

INFRASTRUCTURE AND CAPITAL COSTS REPORT

MAY 2019

pennsylvania
DEPARTMENT OF TRANSPORTATION

WSP

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EXECUTIVE SUMMARY

OVERVIEW

The Altoona to Pittsburgh Passenger Rail Study included a high-level infrastructure assessment to identify the challenges and opportunities for implementing the service alternatives identified and developed in a separate technical report. This effort involved identifying the infrastructure requirements to implement the proposed service alternatives, as well as the proposed capital costs. Operating costs were not estimated as part of this study.

METHODOLOGY

While the project team reviewed all prior reports covering this rail corridor, the most recent prior study, the 2014 Keystone West High Speed Rail Study, provided estimated costs for infrastructure improvements between Harrisburg and Pittsburgh. The study presented those estimated costs in geographic segments corresponding with stations along the corridor. The information contained within the 2014 Keystone West Study was reviewed and it was determined that the costs estimates contained within the 2014 Report would represent credible current costs in a recent time frame. These costs were separated into the Altoona-Johnstown-Latrobe-Greensburg-Pittsburgh segments from the original 2014 study limits. Accordingly, an escalation percentage was applied to those 2014 costs.

ISSUES IMPACTING THE ESTIMATED CAPITAL COSTS

There are some common elements that apply to the development of infrastructure costs for the Altoona to Pittsburgh corridor. The below items are relevant considerations to initiate additional passenger rail service for all or a portion of the corridor between Altoona and Pittsburgh.

- **The corridor from Pittsburgh to Harrisburg is owned by Norfolk Southern.** This corridor has heavy freight traffic and many of the Norfolk Southern trains are long and generally operate at speeds less than passenger trains. Slotting in additional passenger service trains may be difficult.

- There are likely to be **significant infrastructure investments needed to accommodate reliable passenger rail service** on the heavily-used Norfolk Southern corridor and Norfolk Southern would indicate which improvements are mandatory for them to agree to additional passenger rail service.
- **Station improvements will need to be ADA compliant** and may require the construction of pedestrian bridges for passenger access.
- Further complicating potential upgrades to facilities, there are **different owners and entities that control the stations, platforms, and parking facilities along the corridor**. The owning entities are not always the parties responsible for maintenance.
- **Push-pull equipment would minimize crew times and create more possibilities for layovers.** At Altoona, there are two wye tracks nearby, but turning a train would add additional time that has been estimated at two to three additional hours of crew time per train.

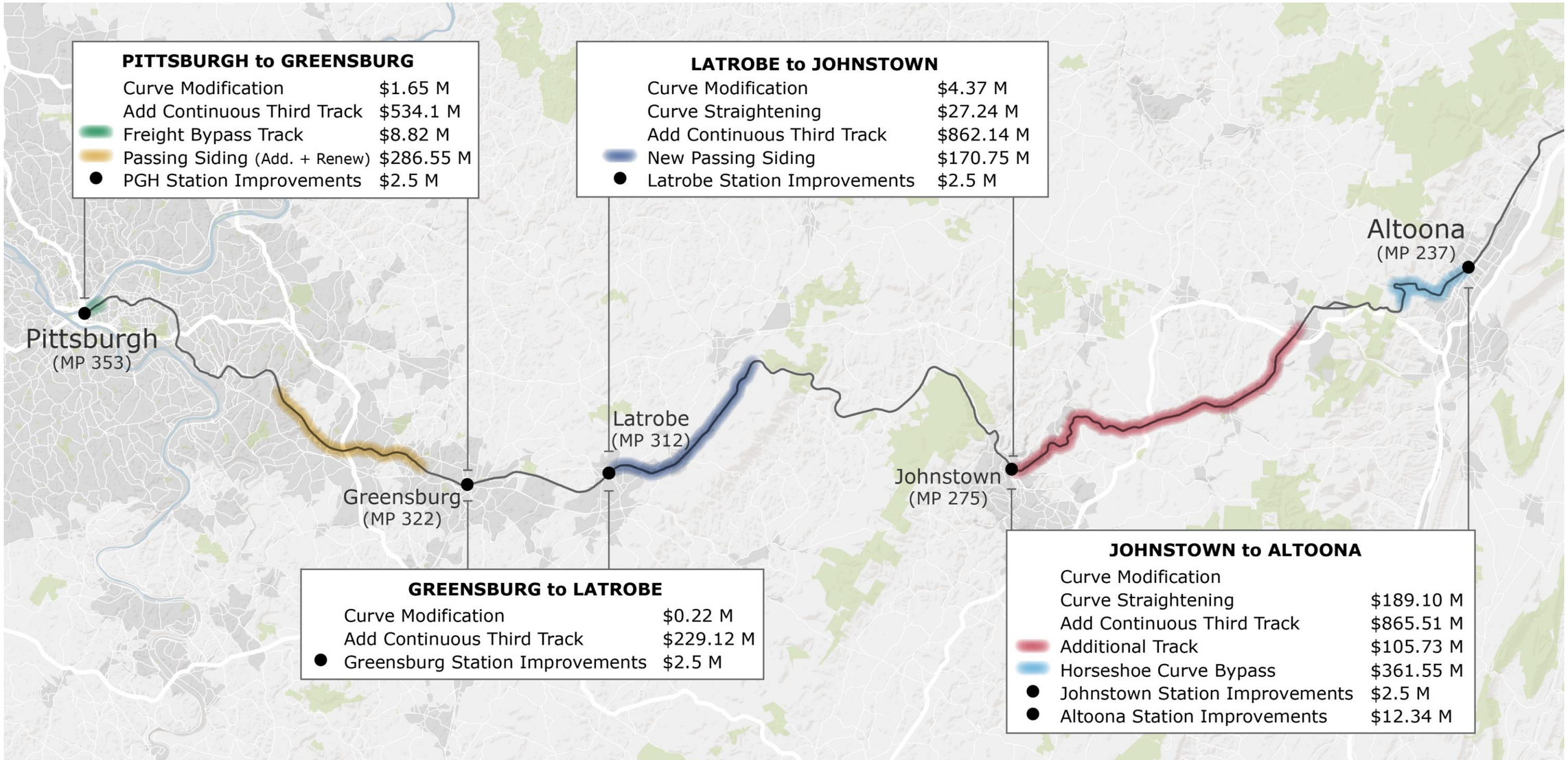
CAPITAL COST SUMMARY

Escalating the estimated capital costs from the 2014 Report to 2019 dollars and considering only the portion from Altoona to Pittsburgh, the projected capital costs are **$3.7 Billion**. If the third track were removed from the proposed work, the projected cost would be reduced to **$1.2 Billion**, a difference of $2.5 Billion. The prior 2014 Report also estimated a project cost implementing a selection of individual improvement components to collectively satisfy the conditions of a lower cost estimate. Improvement types were chosen based on their having a lower cost relative to other improvements, having minimal requirements for additional right-of-way, having fewer environmental impacts, and being easier to implement. Most of these improvements result in improved travel times, with the selected projects predominantly including platform/station improvement and curve modifications. Similar to the review of the full cost estimate, the lower range of costs includes improvements located between Altoona and Pittsburgh. This Lower Cost Option, escalated to 2019 dollars, is estimated at **$427 Million**. Additional costs for **right-of-way acquisition, NS access fees, or environmental impacts and remediation were not considered as part of this effort** and would needed to be added to any of these estimates.

Furthermore, NS may ultimately require different or additional capital improvements which would impact the capital costs.

Figure 1 provides a map of the Altoona-Pittsburgh rail corridor and a summary of the infrastructure improvements by location and type.

Figure 1. Altoona-Pittsburgh Rail Corridor Infrastructure Investments



Infrastructure Investments Total $3,672.49 M

Additional Track	$105.73 M	Horseshoe Curve Bypass	$361.55 M
Curve Modifications	$9.53 M	Passing Siding (Add & Renew)	$457.29 M
Curve Straightening	$216.33 M	Station Improvements	$22.34 M
Freight Bypass Track	$8.82 M	Third Track	$2,490.88 M

INTRODUCTION

The Altoona to Pittsburgh Rail Study consists of a high-level infrastructure assessment to identify the challenges and opportunities for implementing the service alternatives identified and developed. This document identifies the infrastructure requirements to implement the proposed service alternatives, as well as the proposed costs.

Previous studies of the corridor were reviewed to understand and learn from prior assessments of passenger rail service between Altoona and Pittsburgh. These studies include:

- 2005 Keystone West Passenger Train Study (PennDOT and Norfolk Southern)
- 2009 PRIIA Section 224 Pennsylvania Feasibility Studies Report (Amtrak)
- 2009 Allegheny Valley Railroad and Norfolk Southern Commuter Rail Interim Study (Westmoreland Transit)
- 2010 Altoona and Pittsburgh White Paper (Amtrak)
- 2014 Increasing Service of the Pennsylvanian: Benefits and Costs (Pittsburgh Downtown Partnership)
- 2014 Keystone West High Speed Rail Study (PennDOT and Federal Railroad Administration)

These prior studies were referenced to complete a high-level infrastructure assessment identifying the challenges and opportunities for implementing the proposed service alternatives, including:

- Constraints and limitations from freight activity (known at the time of previous studies)
- Station improvements, such as ADA accessibility, warranted by any new service
- Identification of rolling stock – locomotives and cab cars
- Identification of maintenance, layover, and turnaround facilities

- Required infrastructure upgrades or modifications to implement the potential service plans such as sidings and additional track.

EXISTING STATIONS

There are currently five (5) stations in the Altoona to Pittsburgh rail corridor. The ownership of various stations and their facilities are detailed below in addition to general layouts, operating characteristics, and images summarizing existing conditions. All five stations currently have low-level platforms, requiring boarding and alighting assistance for passengers in wheelchairs.

ALTOONA STATION

The Altoona Station is part of the Altoona Transportation Center which is served by Altoona's local public transit provider, AMTRAN, and Greyhound Intercity Bus service. The Station has a staffed ticket office with limited hours. The station is wheelchair accessible with the help of staff. Staff assist with the operation of a wheelchair lift for train boarding and alighting. The station facility does not have any barriers to boarding trains. Paid parking is available in an adjoined parking deck facility.

Located at milepost (MP) 236.1 on Norfolk Southern's Pittsburgh Line, the station facility has one platform serving Track #2, requiring passenger trains to cross over to Track #2 in the eastbound direction. The platform is accessed through a pedestrian bridge from the station located across 10th Ave. A second pedestrian bridge connects the Altoona Station building, AMTRAN Transit Center, and the downtown Altoona community with the Railroaders Memorial Museum, parking, and other points southeast of the rail corridor. Although the pedestrian bridge provides access across the rail corridor, the presence of only a single platform facility on the north side of the rail corridor site prevents passenger boarding and alighting on the south side of the corridor. Norfolk Southern also uses Track #2. Norfolk Southern trains using Track #2 would need to move onto Track #3 west of the station to accommodate passenger trains.

Generally, Norfolk Southern operates trains with a right-hand running rule. West of Harrisburg eastbound trains operate on Track #1 and westbound trains operate on Track #2.

The Altoona Station building is owned and maintained by the City of Altoona. The station's parking facilities are owned by the City of Altoona and

maintained by the Altoona Parking Authority. The station platform is owned and maintained by Amtrak.

Figure 2. Aerial View of Altoona Station

Figure 3. Southeast-Facing Street View of Station Entrance & Pedestrian Bridge at Altoona Station

JOHNSTOWN STATION

The Johnstown Station has a staffed ticket office with limited hours. The station is wheelchair accessible with the help of staff. Staff assist with the operation of a wheelchair lift for train boarding and alighting. The station facility does not have any barriers to boarding the trains. Free parking is available in a small lot adjacent to the station.

There are three tracks at the Johnstown Station, which is located at MP 275.1. Track #3 is the Sang Hollow Extension, while Tracks #2 and #3 are the mainline. The nearest crossover is 1.5 miles west of New Florence at Control Point (CP)-Conpit, approximately 15 miles west of the Johnstown Station (MP 290.6).

The Johnstown Station has one island platform served by Track #2 and Track #3 on the north side of the corridor. To permit passenger loading and unloading at Latrobe, Johnstown and Altoona, eastbound passenger trains must cross over to Track #2, and operate against the general right-hand running rule over a portion of railroad.

The Johnstown Station building is owned by the Johnstown Area Heritage Association (JAHA) with maintenance shared between JAHA and Amtrak. Amtrak is responsible for maintenance of the passenger-specific facilities contained within the building. The station’s parking lot is owned and maintained by JAHA. The platform is owned by Norfolk Southern and maintained by Amtrak.

Figure 4. Aerial View of Johnstown Station

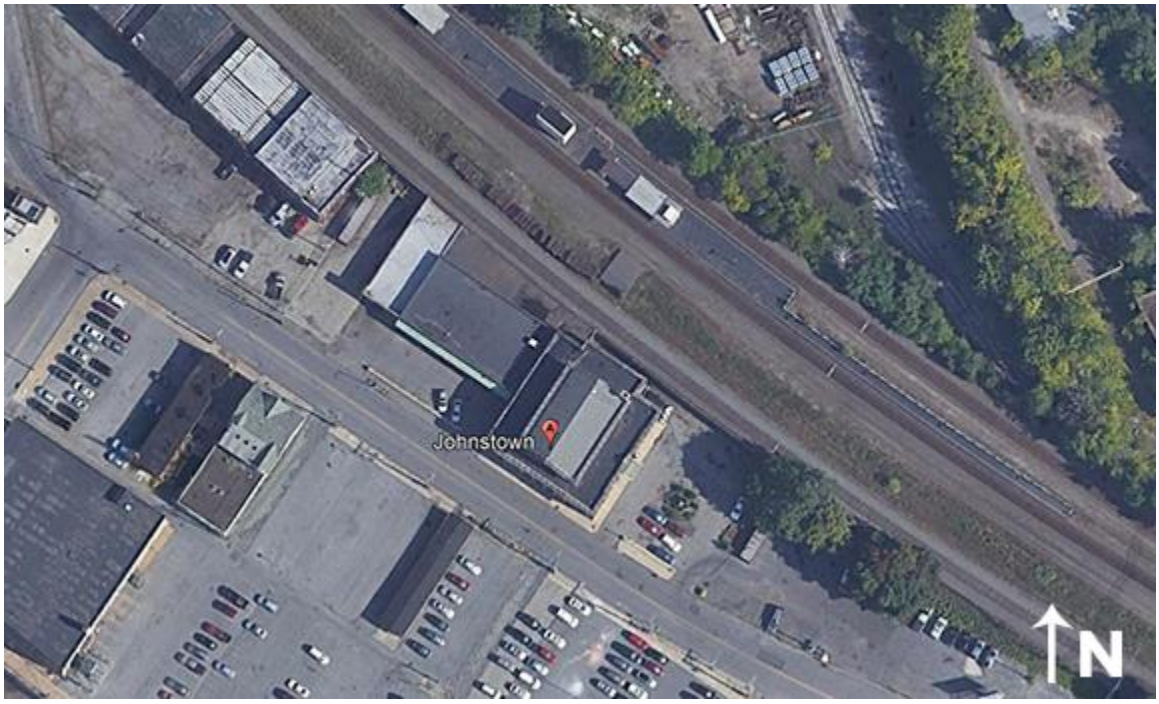


Figure 5. Northwest-Facing Street View of Johnstown Station Building

LATROBE STATION

The Latrobe Station is an unstaffed station and currently serves as a flag stop. The station is not wheelchair accessible, as there is not a barrier-free path from the drop-off area outside the station to the train platform. Free parking is available in a small lot adjacent to the station.

The Latrobe Station is located at MP 312.3 and has one platform serving Track #2 on the north side of the corridor, requiring passenger boarding and alighting from Track #2.

In order to serve the three stations of Latrobe, Johnstown, and Altoona, eastbound passenger trains must operate on Track #2 between Latrobe and CP-C at Johnstown (MP 273.2) and between CP-Slope at Altoona (MP 237.2) and CP-Hunt at Huntingdon (MP 202.4).

The crisscrossing of passenger train movements on the Latrobe to Altoona segment of the corridor causes interference with efficient freight and passenger train operations on the Pittsburgh Line and results in delays and slower speeds.

The Latrobe Station building is owned and maintained by a private entity that operates a restaurant in the station building. The station's parking facilities are owned and maintained by a private entity as well. The station platform is owned by Norfolk Southern and maintained by Amtrak.

Figure 6. Aerial View of Latrobe Station

Figure 7. Northeast-Facing Street View of Latrobe Station Building

GREENSBURG STATION

The Greensburg Station is an unstaffed station located at MP 322.1. A wheelchair lift is present at the station for train boarding and alighting, however other physical features of the station are not wheelchair accessible. Ten free Amtrak-dedicated parking spaces are available in a small lot adjacent to the station.

The Greensburg Station facility features shelters on dual side platforms that serve Tracks #1 and #2. Trains call at both tracks/platforms. Stairs provide vertical access from a pedestrian subway under the rail line.

The Greensburg Station building is owned by a private entity and maintained by Amtrak. The station's parking facilities are owned and maintained by a private entity as well. The platform is owned by Norfolk Southern and maintained by Amtrak.

Figure 8. Aerial View of Greensburg Station

Figure 9. North-Facing Street View of Greensburg Station Building

PITTSBURGH STATION

The Pittsburgh Station has a staffed ticket office with limited hours. The station is wheelchair accessible with the help of staff. Staff assist with the operation of a wheelchair lift for train boarding and alighting. The station facility does not have any barriers to boarding trains. Short-term parking is available at the station; however, no long-term parking is available. Long-term parking is available at the Grant Street Transportation Center Garage across the street from the station.

The Pittsburgh Station is located at MP 353.1 and the facility features a building with a waiting room. Passengers board from Track #1 and Track #4. Track #4 is stub-ended and primarily used for the eastbound *Pennsylvanian*, providing overnight layover storage. Track #1 is used by *Capitol Limited* through-running passenger trains and Pittsburgh-bound *Pennsylvanian* trains requiring wye positioning moves west of the station.

Due to the platform canopy of the station, there are currently limited height clearances at the station. Norfolk Southern is exploring opportunities to increase clearance for double-stack freight service through the station which

could affect track usage at the station, more specifically the availability of Track #1.

The Pittsburgh Station building is owned and maintained by Amtrak. The station's short-term parking area is owned and maintained by Amtrak. Platform ownership is shared between Norfolk Southern and Amtrak. Amtrak is responsible for all platform maintenance.

Figure 10. Aerial View of Pittsburgh Station

Figure 11. East-Facing Street View of Pittsburgh Station Building

It is important to note that any new or renovated station facilities must comply with the Americans with Disabilities Act (ADA), which requires full access for those with mobility impairments. The key physical obstacles for the disabled are vertical circulation at station underpasses or overpasses, and access from the platform to the train car.

Currently, none of the stations in this corridor have high-level platforms. The Altoona and Latrobe Stations only have a platform on one side, so these stations can load and unload passengers from Track 2 which is adjacent to the platform. The same is true for Latrobe. Latrobe is currently on an Amtrak program for ADA access improvements. These proposed improvements will not affect access to Track #1.

The Johnstown, Greensburg and Pittsburgh Station have platforms on both sides. The current Amtrak program underway to improve ADA accessibility at their stations runs between $2.0 and $2.5 million per station where stations are currently in place. Generally, Amtrak retains the low-level platforms to allow for freight operations and includes a wheelchair lift to access the train while also making interior station improvements. A completely new station would cost significantly more, likely ranging from $15 – 25 million. Any improvements or modifications to stations and their facilities should consider

the need for an ADA-compliant path from curbside and parking areas to the station platform.

While the prior studies describe different service frequencies and service, there are some common elements that apply to the development of infrastructure costs for the Altoona to Pittsburgh corridor. The below items are relevant considerations for the study at hand to initiate additional passenger rail service for all or a portion of the corridor between Altoona and Pittsburgh.

- The corridor from Pittsburgh to Harrisburg is owned by Norfolk Southern. This corridor has heavy freight traffic and many of the Norfolk Southern trains are long and generally operate at speeds less than passenger trains. Slotting in additional passenger service trains will be difficult.
- There will be significant infrastructure investments needed to accommodate reliable passenger rail service on the heavily-used Norfolk Southern corridor.
- As described above, station improvements will need to be ADA compliant and may require the construction of pedestrian bridges for passenger access.
- Further complicating potential upgrades to facilities such as stations, platforms, and parking facilities along the corridor are the different owners and entities that control them. The owning entities are not always the parties responsible for maintenance.
- Push-pull equipment would minimize crew times and create more possibilities for layovers. At Altoona, there are two wye tracks nearby, but turning a train would add additional time that has been estimated at two to three additional hours of crew time per train.

METHODOLOGY

The most recent prior study of the corridor, the 2014 Keystone West High Speed Rail Study, provided estimated costs for infrastructure improvements between Harrisburg and Pittsburgh. The study presented those estimated costs in geographic segments corresponding with stations along the corridor.

The information contained within the 2014 Keystone West Study was reviewed with PennDOT representatives and it was determined that the costs estimates contained within the 2014 Report would represent creditable current costs in a recent time frame which could be separated into the Altoona-Johnstown-Latrobe-Greensburg-Pittsburgh segments from the original 2014 study limits. Accordingly, an escalation percentage was applied to those 2014 costs (2012 dollars).

Thus, the estimated cost to provide additional passenger rail service for the smaller corridor segment between Altoona and Pittsburgh was identified. Proposed improvements generally consisted of station improvements, curve modifications, curve straightening, passing sidings, and construction of a third track.

The 2014 Report provided estimated direct costs for the proposed improvements or modifications for additional train service, and included the following percentage additions to those estimated direct costs as listed in below Table 1. **It should be noted that there were no estimated costs for right-of-way acquisition, NS access fees or environmental impacts and remediation as part of the 2014 Report or in this document.**

Table 1. Additions to Keystone West 2014 Report Direct Cost Estimates

Cost Item	Assumed Percentage
Mobilization/Demobilization	3%
Permitting	1.5%
General Conditions/Site Overhead	8%
Contingency	25%
Engineering	8%
Construction Management/Inspection	8%

Accordingly, these percentages were not added again in the preparation of the current estimates for this report. An escalation factor of 8% was used for the current cost estimation from 2012 to 2019.

The following categories of improvements are included in this estimate:

- Station improvements – platforms, garage, elevators, pedestrian bridge
- Curve modifications – modified superelevation and straightening of curves
- Third track – additional capacity, new track, bridges, turnouts, communications and signals (C&S), retaining walls, grade crossings, access roads
- Curve straightening – new track, relocation/shifting, access roads, retaining walls, bridges,

Additionally, between Altoona and Johnstown, the 2014 Report includes an estimate to construct a bypass for the Horseshoe Curve at a cost of $334.77 M. This work included an off-line rail alignment that would be double-tracked and be passenger-only due to grades. Work would include 9.3 miles of new double-track, a new rail/rail grade separation, a new rail/highway grade separation, extensive cut/fills, extensive C&S work and turnouts.

RESULTS

Escalating the estimated costs from the 2014 Report and considering only the portion from Altoona to Pittsburgh, the projected cost is **$3.7 Billion**. If the third track were removed from the proposed work, the projected cost would be reduced to **$1.2 Billion**, a difference of $2.5 Billion. See Figure 1 for a map of the $3.7 billion in improvements proposed.

Following the completion of the 2014 Report, PennDOT requested the development of an improvement option with a cost of less than $500 Million. This Lower Cost Option (LCO) was not determined to be a preferred option, nor a suggestion on what should be built first. Rather it was developed at the request of the study sponsors to identify corridor improvements and to provide an option costing less than $500 Million for the overall Keystone West corridor.

This effort resulted in selection of individual improvement components from the Keystone West Cost Estimate to collectively satisfy the conditions of a lower cost estimate. Improvement types were chosen based on their having a lower cost relative to other improvements, having minimal requirements for additional right-of-way, having fewer environmental impacts, and being easier to implement. Most of these improvements result in improved travel times, with the selected projects predominantly including platform/station improvement and curve modifications. Similar to the review of the full cost estimate, the lower range of costs includes improvements located between Altoona and Pittsburgh. This LCO, escalated to 2019 dollars, is estimated at **$427 Million**.

Table 2. Conceptual Capital Cost Estimates by Station

Cost Category	Estimated 2019 Cost ($M)
Altoona	$1,432
Johnstown	$1,173
Latrobe	$232
Greensburg	$538
Pittsburgh	$298
Additional Items	
Maintenance Facility	$15
Storage/Wye Tracks	$5
Train Set (each)	$50*
Total Cost	$3,743

* Estimated high-end-range equipment cost, per trainset.

The inclusion of a third track in the cost estimate ultimately determines the operating speeds desired. Per Norfolk Southern's passenger planning policy, passenger trains operating in excess of 79 mph require their own dedicated

tracks. Additionally, passenger trains operating in excess of 90 mph would require their own private right-of-way. With potential capital improvements to improve capacity and speed, the 2014 Report assumed maximum operating speeds of 70 to 79 mph. Intermodal freight trains operate at a maximum 60 mph due to civil restrictions. Current average speed for passenger service on the *Pennsylvanian* between Harrisburg and Pittsburgh is 45 mph.

The service alternatives considered assumed existing Pennsylvanian average operating speeds of less than 50 mph, and not exceeding 79 mph west of Harrisburg therefore not requiring a separate dedicated track. The 2014 Report inferred Amtrak would be the operator of any additional passenger train service.

Adding to the estimated escalated projected cost derived from the 2014 Report, the following items would also likely be needed:

Maintenance Facility	$15 million
Storage/Wye Track	$5 million
Train Set (each)	$50 million (high-end range cost of new trainset) $88 million (Amtrak estimate)

The maintenance facility could at a minimum consist of a covered maintenance facility with canopy for overnight servicing and storage, along with associated yard tracks, ancillary support buildings, and utility build out. The storage or wye tracks would provide access from Norfolk Southern's mainline tracks to the storage yard and maintenance facility.

Regarding vehicles, there is a wide range of choices that could be considered depending on the operator and type of service. The 2014 Report indicated that an additional train set consisting of one diesel locomotive, five coaches (including one business class), and one dinette could be used for $960,000 if Amtrak's existing spare units were utilized and only an additional equipment capital charge was utilized. In contrast, Amtrak estimated that additional equipment to operate one additional trip of the Pennsylvanian would be $88 million in 2009 ($105 million in 2019$). This estimate included three diesel locomotives, three electric locomotives, ten coaches, and three food service cars for service between Pittsburgh and New York. Removing the three electric locomotives from this estimate would significantly reduce the cost

estimate. As of early 2019, Amtrak has indicated to PennDOT that surplus equipment is not available.

The purchase of a new train set could be in the range of $30M to $50M, depending on whether service is characterized as commuter or intercity. The use of typical commuter equipment does not require a restroom on board the train, though longer-distance service to Altoona and Johnstown is of a distance where a restroom would be desirable. If restrooms are provided onboard a train, there must be facilities that are ADA accessible. Similar to the existing *Keystone* service and most commuter rail operators, a dining car would not be needed for trips on this corridor, further reducing the equipment cost. For the purposes of the cost estimate, of the higher end of this range, $50 million was used per trainset.

As mentioned above, another aspect of the 2014 Report was the development of a Lower Cost Alternative Option. Consideration was given to identifying those infrastructure improvements that could provide the greatest benefit to the corridor and future passenger rail service while meeting a specified spending limit of $500 million. Accordingly, a new dollar upset limit could be identified, and the associated maximum number of infrastructure improvements could be generated to provide maximum value for this investment.

At this high level of analysis, a wide range of costs can be assumed based on prior efforts, from $357 million to $3.7 billion. A large component of this difference depends on the desired speed of the passenger service. Typically, if a passenger rail service is to operate at speeds greater than 79 mph, Norfolk Southern will require they be on their own dedicated track for the portions of travel at these higher speeds. Additionally, the number of trainsets needed will have a smaller, albeit significant impact on the total capital cost for service. Used locomotives and passenger cars could be purchased or leased and refurbished as needed for a lesser cost than new equipment.

Again, it should be noted that **additional costs, including right-of-way, access fees to Norfolk Southern, and liability insurance are not part of this estimate and would have to be negotiated by the project sponsor with Norfolk Southern and others**. Operating & Maintenance

(O&M) costs are estimated separately from capital costs and would be partially influenced by the number of trains per day provided.

CORRIDOR OWNERSHIP CONSIDERATIONS

The existing rail corridor is a heavily used freight line owned by Norfolk Southern. While all passenger rail proposals are unique and evaluated on a case-by-case basis, Norfolk Southern has identified general requirements for the evaluation and planning of new passenger operations on Norfolk Southern freight corridors.

OPERATIONAL FEASIBILITY STUDY

The initial step for coordinating with Norfolk Southern is the requirement to complete an operational feasibility study in order to identify and understand all potential impacts from a proposed passenger rail service. A completed operational feasibility study performed by Norfolk Southern or their selected consultant is a prerequisite to progress a project and Norfolk Southern will only support passenger project requests that have been fully studied and modeled. This operational feasibility study will ensure that there is transparency in the capacity for passenger trains and freight trains to operate without delay or impact, however minimal, to each other while still allowing for route maintenance.

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. Freight volumes on the Norfolk Southern line between Altoona and Pittsburgh are significant (50-70 trains per day currently) and are expected to increase.

Norfolk Southern's requirements state that the cost of the study, including Norfolk Southern's time, is the responsibility of the sponsoring entity. Norfolk Southern will provide an estimate of study costs in advance, and the studies often take at least a year to complete.

Generally, freight rail operations are long-distance and customer-driven. Hence, the creation of "passenger only" operating windows and/or temporal separation, such as night-time only freight operations, will usually not be possible. Additionally, based on prior experience, Norfolk Southern

recommends that the studied geographic scope be larger than the new passenger service project area in order to identify and address potential network effects on the Norfolk Southern system that can extend beyond the project area.

PROJECT FUNDING

From Norfolk Southern's perspective, all project costs associated with compliance with FRA regulations are the responsibility of the project sponsor. **Given the dynamic nature of freight rail markets, any passenger studies that are delayed or dormant must be revisited with an up-to-date study once project funding and advancement is resumed.**

OWNER COMPENSATION

Norfolk Southern will determine a fair price for the use of its assets, factoring in any new equipment (including Positive Train Control systems) and costs, as well as additional property and other costs, including taxes that may be incurred with passenger service being introduced to the rail corridor. As rail traffic volumes and flows change over time, this capacity, and the flexibility and potential it represents, is a key Norfolk Southern asset.

Additionally, Amtrak has certain statutory intercity passenger service access rights and is not a good example or comparison for other potential project sponsors to use in determining the fair and commercial price for use of Norfolk Southern's assets.

LIABILITY

New and expanded passenger operations on Norfolk Southern-owned corridors require adequate liability protection. Passenger operators are required to compensate or indemnify Norfolk Southern for additional risk created by passenger projects, and any such indemnification needs to be backed up by an adequate level of insurance. These liability and sovereign immunity issues are substantial costs and can create major hurdles to project advancement.

Norfolk Southern's requirements are further detailed in Appendix B.

CONCLUSION

This report provides a high-level investigation of the potential range of improvements necessary to provide additional passenger rail service between Altoona and Pittsburgh based on the most recent detailed study from 2014 investigating the rail corridor west of Harrisburg. Improvements needed in order to provide this service would likely include station improvements, curve modifications, addition of a third track for portions of the corridor, and curve straightening. Additional costs would include a maintenance facility, a storage/wye track, and train equipment if the operator was someone other than Amtrak.

The resulting wide range of potential costs is dependent on the specific improvements required by Norfolk Southern as the rail right-of-way owner. A necessary next step is to further engage Norfolk Southern through an operational feasibility study to fully understand the impact of passenger service on freight operations and the resulting capital improvements needed. A study of this type is required by the railroad to fully understand all potential service impacts. This study would be completed by the project sponsor with coordination from Norfolk Southern.

A potential interim next step is to identify and advance capital improvements to existing stations and infrastructure that would benefit Amtrak's existing *Pennsylvanian* service as well as any additional passenger rail service on this corridor in the future. Efforts of this nature should be performed in conjunction with Amtrak so as not to preclude any potential enhancements planned by Amtrak for the *Pennsylvanian*.

APPENDIX A – COST ESTIMATE DETAILS

These tables summarize the estimated infrastructure investments required to run increased passenger rail service on the Altoona – Pittsburgh Corridor. These estimates do not include costs for right-of-way acquisition, environmental remediation, or NS related costs for access or liability.

Location	Mile Post	Improvement/ Modifications	2014 Keystone West Estimates in 2012$ (M)	Updated Estimated Costs in 2019$ (M)	Lower Cost Option (LCO) 2012$ (M)[1]	LCO Escalated to 2019$ (M)	LCO Benefit
Altoona Station	236.1	Station Improvements	$11.43	$12.34	$15.67	$16.92	Capacity/Time Savings
Altoona to Johnstown		Curve Modifications	$3.04	$3.28	$3.04	$3.28	
		Third Track	$801.40	$865.51			
		Curve Straightening	$175.09	$189.10	$175.09	$189.10	
		Additional Track	$97.90	$105.73	$97.90	$105.73	
		Horseshoe Curve Bypass	$334.77	$361.55			
		Sub-Total		$1,525.18		$298.11	
Johnstown Station	275.1	Station Improvements		$2.50			

[1] Lower Cost Option developed from the 2014 Keystone West Report to provide an option that cost less than $500 million for the overall corridor between Harrisburg and Pittsburgh.

Location	Mile Post	Improvement/ Modifications	2014 Keystone West Estimates in 2012$ (M)	Updated Estimated Costs in 2019$ (M)	Lower Cost Option (LCO) 2012$ (M)[1]	LCO Escalated to 2019$ (M)	LCO Benefit
Johnstown to Latrobe		Curve Modifications	$4.05	$4.37	$4.05	$4.37	Speed
		Third Track	$798.28	$862.14			
		Curve Straightening	$25.22	$27.24	$25.22	$27.24	Speed
		New Passing Siding	$158.10	$170.75			
		Sub-Total	$1,418.32	$1,064.50		$31.61	
Latrobe Station	312.3	Station Improvements		$2.50			
Latrobe to Greensburg		Curve Modifications	$0.20	$0.22	$0.20	$0.22	Speed
		Third Track	$212.15	$229.12			
		Sub-Total	$212.35	$229.34		$0.22	
Greensburg Station	322.1	Station Improvements		$2.50			
Greensburg to Pittsburgh		Curve Modifications	$1.53	$1.65	$1.53	$1.65	Speed
		Third Track	$494.54	$534.10			
		Freight Bypass Track	$8.17	$8.82			
		Passing Siding (Add & Renew)	$265.32	$286.55			

Location	Mile Post	Improvement/ Modifications	2014 Keystone West Estimates in 2012$ (M)	Updated Estimated Costs in 2019$ (M)	Lower Cost Option (LCO) 2012$ (M)[1]	LCO Escalated to 2019$ (M)	LCO Benefit
		Sub-Total	$496.07	$831.12		$1.65	
Pittsburgh Station	353.1	Station Improvements		$2.50			
Total Cost		Altoona to Pittsburgh		$3,672.49			
		Third Track Work		$2,490.88			
		Less Third Track Work		$1,181.61		$357.34	
Additional Items		Maintenance Facility		$15.00		$15.00	
		Storage / Wye Tracks		$5.00		$5.00	
		Train Sets		$1 - $88[2]		$1 - $88[2]	

[2] Range provided based on estimates from prior Keystone reports.

COST BY IMPROVEMENT CATEGORY

Improvement	Estimated 2019 Cost ($M)
Additional Track	$105.73
Curve Modifications	$9.53
Curve Straightening	$216.33
Freight ByPass Track	$8.82
Horseshoe Curve ByPass	$361.55
Passing Siding (Add & Renew)	$457.29
Station Improvements	$22.34
Third Track	$2,490.88

APPENDIX B – NORFOLK SOUTHERN PASSENGER RAIL POLICY PAPER

The following document was provided by Norfolk Southern in October 2018.

GENERAL PRINCIPLES GUIDING NORFOLK SOUTHERN'S EVALUATION OF INTERCITY AND COMMUTER PASSENGER RAIL PROPOSALS

The following principles are a guide for planners of intercity and commuter rail proposals when working with Norfolk Southern. Of course, each proposal necessarily is unique, and NS' application of the principles to particular proposals will often be unique as well.

Safety is our paramount concern. Design, maintenance practices, and operating patterns always will emphasize safety.

An operational feasibility study is necessary to fully understand all potential impacts.

- The proposed passenger operation must create "transparency" in the affected rail system. Transparency is the capacity for passenger trains and freight trains to operate without delay, however minimal, to each other, while still allowing for route maintenance.
    - Passenger projects are meant to be successful, so the study will focus on the proposal's full-build scenario versus any interim plan. Along the same lines, freight volumes will grow, so any study will anticipate future freight levels.
    - Freight operations are long distance and customer-driven, which precludes "passenger only" operating windows and temporal separation such as night-time-only freight operations.
    - Passenger projects might cause "network effects" on the NS system that are broader than the project area. Often, the studied geographic scope will have to be larger than the passenger project area in order to identify and address these effects.
    - Project costs associated with compliance with Federal Railroad Administration regulations are the responsibility of the project sponsor.
- The rail environment changes. Conditions attached to various forms of funding differ. Therefore, until funding is available, any passenger study is necessarily hypothetical.
    - A completed operational feasibility study by NS is a prerequisite to progress a project. NS will support only passenger project requests that have been fully studied and modeled.
    - As the transportation industry is dynamic, any proposal that does not secure funding cannot be shelved for future use – each proposal is unique, requiring its own up-to-date study.
    - Sometimes public funding comes with special conditions and requirements (including so-called "service outcome requirements"), which represent additional costs. Just as NS does not customarily agree to similar guarantees with our freight customers, the public sponsor will be responsible for any passenger guarantees.
    - It is possible that public funding may be taxable to Norfolk Southern, so the public sponsor must indemnify Norfolk Southern for any income taxes paid or incurred as a result of the receipt of public funding.

- NS will coordinate the operational feasibility study. The cost of the study (including NS' time) is the responsibility by the sponsoring public agency. For planning purposes, NS can estimate study costs in advance. Studies are detailed and specific and take a year, and often longer, to complete.

NS will receive fair compensation for use of its transportation corridors.

- NS' corridors consist of track and right-of-way that might, or might not, be fully utilized at any given time. As rail traffic flows change over time, this capacity, and the flexibility and potential it represents, is a key NS asset.

- Amtrak has certain statutory intercity passenger service access rights and therefore is not a good example to use in determining the fair and commercial price for use of NS assets.

- In determining a fair price for use of assets, NS will factor in any new equipment (including Positive Train Control) and costs, as well as additional property and other taxes, that would not be incurred absent passenger service.

New and expanded passenger operations require adequate liability protection.

- Passenger operators must compensate or indemnify NS for additional risk created by passenger projects, and any such indemnification needs to be backed up by an adequate level of insurance.

- Liability issues can create major hurdles. Often, sovereign immunity issues must be overcome. The cost to the passenger carrier for insurance and indemnification is substantial, as borne out by our experience with commuter authorities.

Special considerations are necessary for high speed rail service and corridors.

- Norfolk Southern is pleased to assist states planning for dedicated HSR and will work with planners to insulate those corridors from interference with and from NS freight corridors.

- Passenger trains operating in excess of 79 mph require their own dedicated tracks. Passenger trains operating in excess of 90 mph require their own private right-of-way.

- Where higher-speed trains share tracks with conventional freight trains, they will be able to reach 79 mph maximum. Where shared track is concerned, higher-speed trains must meet the same safety standards as conventional trains.

Special considerations are necessary for light rail service.

- Light rail service involves use of equipment that is not appropriate for use on NS tracks. Physical separation is required.

- Proposals for operating "non-compliant" passenger equipment (equipment that does not meet Federal Railway Administration standards) in joint operations with freight trains are not viable.

- Light-rail and non-compliant project sponsors should approach NS early in the process so that NS can advise if any of the project elements are compatible with freight trains and track.