Advancing a Fast Tracked SEPTA-CSX Separation Project

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ABSTRACT

Faced with the need for achieving a joint commuter-freight solution to comply with the federal-mandate for Positive Train Control (PTC), along with balancing service requirements for both operations, SEPTA and CSXT have recently completed a project to separate commuter/passenger and freight operations to effectively meet these demands. This solution for a 6-mile stretch of shared railroad on SEPTA’s West Trenton Line and CSXT’s Trenton Subdivision between Woodbourne, PA and West Trenton, NJ, required close cooperation and accelerated planning between SEPTA and CSXT, and a fast-paced construction project.

Recently completed with operational separation achieved in August 2015, the project cost is $38.8M and has been partially funded thru a TIGER Grant award. Results include separate PTC-compliant operations in compliance with the initial federally-mandated implementation date of January 1, 2016, and better coordination of peak-hour passenger and freight trains thru this corridor. The entire project, from initial stages of design through completion of construction, was completed in less than two years.

This paper will present an overview of the SEPTA-CSXT Separation Project, with emphasis on select quick-reference diagrams, and include the challenges, careful planning, and coordination involved with making this large-scale project a success.

BACKGROUND (SEPTA)

SEPTA is the nation’s sixth-largest public transportation system and is one of the only two truly multi-modal transit properties in the United States with bus, subway, high speed rail, trolley, trackless trolley, regional rail and paratransit vehicles. The SEPTA service area encompasses approximately 2,202 square miles and includes the heavily populated southeastern Pennsylvania counties of Bucks, Chester,
Delaware, Montgomery, and Philadelphia. SEPTA's service also extends to Trenton and West Trenton, New Jersey and Newark, Delaware. The SEPTA system serves over one-half million customers daily and provides approximately 325 million passenger trips, annually. SEPTA operations include 8 Trolley (light rail) Lines, 2 Subway/Elevated (heavy rail) Lines, 1 Interurban High-Speed Line (heavy rail), and 13 Regional Railroad (commuter) Lines.

BACKGROUND (CSXT)
CSX Transportation, Inc. is the largest freight railroad in the eastern United States and is headquartered in Jacksonville, Florida. Overall, the CSX Transportation network encompasses about 21,000 route miles in 23 states, the District of Columbia, and the Canadian provinces of Ontario and Quebec. Our transportation network serves some of the largest population centers in the nation. CSX serves major markets in the eastern United States and has access to over 70 ocean, river and lake port terminals along the Atlantic and Gulf Coasts, the Mississippi River, the Great Lakes and the St. Lawrence Seaway. The company also has access to Pacific ports through alliances with western railroads. CSX moves a broad portfolio of products across the country in a way that minimizes the effect on the environment, takes traffic off an already congested highway system, and minimizes fuel consumption and transportation costs.

INTRODUCTION
This 6-mile section of railroad, between Woodbourne, PA and West Trenton, NJ was part of a larger route constructed in the 1870’s that became part of the Reading Railroad’s route between Philadelphia and the New York City area via North Jersey. With generally wide right-of-way, the Reading’s New York Line grew to a 4-track raceway for local and long-haul commuter and freight operations, with the exception of a few tight areas such as the Delaware River Bridge. The Reading Railroad electrified the majority of their Philadelphia area commuter lines in the early 1930’s, including the section between Philadelphia and West Trenton.

However, during a period of downsizing in the late 1950’s and early 1960’s, the segment between the Delaware River and Woodbourne (and further south) was reduced to two tracks and remained this way thru 2015. The Reading Railroad became part of Conrail in 1976, and in the Philadelphia area Conrail handled freight operations along with commuter operation on behalf of SEPTA until 1983. In 1983, SEPTA assumed responsibility for commuter operations, along with other responsibilities on shared lines where both SEPTA and Conrail operated.
The shared corridor between Woodbourne and West Trenton was operated as part of Conrail’s Trenton Line and SEPTA’s West Trenton Line. The maintenance agreement along this shared corridor was rather unique where Conrail maintained the track and signal system and SEPTA maintained the catenary (electric traction) system and was responsible for train dispatching. This arrangement continued when Conrail was divided between CSXT and Norfolk Southern in 1999, with this segment of railroad becoming part of CSXT’s Trenton Subdivision.

INCREASED CONGESTION LEADS TO COSTLY DELAYS

A busy corridor for Conrail became even busier for CSXT as freight traffic continued to grow. The Trenton Subdivision had become a key route for moving freight through the greater Philadelphia region and an important east-west corridor in the overall CSXT system. By 2014, on average over 30 trains per day were traveling over this section of railroad, and CSXT was ready to implement a clearance project that would facilitate double-stack container traffic on the Trenton Subdivision thru Philadelphia.

SEPTA’s commuter operation was also experiencing sustained growth, and the West Trenton Line in particular had seen a ridership increase of 60 percent between 2004 and 2014. Every weekday, 57 scheduled electric commuter trains operated over this section of railroad.
With both freight and commuter traffic increasing, the shared corridor was becoming a busy place, especially during morning and evening rush hours. Congestion was not only becoming a problem for thru-put and on-time performance for both SEPTA and CSXT, but finding windows for maintenance was becoming more and more difficult.

The drastic differences with train handling and performance characteristics between electric multiple-unit commuter trains (pictured above) and freight trains made train dispatching a challenge. Electric commuter trains can accelerate and reduce speed relatively quickly compared to freight trains. Travel time through the shared corridor for electric commuter trains was roughly 5-8 minutes, including station stops at Yardley and West Trenton, while freight moves were often 20-25 minutes especially when leaving or entering CSXT Woodbourne Yard located just to the west of Wood Interlocking. Train dispatchers tried to keep trains rolling, however rush hour train coordination was a challenge because of the increased quantity of trains and the travel time disparity, which meant sometimes either the commuter trains or the freight trains (sometimes both) experienced significant delays. Although communication was maintained between SEPTA’s Control Center in Philadelphia and CSXT’s NI Train Dispatcher in Albany, unavoidable travel delays at times caused tension between the two carriers.

PTC MANDATE IMPOSES CHALLENGES ON SHARED CORRIDOR

With the Federal Rail Safety Improvement Act of 2008, SEPTA and CSXT were required to make significant changes to their signal systems. The federal mandate posed another significant issue for SEPTA and CSXT on the shared corridor. Several of SEPTA’s commuter lines operate over AMTRAK-maintained territory via trackage rights, including sections of the Northeast Corridor. SEPTA’s PTC solution must be compatible with AMTRAK’s Advanced Civil Speed Enforcement System (ACSES). Also, when the federal PTC mandate was passed by Congress, SEPTA was already installing Automatic Train Control (ATC) on its commuter railroad. ATC would serve as an ideal base for an ACSES-type PTC system. CSXT’s PTC solution would need to meet the needs of its extensive operating territory and also be compatible with other Class I carriers. Freight carriers are generally implementing the Interoperable Electronic Train Management System (IETMS).
Trains passing at Yardley Station at the start of a weekday evening rush hour; CSX Train #Q417 is heading west on #1 Track and SEPTA Train #5368 heading east on #2 Track toward West Trenton.

Other obstacles surfaced when considering a combined PTC solution for the shared 6-mile corridor. The large IETMS display modules were a good fit for the generally wider cabs of freight locomotives. On the other hand, the much smaller ACSES display modules were a good fit for the much smaller operating compartments on SEPTA’s 396 electric MU cars. A solution to fit IETMS display modules on SEPTA cars was not possible. Installing on a smaller quantity of cars, meaning a captive fleet for the West Trenton Line, would not be practical. On a typical weekday, roughly 84 different MU cars travel on the West Trenton Line, which does not account for a spare ratio to accommodate such things as mechanical issues. Similarly, CSXT installing ACSES equipment on dedicated freight locomotives would mean a captive fleet to travel the 57-mile long Trenton Subdivision and at Woodbourne Yard to support local freight operations, which would not be practical either. However, CSX owned the shared corridor, which meant SEPTA was the tenant.

After evaluating the challenges for the owner (CSXT) and the tenant (SEPTA), it seemed much more logical for SEPTA and CSXT to install their own independent versions of PTC on their respective systems. Another solution was needed for the shared 6-mile corridor.

**SEPARATION PROVIDES AN OVERALL SOLUTION**

Separating freight and passenger operations on the shared corridor was not a new topic. In fact, the idea was discussed between Conrail and SEPTA in the late 1990s, and SEPTA and CSXT had successfully separated in 2004 on a smaller scale closer to Philadelphia where the Trenton Subdivision shared railroad with SEPTA’s Fox Chase Line. However, the time now seemed right in the Spring of 2014. Separating freight and passenger operations between Woodbourne and West Trenton would dramatically help the growing traffic coordination problem, and would alleviate most of the PTC-compatibility problems. CSXT could continue with plans for IETMS and SEPTA could continue implementing the ACSES system. An additional benefit would be that CSXT and SEPTA would dispatch their own trains with the exception of local freight operations on SEPTA-maintained territory, which SEPTA would continue to handle.

A conceptual plan was developed by SEPTA in early 2014, in close cooperation with CSXT, which would allow for the majority of construction to be done offline while both commuter and freight trains kept rolling. A series of short curfews (or outages) would be used for track alignment swings and cutovers. The conceptual plan shown below separates daily road freights and commuter trains, but maintains a connection at Wood Interlocking for local freight to serve customers on SEPTA-maintained territory, and also maintains the connection at Wood between CSX and Norfolk Southern’s Morrisville Line which is a Department of Defense clearance route. SEPTA’s new #1 and #2 Tracks between Iron and Wood Interlockings were also upgraded to 70 MPH track speed, to match the track conditions south of Wood.
West Trenton Yard also was a topic to address. The original location of the undersized yard placed it on what would have been the wrong side for SEPTA operation, and every commuter train coming in and out of the yard would need to cross the CSXT main. If true separation was to be achieved, a creative solution was needed. After brainstorming and forward-thinking track design, SEPTA and CSXT realized there was an opportunity to swing the freight main around the yard and convert the two original main tracks into SEPTA yard tracks. The plan was refined to provide a 50 mph run-around for CSXT at the new yard location. This idea not only enhanced the freight operations thru West Trenton, but also expanded the capacity for SEPTA trains.

The plan would not be easy. During the time when SEPTA and CSXT were discussing a potential separation plan, the PTC implementation deadline of December 31, 2015 was looming on the horizon. Remaining design, permitting, and construction would need to be completed on a very aggressive schedule. To be fully separated by the end of December 2015 meant the project would need to go from concept to completion in less than 19 months.

Another hurdle for construction would be funding. SEPTA’s design and construction initial estimate was $28.8M, and CSXT’s initial estimate was right around $10M, for a combined project total of roughly $38.8M. In the Fall of 2014, help for the project came in the form of a $10M TIGER (Transportation Investment Generating Economic Recovery) Grant. The separation project was the only TIGER V grant awarded in Pennsylvania.

Once an agreement was reached on the concept, work quickly began on finalizing the design and pursuing permits where needed. One key item that helped facilitate the accelerated schedule was that minimal real estate transactions would be required. With the exception of one very small piece of adjacent property, all new infrastructure could be constructed on the former Reading Railroad right-of-way. In fact, the new third track between Wood Interlocking and Yardley Station would be predominantly constructed on the roadbed and alignment of the former Reading Railroad #3 Track. Accelerated design was completed to a point where field work could begin in early 2015.
CONSTRUCTION

Construction started in January 2015 with in-house SEPTA Communications & Signal (C&S) forces, which were soon joined by their counterparts from CSXT. Initial tasks focused on locating all existing buried facilities, installation of new conduit and cable, and preparation to support track construction in the spring. Existing facilities in the way of construction would have to be either relocated or a solution developed to work around it, on a case-by-case basis, as most of the existing signal and power infrastructure had to be kept in service in order to keep trains safely operating.

The majority of new track would be built along the former Reading Railroad roadbed (photo on left), however some existing facilities in that roadbed would need to be maintained during construction, like the westbound home signal for Wood Interlocking (photo on right).

Once early Spring came in 2015, construction activity accelerated and continued on a feverish pace throughout the Summer. Working seven days a week, a combination of in-house construction and MoW personnel were utilized by CSXT and SEPTA, along with third-party contractors. Good communication and coordination was key to the success of the project and for safety during construction. With the majority of construction being conducted both on and adjacent to the active tracks, the daily Roadway Worker protection was a huge task. The growing rail traffic congestion meant there was a lot of train traffic next to multiple work groups, at times spread out over the entire 6-mile corridor.

The solution for keeping workers safe was having one common job briefing for everyone each morning, which meant some days there were 40-50 roadway workers gathered together representing several different disciplines for both CSXT and SEPTA, and multiple contractors and subcontractors. After the briefing, groups would go to the assigned work location and a lead person for each group would interface with the overall Roadway Worker Employee-in-Charge via radio. Additional briefings were held as conditions changed.

For the most part during Spring and early Summer of 2015, commuter trains and freight trains ran on a normal schedule with the exception of some off-peak single tracking on certain weekends. SEPTA utilized a contractor, RailWorks Inc., to construct a 3.75 mile concrete tie track offline between Wood and Yardley Station. The unavailability of wood ties during the tight schedule window for track construction led SEPTA’s decision to create the first section of concrete tie track on their railroad territory. CSXT also utilized a contractor, G.W.Peoples, to construct a 0.75 track around West Trenton Yard and a roughly 0.3 mile section of track near Wood in preparation for cutovers. Offline construction also included retiring the
private at-grade crossing for Dobry Road, construction of a 500-foot long post and plank retaining wall to stabilize a section of deteriorating slope near Edgewood Road, and construction of a property wall that doubles as a sound barrier at West Trenton Yard.

The majority of offline work was completed by mid-July, when more extensive single tracking would be needed. To support weekend single tracking in July and August, SEPTA went to bus substitution between Woodbourne and West Trenton Stations on Saturdays and Sundays. Weekends provided the opportunity to bus based on a combination of lighter ridership than weekends, and the availability of more buses and operators compared to weekdays.

Photos: As a multi-modal agency, SEPTA used in-house busing on weekends (photo on left) to replace trains between Woodbourne and West Trenton Stations. Temporary catenary sectionalization was installed to allow trains to run as far north as Woodbourne, reducing the travel length for busing (photo on right shows work groups relative to Woodbourne with a train in the station).

Construction culminated in late August 2015, in just 15 months after agreeing on conceptual design, with two major weekends to physically separate infrastructure, and thus railroad operations. The first weekend had an ambitious work scope with track cuts, throws and realignments at Wood and Trent Interlocking that created separate territories that were no longer connected. CSXT then cutover the new CP “TL” (Township Line) near Wood, and the new CP Summit near Trent, and connected the track segments that were built offline. SEPTA cutover a reconfigured Wood Interlocking and the new “Iron” Interlocking near Yardley Station, and connected their track segments built offline. On the separation weekend, SEPTA also cutover their new ATC signal system as a base for the upcoming PTC implementation.
One component for SEPTA that added to the complexity of building offline and culminating with a big track swing weekend was the overhead contact system (catenary). Whatever changes were made to the track alignment had to be replicated in the catenary in order to run electric trains again following the weekend cutover. On an electric railroad, track alignment changes essentially equate to double the work. SEPTA’s in-house Electric Traction (ET) forces followed behind the track construction and built the majority of the new catenary offline and out of riding, to minimize the amount time needed during the major track throw weekend. During the separation weekend, ET forces placed the new catenary in riding, raised and secured the old wire runs out of riding, and adjusted the remaining wire where needed. One of the post-separation tasks remaining is for the ET group to remove the old wire above the CSXT track (former #2 Track), remove the cross-track steady spans, and install independent registration. This follow up work is currently being coordinated with CSXT.

**SUMMARY**

Overall, SEPTA and CSXT completed a major separation project, on a very aggressive schedule, without incident and without any reported injuries. Several factors contributed to the project success. SEPTA and CSXT had developed a good working relationship in the years leading up to the operation separation. Second was developing a plan that was based on a good understanding of each other’s operational needs and respect for the other’s business needs. And third was almost constant meetings and talk, especially with the tight schedule, to keep everything advancing in the right direction.

The benefits of separation were almost immediately apparent, easing congestion and allowing for both railroads to now control their own operation, and progress their respective PTC systems. Also, SEPTA now has the ability to make both Yardley and West Trenton Stations fully ADA-accessible by constructing high-level platforms. No time was wasted as construction begins in May of this year for the new high-level station at Yardley, and conceptual design for West Trenton Station is in progress.
Further work and cooperation is needed moving forward to wrap up loose ends left by the initial separation work, but the project has left both railroads with ability to control their own destiny and better plan and execute maintenance and construction activities.
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AREMA 2016 Annual Conference & Exposition
System Maps

- CSXT
- SEPTA

History

- Conrail Territory from April 1976 through May 1999
- CSX Territory from May 1999 to present

Class I and Commuter Railroad Working Together

- Constructed by North Pennsylvania RR and Delaware & Boundbrook RR.
- Railroad Operations began May 1, 1876.
- Control by Philadelphia & Reading (later Reading Railroad) in May 1879.
- Part of Reading RR’s Philadelphia Route to New York (Via Hoboken).
- Electrified (catenary) by Reading RR in July 1931.

The Need to Separate Railroad Operations

- Increased Congestion Leads to Costly Delays
- PTC Mandate Imposes Challenges on Shared Corridor
- Control of Train Operations/Dispatching
- Need for High Level Platforms (ADA) and Higher Passenger Train Speeds

Previous Experience

Successful Separation on 3.5 Mile Shared Corridor in Philadelphia, PA
Completed in 2004
SEPTA’s Fox Chase Line and CSXT’s Trenton Subdivision
**What Was Needed**

- Cooperation, Communication and Trust
- Good Understanding of Each Other’s Operational Needs
- Respect for the Other’s Business Needs
- Focus on Safety
- Funding (SEPTA at a Historic Capital Low)

**Time Frame**

- MOU Signed: April, 2013
- TIGER Grant Application Filed: June 2013
- TIGER Grant Approval Received: September 2013
- Concept, Design and Permitting: 2014
- Construction: 2015
- Separation Achieved: August 2015
- SEPTA PTC Implementation: 2016

**SEPTA-CSX Separation**

**Woodbourne to West Trenton**

**Design Challenges**

**Permitting and Accelerated Time Frame**

- Minimal Property/Real Estate Required
- Majority of New Infrastructure on Existing Railroad Right-of-Way
- New Third Track Built on Roadbed of Former Track
- Limiting the Amount of Disturbed Area for Construction

**Design Challenges**

**Wood Interlocking/CP Township Line**

- Maintain Department of Defense (STRACNET) + Norfolk Southern Connection
- Maintain 50 MPH on Reverse Curves for all Through-Moves
- Pre-build as Much Track and Catenary as Possible Before Cutover
- Separate CP Wood into Two (2) Interlockings: Wood (SEPTA) and CP TL (CSX)

**Design Challenges**

**New Third Track**

- Upgrade to 70 MPH for Passenger Operations
- Availability of Wood Ties at Start of Construction
- Construct Track and Catenary for 3.75 Miles of New Main Line Track
- Drainage and Slope Improvements, including a 550 Foot Retaining Wall
- Relocate Wayside Signals + Grade Crossing Warning Devices, and Keep in Service During Construction
**Design Challenges**

**Trent Interlocking and West Trenton Station**
- Maintain Full Yard Operations During Construction
- For True Separation, Need Quick Solution for Yard Access
- Original Concept was a Relocated Yard to be Constructed by SEPTA at a Later Date
- Maintain Access for Trenton Industrial Track and Restore Wye

**West Trenton Run-Around Track**
- 50 MPH Run-Around Track Built Offline
- Minor Property Purchase Without Impact on West Trenton Station
- Fully Separates Freight and Passenger Operations
- Maintains Connection for Trenton Industrial Park

**Finished Product**

**Roadway Worker Safety**
- Good Communication and Coordination Key to Success
- Majority of Construction Both on and Adjacent to Live Tracks
- Growing Rail Traffic Meant More Trains and Multiple Work Groups
- Common Job Briefings (30-50 Roadway Workers)
- Start of Day and as Conditions Changed
- No Reported Injuries

**Construction Ramps Up In Spring**
- Construction Activity Accelerated In Early Spring 2015
- Start Construction of New Third Track
  - Wood Ties vs. Concrete Ties
  - Rail Train with Welded Rail Strings
- 500’ Long Post/Plank Retaining Wall
- Working Offline While Maintaining Normal Train Operations
**Major Construction Tasks**

- Rehab Bridge Superstructure at Reading Avenue for New Third Track
- Build Three New Interlockings Offline: 
  - CSXT (CP “TL” and CP “Summit”) 
  - SEPTA (“Iron”) 
- New 3.75 Mile Electrified (Catenary) 3rd Track + Four Road Crossings
- Retire One Private Road Crossing
- Wrap Around Track at West Trenton
- ATC (SEPTA) + PTC-prep (SEPTA and CSXT)

**Cutover Weekends**

- Two Major Weekends (August 2015)
- Weekend Busing (SEPTA) and Multiple 12-hour Curfews (CSXT)
- Temp Infrastructure Changes to Minimize Busing Length
- CSXT Track Cut/Swings at CP “TL” and CP “Summit”
- SEPTA Track Cut/Swings at “Wood” and “Trent”

**Cost**

Overall Project Cost $38.8 Million (Tiger Award at $10 Million)

- CSX Scope of Work $10 Million
- SEPTA Scope of Work $28.8 Million

**Benefits**

- Benefits Immediately Apparent
- Easing of Traffic Congestion
- Both Railroads Can Control Their Own Operation
- Both Railroads Can Progress Their Own Respective PTC Systems
- SEPTA Can Now Make Yardley and West Trenton Stations ADA Accessible (Yardley In Progress)
- Passenger Maximum Authorized Speed Raised to 70 MPH
- Allow For Better Planning and Execution of Maintenance and Construction Activities

**HIGH POINTS**

- Fast Tracked Completion
  - TIGER Grant Announced September 2013
  - Separation Completed August 2015
- No Reported Injuries!
## Project Teams

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