AMERICAN
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Positive Train Control:
An Assessment of PTC Implementation by Commuter Railroads

April 2015

Abstract

Despite significant efforts and expenditures close to $1 billion, most commuter railroads will be unable to meet the December 31, 2015 deadline to implement Positive Train Control (PTC)

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About APTA

APTA is a nonprofit international association of 1,500 public and private sector organizations, engaged in the areas of bus, paratransit, light rail, commuter rail, subways, waterborne services, and intercity and high-speed passenger rail. This includes: transit systems; planning, design, construction, and finance firms; product and service providers; academic institutions; transit associations and state departments of transportation. APTA is the only association in North America that represents all modes of public transportation. APTA members serve the public interest by providing safe, efficient and economical transit services and products. More than 90 percent of the people using public transportation in the United States and Canada ride APTA member systems.

Introduction and Executive Summary

The Rail Safety Improvement Act of 2008 (RSIA, P.L. 110-432), mandates that all passenger railroads and certain freight railroads install Positive Train Control (PTC) technology by December 31, 2015. Freight and commuter railroads have spent billions of dollars, to date, working towards implementation of the PTC requirement as the statutory deadline nears. However, even as railroads have devoted tremendous resources to PTC installation, APTA on behalf of the commuter industry and working in conjunction with other railroad industry partners, including AAR and ASLRRA, continues to assert that the complete deployment of a nationwide interoperable PTC network is not achievable by the statutory December 31, 2015 deadline. The Administration also testified before Congress that nationwide implementation of PTC is highly unlikely by the end of 2015.

We support the contentions of the AAR in the April 2015 update that key components of the so called I-ETMS system remain under development and understand that the supply community is unable to produce systems and subsystems at a rate commensurate with a 2015 deadline.

Complicating the issue for commuter railroads is the fact that the operators in the Northeast must contend with a non-interoperable yet FRA approved system, ACSES, in addition to I-ETMS, which is being deployed where required on the general railway network. Some operators are likely being required to "dual equip" their prime movers, so as to operate in territory covered by either ACSES or I-ETMS. An additional complication for commuter railroads is the use of a variety of prime movers (locomotives, cab cars, and self-propelled cars) which are not typical in the general railway network. The differences between the prime movers and control vehicles add to the engineering complexity, and make the situation for commuter railroads more complicated than that presented to the freight railroads.

As details of the hardware and software requirements for I-ETMS deployment become more clear, the ongoing "back office " requirements for even the most simple tenant commuter operations are presenting major issues in terms of initial cost, long term license fees and full time qualified personnel to make the system work.

APTA's commuter railroads are unequivocally committed to implementing PTC on their systems as a national safety priority. However, meeting the PTC deadline remains a significant challenge for publicly-funded commuter railroads due to funding constraints, access to communication spectrum, and the state of the technology under development. In addition to the technical and logistical challenges faced by the freight railroads, the commuter situation is further complicated by the fact that commuter railroads are publicly funded and there are significant limitations in what they can do to free up resources. This remains especially true given the substantial and continuing backlog of state of good repair projects facing many agencies. Critical state of good repair projects, which also have significant safety implications, have been deferred in order to fund PTC at some railroads.

Additionally, key parts of the technology required for PTC are still under development, and tens of thousands of radios remain to be manufactured. Lastly, the availability and acquisition of radio spectrum for PTC interoperability is a continuing challenge, along with the timely approval of required radio towers and antennas under the Federal Communications Commission (FCC) review process.

Even for smaller systems, the complexity of the undertaking presents numerous challenges. Those commuter railroads who are right of way owners share the issues associated with track and wayside equipment database validation with the larger railroads. Those who operate on right of way owned by others must be conversant with revised and updated data bases on which they will operate. All operators dependent on I-ETMS software are constrained by the progress of "final releases" of the software. The instability of the I-ETMS system and its software represents a major challenge for commuter railroads with limited resources and no tolerance for incomplete or noncompliant systems.

Moreover, commuter railroads will be required to train and, in most cases, hire employees to implement PTC. Freights are expressing willingness to share training programs but commuter railroads must adapt them to their specific circumstances adding a further burden to already minimal staff. Hopefully the concept of the shared back office will alleviate this situation to some extent.

And there are issues that are certainly somewhat unique to commuter railroads and the environment in which they operate. Commuter operations present challenges not faced by the

freight railroads including numerous turn-backs which may require re-initialization of onboard PTC equipment, station stops requiring precise alignment, and in-service consist changes.

While commuter railroads share the concerns of the freight operators regarding wayside implementation, resource constraints often place commuter railroads in a poor position to compete with larger railroads for procurement priority.

Furthermore, the paperwork requirements for the planning and implementation of this one technology has raised concerns. Those who must submit PTC Safety Plans (which can reach 3000 pages) are faced with a daunting task, and some have expressed concerns that the scale of effort is not proportional to the size of the submitting agency.

PTC Costs, Expenditures and Available Resources

Based on the most recent data provided by commuter railroads, **APTA estimates that it will cost more than $3.48 billion to fully implement PTC on all commuter railroads nationwide**, an increase from the previous estimate of $2.75 billion. This remains a conservative estimate that excludes the remaining costs associated with spectrum acquisition or ongoing operational costs expected once these systems are fully implemented. Constrained budgets are a reality for publicly-funded commuter systems and substantial federal support is critical for these railroads to address PTC. These estimates do not take into consideration the costs of license fees for proprietary, yet required hardware and software and the ongoing fees for operations beyond the in-house costs for personnel not currently required for operations. The constraints that face public agencies such as commuter railroads cannot be overstated, as publicly funded operations are severely limited, with existing resources already committed, and shifts in resources highly difficult.

Over two years ago the initial conservative estimate for PTC implementation on commuter railroads was over $2 billion, with more than 4,700 locomotives and passenger cars with control cabs and nearly 8,300 track miles to be equipped. Since this initial estimate, as commuter railroads progress with installation of PTC, the total costs of implementation have exceeded that previous estimate, and the estimates do not include costs related to the acquisition of the necessary 220 MHz radio spectrum. Further, the commuter sector represents a small percentage of the total rail industry's needs for PTC hardware and related vendor services, placing it at a disadvantage in a market where qualified vendors and equipment are limited.

Taking the commuter industry as a whole, it is evident that considerable resources have been and must continue to be applied in order to achieve compliance. Taken individually, resource availability is not uniform. Since the industry is in the end widely distributed, commuter railroads

are in a poor position to compete for priority in the supply sector. All operators are in the end public, not for profit enterprises, supported by public funds, which are in short supply.

Progress is being made in compliance with the PTC mandate. However, progress is not uniform throughout the industry given the differences in funding resources, the complexity of systems, interrelationship with other railroads, and even geographic distribution of operations. Some operators will be prepared within their own operations to begin serious deployment. Others while less developed are working seriously to be in compliance.

To date, drawing from scarce public funds, **commuter railroads have spent nearly $950 million**, toward the estimated $3.48 billion cost to complete deployment. In the absence of Federal funding to support efforts to comply with the Federal mandate, commuter railroads have faced significant challenges to identify capital resources for implementation, as well as resources for the long-term operational costs of PTC. Yet, despite these challenges, nearly 71 percent of commuter railroads say they have identified a potential funding source for full implementation costs. However, even among those agencies, funding continues to be cited as a significant challenge (see page 11). Further, 50 percent of commuter railroads are deferring other capital improvements in order to implement PTC.

Sources identified for full implementation costs
Capital Fund
Full Funding Grant Agreement (FFGA)
FRA, FHWA, state, Local
FTA (primary) and State (secondary)
FTA, Regional, state and agency funds
Federal and state funds
Federal, Local, potential RRIF
Federal, State and Local sources
Federal, State, Local and private sources
Internal, Federal and State sources
Local Funds
Local funds, capital budget
Local, State & Federal Grants
State funds and Federal grants
State Funds
State safety and security funding
Sales tax

However, despite progress in identification of resources needed to implement the technology, questions remain when considering long-term operational costs. Total national annual operating costs are estimated to be more than $83 million, with individual agency estimates ranging from a high estimate of $40 million down to several agencies reporting less than

$1 million per year to operate their PTC system. Most of those reporting operating costs below $1 million are attributable to limited estimates and insufficient data.

However, only 50 percent of agencies report having identified a source of funds to support PTC operational costs for the long-term. Some uncertainty remains for agencies however, regarding what the full costs will be for operations, not the least of which involves back office server (BOS) considerations.

And again, when asked whether agencies were deferring other aspects of their capital program to fulfill the PTC mandate, 50 percent of commuter railroads state that they are deferring other capital investments to implement PTC.

What projects are you deferring or have you deferred to pay for PTC?

- Bridge rehabilitation and tie replacements
- Several rail, highway and bridge projects
- Signal upgrades, yard improvements, rolling stock, track and bridge improvements
- State of good repair projects
- Track improvements, speed enhancements, safety projects at crossings.
- Bridge, station, substation and numerous other projects.
- Deferred fleet & route expansions that can possibly double the agency's annual ridership. Deferred investments in transit oriented development.
- Design/Construction of redundant dispatch control center, highway grade crossing safety improvements, double-tracking and capacity improvements, traction power rehabilitation, radio communication improvements
- Master finance plan is complex with many projects and it would be difficult to state exactly which projects have been deferred.

PTC Components

Locomotives and control cars

Issues faced by the freight railroads are replicated in the commuter environment magnified by the added complexity of the nearly 4900 prime movers in commuter service. There are cab cars, double ended units, and a variety of electric and diesel units presenting numerous additional challenges for equipment installers.

The Commuter Industry

Component	Industry Total (estimated)
Revenue vehicles operated in maximum service	6,184
Revenue vehicles available for maximum service	7,304
Number of cab units*	4,744
Track Mileage	8,265
Total Rail-Grade Crossings	3,668
Annual Total Vehicle Miles (millions)	359
Unlinked passenger trips (millions)	488
Annual Total Train miles (millions)	59

*Cab units include locomotives, self-propelled cars and locomotive hauled cars with control cab units. Vehicles in "Industry Total" reflect those requiring PTC equipment. Numbers drawn from Appendix B include Loco-motives, Self-Propelled Passenger Cars (one Cab), Self-Propelled Passenger Cars (Two Cabs – counted twice), and Loco-motive Hauled Passenger Cars (One Cab). Not included in count are Loco-motive Hauled Passenger Cars (No Cab), Self-Propelled Passenger Cars (No Cab).

Technology

Fifty percent of commuter railroads will be utilizing I-ETMS as their technology, however, some may have to utilize more than one technology due to track and ROW shared with other railroads. This is a major issue facing commuter railroads which differs from the freight situation -- the prospect that some commuter railroads in the Northeast may be required to "dual equip" in order to accommodate I-ETMS and ACSES.

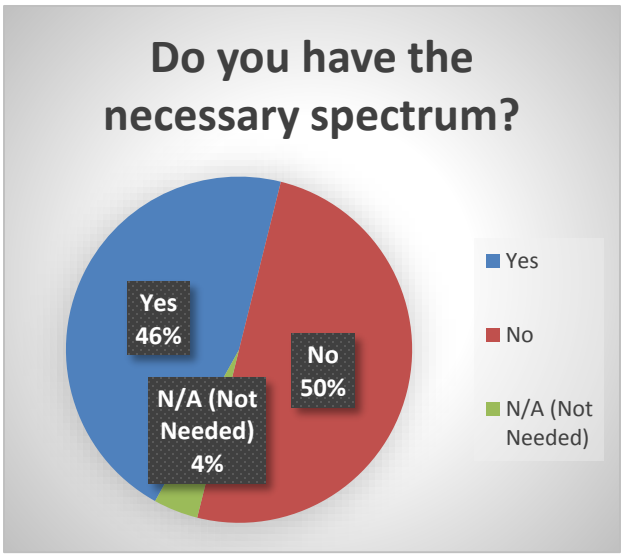
Which technology are you planning to use?

Value	Count	Percent
ACSES	5	20.8%
I-ETMS	12	50.0%
Enhanced Automatic Train Control	3	12.5%
Communications-Based Train Management (CBTM)	1	4.2%
Other (required)	3	12.5%

Communications

Spectrum remains an issue for commuter railroads. Lack of availability and the initial cost of leasing spectrum from "220 LLC" and yet undefined ongoing costs are major challenges. Smaller commuter railroads at least are not in a position to compete in the market for priority.

More than 54 percent of commuter railroads report that they do not yet have access to the spectrum necessary for their PTC system to function (including one reporting that it is utilizing a PTC technology that will not require spectrum). Of those reporting that they have not acquired adequate spectrum, eleven agencies have not acquired any spectrum, one agency has acquired 10 percent, and 1 agency has acquired 75 percent.



When asked what steps they were taking to obtain the needed spectrum, agencies provided a variety of responses.

What are you doing to acquire the necessary spectrum?

- Pursuing purchase of spectrum on secondary market
- Type approval does not rely on an I-ETMS solution.
- Waiting on TYPE approval from the FRA before pursuit of spectrum.
- Leasing spectrum from PTC 220 LLC
- In negotiations with PTC-220 LLC to acquire spectrum.
- Pursuing multiple commercial providers for access via lease or purchase
- Working with regional partners to acquire or lease but we have been in the process for several years now. It is not clear if there is a reasonable path forward at this time.
- 5-year lease with PTC 220 LLC is in place to support near-term needs while we continue to seek FCC approval of spectrum acquisition that has been in escrow for many years.
- Will be compelled by circumstance to utilize WSRS and fiber optic backbone. Wayside to train communication via Federated network and PTC 220 LLC facilities.
- Multiple approaches, negotiating with sister agencies to sub-lease RF Spectrum from them; contact with PTC-220 LLC; issue a second RFP on the commercial market for source and identify any other license holders of the 220 MHz Spectrum.
- Work with the partners to complete the regional slot plan. PTC-220 got their waivers approved by FCC almost doubling the available 220 MHz channels in our area.
- In the process of negotiating with two spectrum holders at this time. One request is currently with the FCC - the second is being sought in the event the first request is denied by the FCC.

Back Office

As mentioned elsewhere in this report, mechanizing back office operations is a major challenge for commuter railroads. The purpose of the PTC back office (or control center) is to provide a central location for communication and coordination of Crew Sign-in/off, Bulletins, Train orders, Track Authorities, Speed Restrictions, and Train Information, as well as specialized data to and from the wayside, and train operational and safety data. Especially for smaller commuter rail operations, the "back office" requirements add a unique level of complexity never before included in their operations. Safely guaranteeing the flow of critical information between the sub-systems and maintaining the functionality of the back office server (BOS) is an essential part of the operation of the system. There remain some issues concerning to what degree commuter railroads must install and operate "back offices". With FRA concurrence, shared back office solutions are being investigated however there continue to be obstacles contributing to delays in developments in this area. Back office issues are also relevant for commuter railroads required to "dual equip". The freight industry and AMTRAK have been most helpful in defining requirements as the details of the various system requirements emerge.

Workers with the skills required are generally not currently available at most commuter railroads and certainly not in quantities necessary to support sustained back office operations. APTA and FRA have been advocating the availability of a "Shared Back Office". Nearly 71 percent of commuter railroads state that they will either host or work with Class I railroad who will serve as host to back office server operations, while 29 percent indicate they would use "shared services".

Integration and Testing

Where commuter railroads are hosted by others, integration and testing can be complicated by tenant relationships, adding yet another step in the deployment process. Commuter railroads will be asked to execute agreements defining the relative roles of the parties involved also leading to the workload of the host railroad. Internally, commuter railroads must accommodate the requirements of host dispatchers and system initialization practices which are likely to change under PTC.

Most commuter railroads do not have separate test facilities and are therefore dependent on hosts or contractors to facilitate testing. Test plans must be coordinated with host systems to insure acceptance and authorization to proceed into PTC territory.

Certification Process

Where required by the nature of operations commuter railroads will submit Safety Plans for consideration by FRA. In most cases reliance will be placed on contract resources due to the lack of internal manpower or expertise. Issues related to coordination with the FRA and the pace of approval will in some cases need to be coordinated with host railroads. FRA reported to Congress

in August 2012, that it will need "at least 6 to 9 months to review PTC Safety Plans, and approximately 38 railroads will need certification."

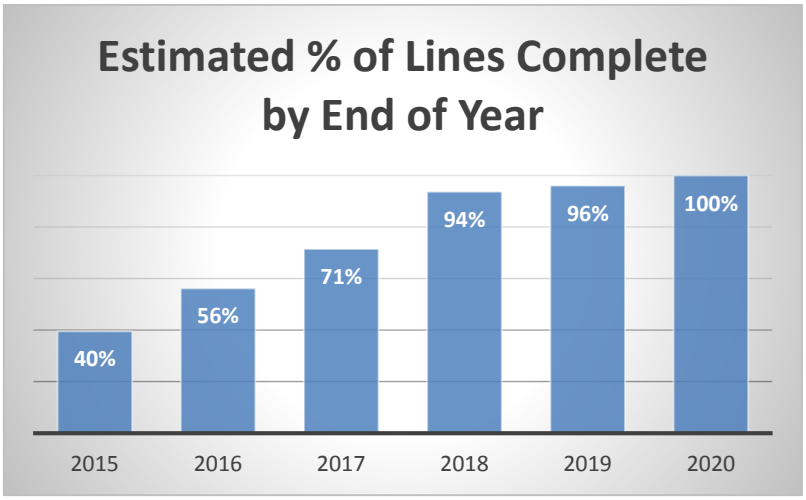
And FRA has also indicated its own concerns over a shortage of qualified FRA staff, noting that its PTC staff consisted of 10 PTC specialists and one supervisor. There has also been some suggestion that certification responsibilities may fall to the railroads themselves, in order to expedite certifications within the current 2015 deadline, due to this FRA staffing shortage. For smaller commuter railroads, staff capacity is even more limited, and commuter railroads will not have the capacity to fulfill the Federal government's responsibilities for certification. If the expectation is that commuter railroads hire independent, third-party consultants to certify the systems, then that will add to additional unexpected and unfunded costs facing these agencies, in addition to raising liability questions and adding further delay.

Conclusion

The commuter industry has made great strides in responding to the PTC deployment mandate, and all commuter railroads remain committed to implementing this important safety technology. However, while **29 percent of agencies continue to openly target dates within 2015** for full implementation of their PTC systems, significant questions remain around whether those target dates are achievable, given the testing and certification steps that must occur. Systems which may be prepared to deploy by the end of 2015, may also find themselves delayed by forces beyond their control such as plan approval. **More than 57 percent of those agencies do not include FRA certification within the time estimated**.

Agencies indicating that they will not be able to fully implement by the deadline were asked by APTA to estimate their target date for implementation. Most agencies indicated a completion date prior to the end of 2018, although two indicated needing until 2019 and one indicated the timeline was dependent upon the host railroad.

It is worth noting again, that even among the 71 percent of agencies which do not claim to be on target to achieve full implementation before the statutory deadline of December 2015, considerable resources have already been expended or committed to the process drawn from extremely limited funds.



Continuing challenges facing agencies include:

- Incomplete identification of funding sources, including ongoing funding stream for operational costs;
- Concerns over other important projects have had to be deferred to pay for PTC, including rail and bridge rehabilitation, and restoration or replacement of rail cars and locomotives currently exceeding their useful life;
- Insufficient internal capital being generated to fund PTC while taking care of capital maintenance;
- Concerns over unknown costs, especially for tenant railroads who have not yet received all operational cost information from host railroads;
- Concerns over debt to be issued and possibility that costs will exceed bonding capacity;
- One agency responded that a recent proposal was eight times their annual capital budget. Insurance and licensing requirements to utilize 3rd party spectrum and software may consume 25% or more of operating budget;
- Lack of dedicated funding at state level, with existing funding available subject to annual appropriation by the state legislature;
- Competition for funding with existing capital expansion programs and other projects aimed at meeting increased service demands;
- Unknown issues related to on-going software updates or other challenges that may delay implementation further.

All commuter railroads are committed to compliance with the mandate which is seen as improving safety on the commuter network. Progress is inhibited by lack of funding, the more limited "purchasing power" of commuter railroads when procuring critical equipment, and the uncertainty of all required components of the I-ETMS system. Spectrum availability also continues to be elusive along with the yet to be finalized costs of licensing proprietary software and systems. Further, commuter railroads face challenges in finding employees and consultants who are trained and knowledgeable in PTC technology.

APTA policy supports providing the Department of Transportation with the authority to provide extensions on a case by case basis, in order to accommodate individual railroad needs and circumstances. Each incremental improvement is a safety enhancement. However, achievement of nationwide interoperability will remain dependent on a number of variables over which commuter railroad agencies have limited control.

Appendix A - Commuter Railroad Statistics from the 2013 Federal Transit Administration National Transit Database					
State	Agency Name	Primary Urbanized Area	Annual Vehicle (Passenger Vehicles Only) Revenue Miles	Passenger Miles	Total Track Miles
AK	Alaska Railroad Corporation	Anchorage, AK	1,014,646	20,181,054	682.8
CA	Altamont Corridor Express	Stockton, CA	914,658	42,140,286	90.0
CA	North County Transit District	San Diego, CA	1,392,446	44,875,290	101.0
CA	Peninsula Corridor Joint Powers Board, Caltrain	San Francisco-Oakland, CA	6,590,727	357,919,061	136.7
CA	Southern California Regional Rail Authority, Metrolink	Los Angeles-Long Beach-Anaheim, CA	13,162,863	464,643,102	655.8
CT	Connecticut Department of Transportation	Hartford, CT	1,467,607	20,872,242	106.0
FL	South Florida Regional Transportation Authority,TrI-Rail	Miami, FL	3,164,457	116,122,404	152.2
IL	Northeast Illinois Regional Commuter Railroad Corp., Metra	Chicago, IL-IN	43,197,735	1,665,749,719	1,206.1
IN	Northern Indiana Commuter Transportation District	Chicago, IL-IN	3,736,383	104,240,161	130.4
MA	Massachusetts Bay Transportation Authority	Boston, MA-NH-RI	22,072,553	729,585,705	711.5
MD	Maryland Transit Administration	Baltimore, MD	5,687,358	274,230,952	471.0
MN	Metro Transit	Minneapolis-St. Paul, MN-WI	536,880	19,877,441	69.1
NJ	New Jersey Transit Corporation, NJ TRANSIT	New York-Newark, NY-NJ-CT	60,753,208	2,224,999,169	868.0
NM	Rio Metro Regional Transit District	Albuquerque, NM	1,398,319	48,413,122	111.1
NY	MTA Metro-North Commuter Railroad Company	New York-Newark, NY-NJ-CT	65,213,150	2,501,154,174	808.0
NY	MTA Long Island Rail Road	New York-Newark, NY-NJ-CT	64,819,926	2,161,002,940	701.1
OR	Tri-County Metropolitan Transp. District of Oregon, TriMet	Portland, OR-WA	162,097	3,552,562	19.2
PA	Southeastern Pennsylvania Transportation Authority	Philadelphia, PA-NJ-DE-MD	18,678,960	502,346,133	610.0
TN	Regional Transportation Authority	Nashville-Davidson, TN	199,994	3,917,486	33.0
TX	Capital Metropolitan Transportation Authority	Austin, TX	279,358	13,281,938	64.6
TX	Dallas Area Rapid Transit - Trinity Railway Express	Dallas-Fort Worth-Arlington, TX	1,144,466	40,170,296	55.3
TX	Denton County Transportation Authority	Denton-Lewisville, TX	598,073	7,637,399	28.7
UT	Utah Transit Authority	Salt Lake City-West Valley City, UT	5,068,068	108,921,186	119.8
VA	Virginia Railway Express	Washington, DC-VA-MD	2,081,168	149,745,124	174.5
WA	Central Puget Sound Regional Transit Authority	Seattle, WA	1,636,847	64,702,017	158.9
Total			324,971,947	11,690,280,963	8,264.80

The Sunrail system, operating out of Orlando, FL began service in May 2014, and has not yet reported statistics to the National Transit Database (NTD).

Appendix B - APTA 2014 Public Transportation Vehicle Database and Other Sources								
State	Agency Name	Primary Urbanized Area	Loco-motives	Self-Propelled Passenger Cars, No Cab (Active Vehicles Only)	Self-Propelled Passenger Cars one Cab (Active Vehicles Only)	Self-Propelled Passenger Cars Two Cabs (Active Vehicles Only)	Loco-motive Hauled Passenger Cars No Cab (Active Vehicles Only)	Loco-motive Hauled Passenger Cars One Cab (Active Vehicles Only)
AK	Alaska Railroad Corporation	Anchorage, AK	54	---	---	---	42	---
CA	Altamont Corridor Express	Stockton, CA	6	---	---	---	20	8
CA	North County Transit District	San Diego, CA	7	---	---	---	18	10
CA	Peninsula Corridor Joint Powers Board, Caltrain	San Francisco-Oakland, CA	29	---	---	---	87	31
CA	Southern California Regional Rail Authority, Metrolink	Los Angeles-Long Beach-Anaheim, CA	53	---	---	---	129	60
CT	Connecticut Department of Transportation	Hartford, CT	14	---	---	---	23	10
FL	South Florida Regional Transportation Authority,TrI-Rail	Miami, FL	26	---	4	---	31	21
IL	Northeast Illinois Reg. Commuter Railroad Corp., Metra	Chicago, IL-IN	146	---	180	---	526	286
IN	Northern Indiana Commuter Transportation District	Chicago, IL-IN	---	---	24	48	10	---
MA	Massachusetts Bay Transportation Authority	Boston, MA-NH-RI	82	---	---	---	299	110
MD	Maryland Transit Administration	Baltimore, MD	42	---	---	---	98	32
MN	Metro Transit	Minneapolis-St. Paul, MN-WI	6	---	---	---	12	6
NJ	New Jersey Transit Corporation, NJ TRANSIT	New York-Newark, NY-NJ-CT	203	---	230	---	648	171
NM	Rio Metro Regional Transit District	Albuquerque, NM	9	---	---	---	13	9
NY	MTA Metro-North Commuter Railroad Company	New York-Newark, NY-NJ-CT	43	---	929	---	161	52
NY	MTA Long Island Rail Road	New York-Newark, NY-NJ-CT	69	---	1,006	---	111	23
OR	Tri-County Metropolitan Transp. Dist. of Oregon, TriMet	Portland, OR-WA	---	1	---	5	---	---
PA	Southeastern Pennsylvania Transportation Authority	Philadelphia, PA-NJ-DE-MD	8	8	266	85	35	10
TN	Regional Transportation Authority	Nashville-Davidson, TN	3	---	---	---	7	4
TX	Capital Metropolitan Transportation Authority	Austin, TX	---	---	---	6	---	---
TX	Dallas Area Rapid Transit - Trinity Railway Express	Dallas-Fort Worth-Arlington, TX	6	---	---	13	10	7
TX	Denton County Transportation Authority	Denton-Lewisville, TX	---	---	---	11	---	---
UT	Utah Transit Authority	Salt Lake City-West Valley City, UT	18	---	---	---	31	22
VA	Virginia Railway Express	Washington, DC-VA-MD	20	---	---	---	70	21
WA	Central Puget Sound Regional Transit Authority	Seattle, WA	14	---	---	---	40	18
Total			858	9	2,639	168	2,421	911