
Office of Inspector General

Audit Report

*Amtrak's High-Speed Rail
Electrification Project*

Federal Railroad Administration

Report Number: RT-2000-020
Date Issued: December 14, 1999





Memorandum

**U.S. Department of
Transportation**

Office of the Secretary
of Transportation

Office of Inspector General

Subject: INFORMATION: Report on Amtrak's
High-Speed Rail Electrification Project
Federal Railroad Administration
Report No: RT-2000-020

Date: December 14, 1999

From: Alexis M. Stefani 
Assistant Inspector General for Auditing

Reply to JA-1
Attn. of:

To: Federal Railroad Administrator

We are providing this report for your information and use. The report was shared with Amtrak officials responsible for overseeing the electrification project at a meeting on December 2, 1999. We also shared the report with Amtrak's President, George Warrington. Mr. Warrington and the Amtrak officials overseeing the project agreed with the report's finding and recommendations. We considered their comments in preparing this report.

We appreciate the cooperation and assistance provided by FRA and Amtrak staff during the review. If I can answer any questions or be of further assistance, please contact me at 366-1992 or Francis P. Mulvey, Deputy Assistant Inspector General for Rail, Transit, and Special Programs, at 366-0477.

#

AMTRAK'S HIGH-SPEED RAIL ELECTRIFICATION PROJECT

Report No: RT-2000-020

December 14, 1999

Objectives

The objectives of our review were to assess Amtrak's progress in meeting its milestones for the electrification of the Northeast Corridor between New Haven and Boston and identify critical issues that may pose risks to Amtrak meeting its interim goal of initiating limited electrified service between New York City and Boston in January 2000. See Exhibit 1 for a discussion of the scope of work and the methodology used.

Background

In 1992, Congress passed the Amtrak Authorization and Development Act requiring Amtrak to establish high-speed rail passenger service between New York City and Boston. The goal was to reduce travel time in this corridor from 4.5 hours to less than 3 hours. Revenue from this service is expected to play a critical role in helping Amtrak achieve operating self-sufficiency by 2003. Before Amtrak can begin high-speed rail service, 155 miles of rail line between New Haven and Boston must be electrified.¹ Currently, electrified Metroliner service is available between Washington, D.C. and New Haven, Connecticut. At New Haven, Amtrak must switch to a diesel locomotive to complete the trip to Boston. Once electrification is complete, in addition to the higher operating speeds possible with electrified service, Amtrak will also save the time it now spends on switching locomotives. By the time the project is complete, Amtrak will have spent over \$600 million to electrify the line between New Haven and Boston.

Results in Brief

Amtrak originally planned to begin high-speed rail service before the end of 1999. On September 1, 1999, Amtrak announced its high-speed trainsets would not be ready for service before the Spring of 2000 due to the need for additional design modifications. Building and testing the electrified line between New Haven and Boston also has been delayed and the full line with a separate electrified east and westbound track will not be completed until June 2000. (Exhibit 2 provides a chronology of the electrification project delays.)

Until both tracks are fully electrified, Amtrak plans to introduce limited high-speed service between Boston and New York in January 2000. This service will

¹ The section of track between New York City and New Haven has been electrified since the early 1900's.

consist of two daily round-trips using refurbished Metroliner equipment. The limited high-speed service will not be as fast as the Acela Express² service that will be available in June 2000 with the new trainsets, but at just under 4 hours, the January service will be a noticeable improvement over current trip times, which range from 4.5 hours to just over 6 hours.

To operate the limited service, Amtrak must complete enough of the work so that electrified track alternating between east and westbound is available for the entire corridor. This electrified route will require trains to switch tracks three times between New Haven and Boston. The schematic map on page 3 shows the track that will be available for the January 2000 service. The contractor plans to complete this task, including the requisite testing, in time to permit the limited high-speed service in January 2000. Amtrak and the contractor have agreed to defer electrification work not necessary for establishing the limited service until after the start of the new service in January 2000.

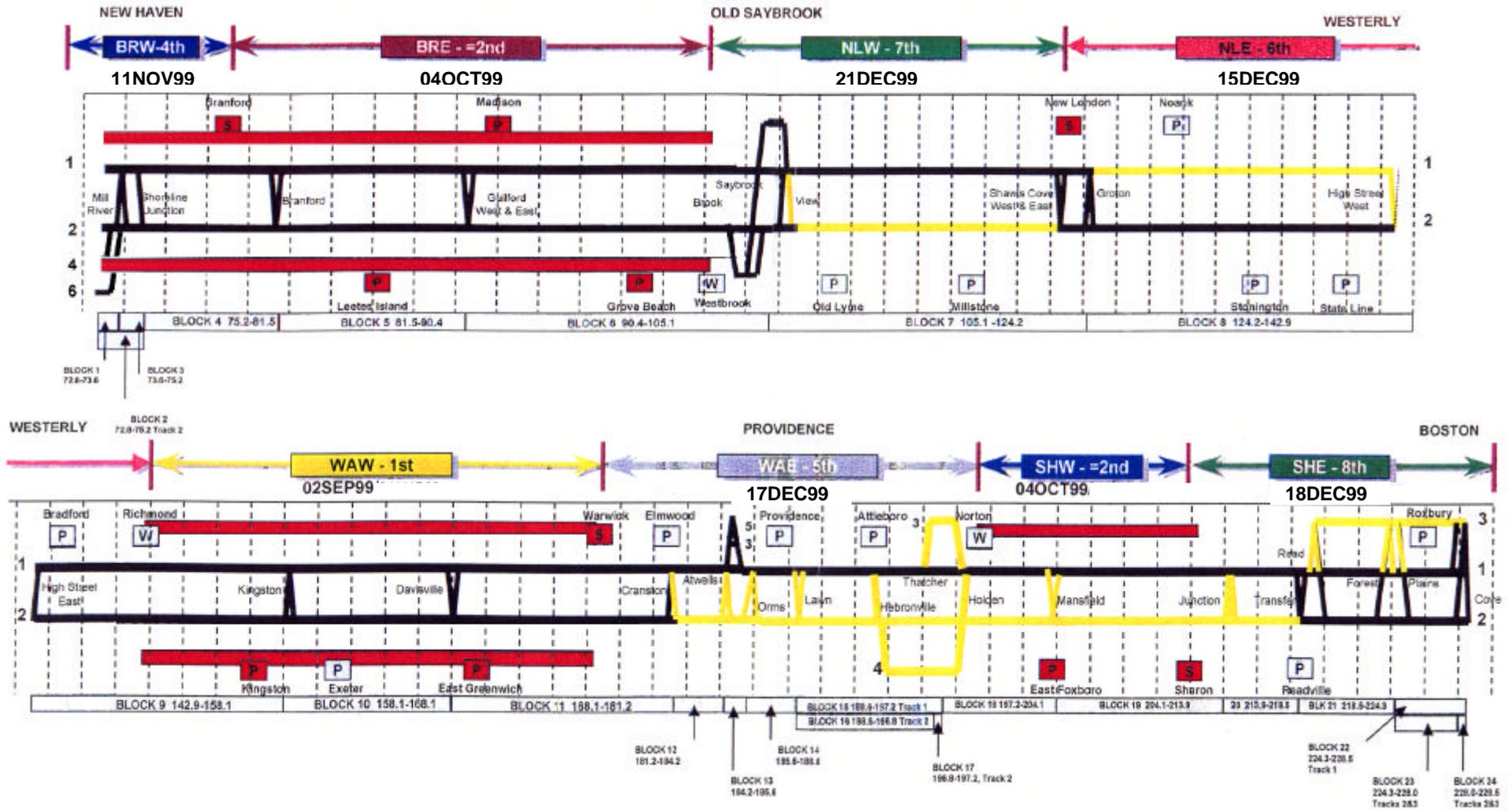
The electrification work needed to allow limited high-speed operations is likely to be completed in time for service to begin in January. There are risks, but they are receiving a high level of attention. According to Amtrak officials, the most challenging tasks would be completing construction work in the Boston Terminal Area and on the movable bridges between Old Saybrook and Mystic, Connecticut, and completing the testing of the electrified line.

The contractor faces a difficult working environment in the Boston Terminal Area because of the extensive construction work being done on the Central Artery and the large volume of Amtrak and commuter traffic operating through the area. The Central Artery design took into account Amtrak's electrification plans and actions taken by the Artery have facilitated Amtrak work. Furthermore, Amtrak and Central Artery officials meet regularly to ensure that the work progresses smoothly and to address problems as they arise. Recently, work on a Central Artery tunnel caused 500 feet of track in the terminal area to "sink" and required additional ballast. This problem will not affect Amtrak's ability to offer limited high-speed service in January, 2000. Electrification work on the five movable bridges between Old Saybrook and Mystic, Connecticut is now complete.

The testing schedule established by the contractor is extremely tight and allows little room for addressing any serious problems that arise. Amtrak had expected that it would take an average of 3 weeks to test each section of track. Testing of

² Acela Express will be Amtrak's fastest service between Boston and Washington, DC. The Acela Express will replace Amtrak's Metroliner service (between New York and Washington, DC) and make fewer stops than Amtrak's other two services, Acela Regional and Acela Commuter.

SCHEMATIC MAP OF CORRIDOR SECTIONS AVAILABLE FOR HIGH SPEED SERVICE IN JANUARY 2000



- Tracks on which electrification is to be completed after January 2000
- Tracks on which electrification is to be completed by January 2000
- Sections now electrified

- S Substation
- P Paralleling Station
- W Switching Station

01 JAN00 Current start of testing date

the first of eight sections began on September 2, 1999, more than 12 weeks ago; and the contractor does not expect to complete testing this section until later this month (December 1999). To complete sufficient testing to allow service to start in January, the contractor has foregone some noncritical tests and has compressed the sequence of other tests.

Amtrak is under intense pressure to begin high-speed service as quickly as possible. If it encounters any serious problem in completing and testing the electrification work, it should carefully weigh the short-term advantages of beginning this service in January against the potential damage an unreliable service could have on Amtrak’s long-term ability to attract and retain riders.

Some Electrification Work Deferred to Enable Amtrak to Operate Limited High-Speed Service in January 2000

Because all electrification work between New Haven and Boston is not scheduled to be completed until June 2000, trains running on electric power will need to switch between eastbound and westbound tracks three times between New Haven and Boston. Switching between tracks will not add substantially to trip times because the crossovers (locations where the trains will switch tracks) are located in areas where speeds are already reduced due to curves.

To concentrate on getting alternate sections of east and westbound track ready for limited service, Amtrak and the contractor have agreed to defer construction and testing on parts of the electrification system until after service starts in January 2000. Although a schedule for completing the deferred work has not been developed, the contractor is expected to complete deferred work listed in Table 1 and all other contract requirements by June 2000.

Table 1. Deferred Electrification System Work

Location	Track*	Work Deferred
Old Saybrook, CT to Groton, CT	Track 2	Completion of overhead wiring system
Groton, CT to Westerly, RI	Track 1	Completion of overhead wiring system
Cranston, RI to Attleboro, MA	Track 2	Alignment of contact wire
Attleboro, MA (Thatcher St. to Holden St.)	Track 3	Construction of overhead wiring system
Attleboro, MA to Readville, MA	Track 2	Correction of deficient work items and completion of overhead wiring system
Readville, MA to Boston’s Back Bay Station	Track 3	Completion of overhead wiring system
* Track 1 –Westbound (New York City), Track 2 –Eastbound (Boston), Track 3 –Auxiliary track Source: Amtrak’s electrification project schedule.		

Actions to be Completed to Permit January 2000 Service

Amtrak officials have stated that the contractor's plan to establish the route for limited electrified service is achievable. They identified three areas, the Boston Terminal Area, the movable bridges between Old Saybrook and Mystic, Connecticut, and the completion of testing the electrification system, that would be particularly challenging.

Boston Terminal Area. Amtrak's contractor faces a difficult working environment in the Boston Terminal Area because of the extensive work being undertaken for the Central Artery project. Specifically, the Central Artery project involves over 500 employees in the South Boston Terminal area alone and entails on-site storage of a large amount of heavy construction equipment and supplies. The Central Artery project was ongoing before the electrification project started, and personnel working on the Central Artery project occupy and control much of the site access and equipment staging area around Boston's South Station (see Figure 1).



Figure 1. South Station Staging Area

Amtrak has been coordinating the electrification work in this area through weekly meetings between its contractor personnel and Central Artery engineers. Through these efforts, three bridges have been demolished that would have prevented Amtrak's electrification work from proceeding. While no individual Central Artery construction activity presents barriers to Amtrak's electrification efforts, the

numerous Central Artery personnel and pieces of equipment in the work area posed a challenge to the ability of Amtrak's contractor to move and store equipment. The high level of cooperation provided by the Central Artery personnel has prevented the difficult working environment from becoming a "show stopper" for Amtrak's January 2000 service.

Another factor complicating electrification work in the Boston Terminal Area is the large volume of rail traffic. Over 250 Massachusetts Bay Transportation Authority (MBTA) commuter trains and 20 Amtrak trains operate through the area daily. As a result, scheduling "outages"-- taking track out of service to work on the electrification -- can be difficult. While Amtrak believes it has provided the contractor sufficient outage time, the contractor has stated that additional time will be needed if electrification is to be completed in time for January service.

Amtrak's position is that the contractor needs to better use the time made available during the outage time already provided. For example, in August 1999, Amtrak documented numerous instances in which the contractor failed to have the necessary equipment, supplies, and personnel in place. Since then, according to Amtrak officials, the contractor has made better use of the scheduled outage time. Amtrak's Program Director for Electrification stated that it is continuing to work closely with the contractor to ensure sufficient outage time is available. If the current outage times are insufficient to meet the goal, Amtrak plans to request additional time from MBTA.

Recent tunnel construction for the Central Artery project caused Amtrak tracks to "sink" between 7 and 9 inches over a 500 foot stretch of track in the Boston Terminal area. Over the December 11-12, 1999 weekend, Amtrak shored up the track in this section with additional ballast. Amtrak does not believe that this problem will affect its ability to begin limited high-speed service in January.

Electrification of Movable Bridges. Amtrak officials told us completing the electrification work on the five movable bridges between Old Saybrook and Mystic in Connecticut would be a challenge, as each one required a unique electrification design and construction solution. The bridges span busy waterways shared by pleasure craft, commercial carriers, and military traffic. Unlike most movable highway bridges, these bridges are usually open, and are closed only to accommodate approaching train traffic. The Niantic River, Connecticut River, and Thames River bridges are drawbridges, while the Shaw Cove and Mystic River bridges swing horizontally to accommodate water traffic.

By working carefully with the Coast Guard to extend the bridge closure periods to allow work to proceed without interruptions from boat traffic, Amtrak has successfully completed electrification of the five bridges.

Testing of Completed Electrification Work. The track between New Haven and Boston is divided into eight sections, based on the location of electrical substations and switching stations that provide and regulate power to the system. Each section will have electric power supplied to it and will be tested individually before the sections are linked together as an integrated system. Originally, the electrification schedule provided for an average of 3 weeks for testing. After all the sections had been tested, the contractor was to test the system as a whole.

As shown in Table 2, testing has been delayed and the testing that has begun has taken considerably longer than 3 weeks to complete. There are no planned end dates for any of the testing. However, Amtrak still plans for all testing to be complete in time to begin service in January, and has dedicated additional resources, including additional locomotives, to facilitate the testing. In addition, the contractor has eliminated noncritical tests and has compressed the sequence of testing.

Table 2. Schedule for Electrification System Testing

Electrical Section	Prior Planned Start	Current Planned Start	Days Delayed
Warwick West	Aug. 2, 1999	Sep. 2, 1999*	31
Sharon West	Aug. 9, 1999	Oct. 4, 1999*	56
Branford East	Oct. 1, 1999	Oct. 4, 1999*	3
Branford West	Nov. 3, 1999	Nov. 11, 1999*	8
New London East	Nov. 4, 1999	Dec. 15, 1999	41
Warwick East	Oct. 21, 1999	Dec. 17, 1999	57
New London West	Nov.11, 1999	Dec. 21, 1999	40
Sharon East	Nov.20, 1999	Dec. 18, 1999	28
* Actual start date Source: Amtrak			

The start of testing on the Warwick West section was delayed 31 days from August 2, 1999 until September 2, 1999 to correct problems with construction work, and 12 weeks later testing is not complete. After testing began at Warwick West, problems arose when electrical power was supplied to the section. Two transformers failed, becoming severely damaged and requiring replacement. Amtrak and the contractor initially agreed to suspend testing of all other sections until the problem was resolved. Amtrak subsequently decided to allow the contractor to continue testing by taking the remaining 71 transformers out of service. Amtrak stated that the transformers, which aid in identifying electrical problems in the system, are not required to run electrified service.³

³ According to Amtrak, these transformers are not used on the electrified section between Washington, D.C. and New York City.

According to Amtrak's Program Director for Electrification, it is difficult to predict what problems might surface when power is provided to the system. When problems arise, the contractor must determine the cause of the problems and develop solutions. Testing has begun on four sections, but has not been completed on any of the sections.

Only preliminary testing to check the mechanical interface between the bridges and the catenaries on the five movable bridges has been done, thus far. Electrification work is not yet completed in the Boston Terminal Area (Sharon East) and testing there also can not begin until the work is completed. Because of the testing delays, Amtrak and the contractor have forgone some noncritical tests and have compressed the sequence of other tests.

Recommendations

We recommend Amtrak:

1. Carefully weigh the short-term advantages of beginning limited high-speed service in January against the potential damage an unreliable service could have on Amtrak's long-term ability to attract and retain riders, if it encounters any significant problems during its testing of the electrification work.
2. Require the contractor to prepare a schedule with appropriate milestones detailing the plan to complete the overall electrification by June 2000.

Management Comments

On December 2, 1999, Amtrak's Program Director for Electrification provided us with verbal comments which we considered in preparing this report. He agreed with the finding and with the intent of the recommendations. We also shared a copy of this report with Amtrak's President and CEO, George Warrington. Mr. Warrington also agreed with the report's finding and recommendations.

Scope and Methodology

To address critical issues associated with Amtrak's goal of initiating limited high-speed service, we reviewed the electrification contractor's progress in meeting the project schedule and measures taken by Amtrak and the contractor to address schedule risks. To identify these issues, we reviewed project-specific documents, including: project schedules, contractor and Amtrak progress reports, meeting minutes, contract modifications and other related documents.

We also interviewed personnel from Amtrak, Amtrak's construction management consultant, the electrification contractor, FRA, Central Artery project consultants, the Massachusetts Bay Transportation Authority, and Metro North Railroad. We discussed the progress made by the contractor, risks to the schedule, and the potential of starting service with partial electrification.

We performed our review from August 9, 1999 through November 29, 1999. We conducted our review at FRA Headquarters, Washington D.C.; Amtrak Northeast Corridor Headquarters in Philadelphia, Pennsylvania; and Amtrak field offices in Old Saybrook, Connecticut and Boston, Massachusetts. This review was conducted in accordance with Government Auditing Standards prescribed by the Comptroller General of the United States.

Chronology of Project Delays

December 1995	\$321 million contract awarded to Balfour Beatty Construction, Inc./Mass. Electric Construction (BBC/MEC) to verify and complete MK design and build the electrification system. System to be completed by June 1999.
July 1996	Electrification system ground-breaking ceremony. Contractor begins construction and encounters numerous time-consuming delays: Subsurface rock; unanticipated field conditions; and slow production.
November 1996	Safety shutdown: work is shut-down for 6 weeks after a worksite incident. Contractor completed a safety audit and implemented safety improvements. Cable conflicts: delays encountered while contractor attempted to locate buried signal wires and ATT/MCI fiber optic cables.
October 1997	BBC/MEC submits new schedule, indicating delay in completing electrification project until October 1999, a 3-month delay.
March 1999	Amtrak realizes system cannot be fully commissioned by October 1999. Agrees to defer non-critical projects until after service starts. Amtrak still anticipates starting limited service in December 1999, but delays project completion until June 2000.
September 1999	Amtrak approves schedule providing for secured route by December 22, 1999 in order for Amtrak to begin service any time thereafter. Amtrak announces service to start-up in January 2000.