EXECUTIVE SUMMARY

Keystone West High-Speed Rail Study Goals

- *Extend higher speed rail service from Harrisburg to Pittsburgh.*
- *Increase ridership on Keystone West.*
- *Stimulate regional economic development.*

The Pennsylvania Department of Transportation (PennDOT), in cooperation with the Federal Railroad Administration (FRA), Amtrak, and Norfolk Southern (NS), conducted the Keystone West High Speed Rail Study to evaluate the feasibility of options to reduce rail travel times and increase trip frequency on Amtrak's Keystone West portion (Harrisburg – Pittsburgh) of the Pennsylvanian service between New York City and Pittsburgh. **See Figure 1: Project Area Map.** It is important to note that this is a high-level, conceptual feasibility study. As such, the analyses relied on:

(a) information gleaned from prior studies and reports;
(b) secondary sources of readily-available data; and,
(c) planning-level techniques for engineering assessments, cost estimation, rail operations analyses, demand estimation, and impact assessment.

A detailed analysis of the purpose and need for this study is provided in the "Keystone West High Speed Rail Study, Project Purpose & Need (Final, May 2012)" report, contained in the project technical files. Briefly, needs include:

- There is currently only inconvenient, limited, 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.

Pennsylvanian Facts

1. *Long time east-west passenger & freight link.*
2. *Heavy freight usage from the west to New York / Philadelphia.*
3. ***Keystone East** portion (Harrisburg to Philadelphia) offers high speed, electrified passenger rail service.*
4. *Amtrak owns Keystone East portion of the Pennsylvanian.*
5. ***Keystone West** portion (Pittsburgh to Harrisburg) owned by Norfolk Southern.*
6. *Since 1971, Amtrak has leased Keystone West portion to operate passenger rail service.*
7. *One round trip daily for passengers on Keystone West.*

Keystone West Intermediate Stops

Greensburg, Latrobe, Johnstown, Altoona, Tyrone, Huntingdon, and Lewistown

The Keystone West corridor is characterized by urban development at both ends (Pittsburgh and Harrisburg) with intermediate stops at smaller boroughs and cities along the route. Topography ranges from rolling in the west, to mountainous in the central portions of the corridor near Johnstown and Altoona, to more gently sloping as the route approaches Harrisburg. The varying topography creates unique challenges for rail (passenger and freight service) transport, including winding alignments with steep grades and a narrow cross section.

The study evaluated existing rail operations and infrastructure within the Keystone West corridor and identified potential improvements and conceptual alternatives to provide higher speed passenger rail service. The analysis of conceptual alternatives involved a two-tiered approach:

1. Identification & analysis of "full alternatives."
2. Evaluation of individual improvement components (options).

All alternatives were rooted in incrementally increasing speeds of passenger trains and providing the capacity for additional passenger train frequencies, while minimizing impacts to current Norfolk Southern operations and future opportunities. Conceptual alternatives included the Base Case (No-Build) Alternative along with four build alternatives, as presented in **Table ES-1**.

The types of improvements considered under each alternative included:

- curve modifications and curve straightening
- off-line alignments to bypass slow/circuitous sections
- adding tracks to increase capacity
- switch upgrades to allow higher speeds through transitions from one track to another
- addition of platforms to eliminate the need for trains travelling in opposing directions to share the tracks though station areas
- a rail spur connection or connecting bus service from the mainline to State College
- connecting bus service to other off-line communities
- more frequent passenger train service

Alternatives Analysis

Early Screening

a. Screening Metrics, including:
   - Purpose & Need
   - Public / Stakeholder feedback
   - Physical, financial, and institutional feasibility

b. Metrics ranked with 1 being least favorable & 5 most favorable

Detailed Study

a. Ridership forecasts
b. Operations analysis
c. Equipment considerations
d. Financial plan
e. Impact assessment
f. Benefits assessment
g. Phased implementation

Table ES-1: Summary of Screening Alternatives

Alternative	General Improvement Types	Estimated Right-of-Way Costs	Infrastructure Construction Cost	Metrics Screen Score*	Carried to Detailed Analysis?
No-Build	None	$0	$0	2	No
1	Curve modifications in existing right-of-way	$400,000	$1.5 billion	5	Yes
2	Alternative 1 improvements PLUS curve straightening and some new alignment at slow points	$14 million	$9.9 billion	5	Yes
3	Alternatives 1 and 2 improvements PLUS addition of a continuous third track	$16 million	$13.1 billion	3	Yes
4	All new electrified, two-track, passenger train only, high speed alignment on southerly route similar to PA Turnpike	$50 million	$38.3 billion	1	No

* 5 indicates the highest or best score and 1 indicates the lowest or worst score.

All alternatives, except the Base Case, would include either a rail connection from the Tyrone Amtrak Station to State College, or bus connection(s) from one or more existing rail stations to State College. The Base Case (No-Build) Alternative, with a metrics ranking of "2," and Alternative 4 (metrics ranking of "1") were eliminated from further consideration during the initial screening of alternatives. The Base Case does not address identified needs and Alternative 4 was dropped primarily based on financial feasibility and the probability of extensive impacts to the communities through which it would pass. Both also had the lowest ranking among alternatives considered.

Following the initial screening, additional details were developed for Alternatives 1, 2, and 3, including individual improvement options by station and alignment segments. **Table ES-2** provides a high-level summary of the improvements and capital costs, by route segment, for Alternatives 1, 2, and 3.

Table ES-2: Summary of Improvements and Costs for Alts 1, 2, and 3

Route Segment	Type(s) of Improvement	Alt 1 ($000's)	Alt 2 ($000's)	Alt 3 ($000's)
Pittsburgh-Greensburg	Capacity, Speed	275,027	275,027	504,239
Greensburg-Latrobe	Capacity, Speed	158,308	158,308	212,355
Latrobe-Johnstown	Capacity, Speed	4,054	29,275	827,552
Johnstown-Altoona	Capacity, Speed	100,944	610,799	1,314,298
Altoona-Tyrone	Capacity, Speed, Stations/Platforms	11,791	11,791	336,683
Tyrone-State College Spur	New Connection	71,887	71,887	71,887
Tyrone-Huntingdon	Capacity, Speed, Stations/Platforms	3,358	1,118,098	1,592,414
Huntingdon-Lewistown	Capacity, Speed, Stations/Platforms	573,322	6,385,249	6,205,988
Lewistown-Harrisburg	Capacity, Speed	275,250	1,279,147	2,002,480
Subtotal-Construction		**1,473,941**	**9,939,581**	**13,067,896**
Right-of-Way		400	14,000	16,000
Total Costs		**1,474,341**	**9,953,581**	**13,083,896**

Alternatives 1, 2, and 3 were studied and potential environmental effects developed based upon select environmental information and features collected from the Pennsylvania Spatial Data Access (PASDA) webpage.

A rail operations analysis assessed the performance aspects of Alternatives 1 and 2, and included a qualitative assessment of the performance aspects of Alternative 3. The results of the rail operations analysis predict the time savings shown in **Table ES-3** for each detailed study alternative.

Table ES-3: Time Savings by Alternative			
	Alternative 1	**Alternative 2**	**Alternative 3**
Eastbound	9 minutes +	35 minutes +	Alternative 2 time savings plus additional time savings due to fewer conflicts between passenger and freight trains; plus additional capacity and reliability due to continuous third track*
Westbound	Almost 5 minutes	29 minutes +	
* The additional time savings due to the addition of a third continuous track could not be quantified using the tools applied as part of this study.			

Pro forma schedules assuming increased service frequency were also developed. The schedules were developed using Alternative 2 as it incorporates all of the Alternative 1 improvements and all of the Alternative 3 improvements, with the exception of a continuous third line. Full implementation of Alternative 2, with an eight percent recovery time (the time required for a train to get back up to speed after a delay or a stop), results in an approximately 4-½ hours trip time, in either direction. This trip time was used along with an increase in service to two-round trips to create the frequency schedule that was used in ridership forecasting and the financial analysis.

In support of the ridership forecasts, an analysis was completed to determine how ridership would be affected by increased bus service to the Keystone West stations. The results of the ridership forecasting (demand estimates), with and without the connecting bus services, are presented in **Table ES-4**.

Table ES-4: Demand Estimate Summary							
	2012 Base Case	**2020**			**2035**		
		Base Case	**Alternative 2**		**Base Case**	**Alternative 2**	
			With Bus Service	**Without Bus Service**		**With Bus Service**	**Without Bus Service**
Keystone West ONLY	107,420	111,220	169,910	162,502	117,870	206,815	197,675
TOTAL Pennsylvanian	211,990	224,840	315,045	307,637	241,140	384,170	375,030

Finally, a financial analysis and assessment of benefits were developed—based primarily on using Alternative 2 infrastructure inputs as a baseline, as stated above in the pro forma schedule discussion —to provide information on expected ridership and revenue increases, capital cost needs, operating needs and expected benefits that would be realized should Alternative 2 be fully constructed. Even assuming the higher speeds and service frequencies that would result from full implementation of Alternative 2, at a construction cost of $9.9 billion, the forecast demand and corresponding passenger revenue estimates would result in a substantial increase in required operating subsidies. Although this effort was carried out at a conceptual level and more in-depth analyses would be required to produce more definitive conclusions, the results of the demand estimation and financial analysis suggest that a more detailed evaluation of demand, anticipated benefits, and funding availability will ensure that the most reasonable and prudent improvements, or combinations thereof, are advanced to construction.

Example Initial Improvement

Station & Platform improvements with one added daily round trip
- operations benefits
- more travel options

Realizing that it is unlikely that a program of improvements along the lines of Alternative 2 could be implemented all at once, potential improvements were developed in a manner that would allow them to be completed incrementally, based on need, expected benefits and funding availability. Incremental improvements along the corridor would offer a fiscally constrained approach to the long-term implementation of a full and complete alternative; and allow ridership to increase systematically in support of future improvements.

Future Considerations

1. Should improvements be constructed individually or in some combination?
2. Improvement options (or combinations thereof) must be prioritized.
3. Is there sufficient demand to justify cost of individual or combined improvements?

It must be noted that part of the analysis as to what improvements move forward, and what order (priority), must consist of evaluating whether there is sufficient demand available to justify the cost required to construct any individual or combined improvements. Because the presented improvement options offer varying levels of improvement at widely varying funding levels, whether constructed individually or in some combination of improvements, a determination on whether the improvement(s) are justified based on demand can only be made once they are prioritized for future action and decisions are made on whether to construct improvements individually or in some combination.

To aid in future discussions concerning what improvements could be advanced—considering fiscal constraints, in particular—a menu of possible improvement options was developed. This menu is included in **Appendix B** of the Feasibility Study / Preliminary Service Development Plan and available as a stand-alone document (*Keystone West High Speed Rail Study: Menu of Options*), that provides information on potential benefits, costs, right-of-way needs, and environmental considerations for each improvement. Ultimately, this information could be used to program potential projects through the State Transportation Improvement Program (STIP) development process.