R179 Return to Service Phase 1 Report
September 16, 2020

INTRODUCTION:

In June 2012, New York City Transit Authority (NYCT) awarded Bombardier Transportation Group (Bombardier) a contract for a fleet of 300 new R179 subway cars. Production delays and quality issues resulted in a 35-month delay in completion of the order. NYCT negotiated a settlement that entitled it to an additional 18 cars at no extra cost. The 318th and final car was delivered to NYCT on December 30, 2019.

Three significant quality and safety issues with the R179 cars emerged between May 2019 and June 2020.

Primary Side Collision Post Welds: In May 2019, primary side collision post welding anomalies were found by Bombardier during routine inspection at their Plattsburgh, New York production facility. Bombardier performed an engineering validation and a safety assessment of production and installed posts on R179 cars and determined that the cars delivered to NYCT were safe to operate. An independent safety assessment concluded that all cars delivered to date were safe for revenue service.

Door Operations: On December 24, 2019 and January 3, 2020, two un-commanded door openings took place while R179 cars were in motion. In both instances, door closure status was lost, propulsion was removed, and the train coasted to a stop. NYCT removed the fleet from revenue service while Bombardier performed an engineering review. Testing and analysis revealed workmanship issues with the system's door solenoid lock switch, and software deficiencies in the door motor control unit. Bombardier with oversight from LTK, NYCT's consultant, performed field modifications to address the solenoid lock and software issues and confirmed that the R179 fleet was safe to resume revenue service.

Draft Gear: On June 3, 2020, two R179 cars separated in revenue service at a drawbar draft gear assembly. After parting, both sides of the train came to an immediate emergency stop. NYCT removed the fleet from revenue service pending an investigation. Bombardier and the draft gear manufacturer discovered that a spiral pin was missing from the draft gear assembly and allowed the cars to separate. The omission of the spiral pin was traced to the manufacturer's assembly line. An emergency inspection of the R179 fleet was completed on June 5, 2020, with no other instances of missing spiral pins detected.

Because of the above incidents, use of the R179 fleet was suspended and NYCT established the R179 Review Panel (Panel). The Panel was instructed to review the incidents and recommend appropriate steps for NYCT to take before returning the R179 fleet to service (Phase 1), and to determine whether any recommendations should be made to modify Quality Assurance requirements and processes for current and future rail car procurements (Phase 2).

PANEL MEMBERSHIP:

The Panel began work on this assignment with a kickoff meeting sponsored by NYCT senior leadership on July 28, 2020. The R179 Review Panelists include:

- Robert C. Lauby: (Panel Chair) Former Associate Administrator for Railroad Safety and Chief Safety Officer for Federal Railroad Administration and current head of RCL Rail Safety Consulting, LLC
- Carolyn Flowers: Former Acting Administrator for Federal Transit Administration and currently serving as Managing Principal, Infrastrategies, LLC
- Dr. J. Victor Lebacqz: Former Associate Administrator for Aeronautics Research at NASA and current Founder and Principal, VICC Associates
- Dr. Thomas R. Kurfess: Professor of Mechanical Engineering, Georgia Tech.

Each panelist brings a set of diverse talents and expertise in engineering, transit, aviation, and manufacturing to the R179 Review.

PANEL ACTIVITIES AND STRATEGY:

The Panel developed an R179 Panel Work Plan during the first week of the assignment. The work plan includes day to day activities and is reviewed and updated throughout the assignment. It also includes the strategy the Panel followed to complete Phase 1 of the assignment, the R179 Return to Service Plan. The work plan identifies the following activities:

Panel Meetings: Panel members meet at least once each week on Tuesday. The weekly Panel meetings are used to update the members on progress and address specific technical topics identified in the task schedule. Six Panel Meetings have been held to date.

NYCT Meetings: Meetings with NYCT technical staff are scheduled once or twice a week or as mutually agreed. The purpose of the NYCT meeting is to provide regular updates on the progress of the review and address specific technical topics contained in the technical documents and as indicated in the Work Plan task schedule. Eleven NYCT Meetings including one with Bombardier have been held to date.

Review of Technical Documents: NYCT provided the Panel with technical documents including test procedures, test reports, and other documents that address the pertinent quality and safety issues described above. The Panel also has access to the R179 Technical Specification, NYCT Quality Assurance requirements, R179 car descriptions and methods of operation. The Panel also has reviewed the New York City Comptroller's report and NYCT's response. Over 80 technical documents have been reviewed or are under review by the Panel.

INVESTIGATION RESULTS:

The Panel reviewed the R179 technical documentation in detail and met with NYCT technical staff and LTK consultants to thoroughly discuss the technical challenges posed by the incidents. The technical document review and the subsequent meetings with NYCT technical staff were critical to the Panel's work and informed the Panel's recommendations for the R179 Return to Service Plan.

Based on the documents reviewed, and subsequent discussions with NYCT technical staff, LTK consultants, and Bombardier, the Panel concludes that all three quality and safety issues discovered to date (collision post welds, door control operations, and draft gear) have been adequately and completely addressed. Therefore, the events themselves have no current bearing on a decision to return the R179 fleet to revenue service.

However, the issue at hand is the lack of confidence generally in the R179 fleet based on these previous experiences and performance. The panel believes NYCT has done all it can do to attempt to detect or predict additional potential unforeseen flaws or future issues. None have been found. Construction of the R179 subway cars has been completed and the entire fleet was operating in revenue service up to the time of removal in June 2020. Thus, the Panel suggests that the best way to gain confidence in the R179 subway cars at this juncture is by running the R179 fleet in revenue service and carefully monitoring performance.

The three quality and safety issues remain important concerns and reflect on the performance of the R179 contract by the car builder and its subcontractors. These issues will be fully addressed during Phase 2 of the assignment and in the R179 Panel's final report.

RECOMMENDATIONS:

The R179 Panel recommends that the New York City Transit Authority return the R179 fleet to revenue service by adopting the following return-to-service process. The recommended process includes careful performance monitoring to detect any other quality issues as quickly as feasible and provides the opportunity to gradually restore confidence in the R179 fleet.

The process is divided into three distinct steps (Preparation, Simulated Service, and Performance Monitoring) and is fully described below:

Preparation:

1. NYCT, LTK and Bombardier shall identify all pending software/firmware upgrades for the fleet and determine which upgrades are essential for the safety of critical systems.

2. Pending software/firmware revisions must be independently tested by Bombardier in the lab, static tested in the shops, and tested in simulated service before installing the upgrade on the fleet and releasing the R179 cars for revenue service.

3. The door Complex Programmable Logic Device (CPLD) firmware upgrade (a tertiary safety feature for door controls) meets this criterion and shall be tested by Bombardier, tested in simulated service, and approved by NYCT prior to installing the upgrade on the R179 fleet.

4. NYCT shall perform pre-inspection and/or periodic maintenance on each R179 subway car and train set per NYCT existing maintenance practices before running the cars in simulated service and returning the cars to revenue service. Pre-inspection and/or periodic maintenance shall include confirmation that correct versions of software and firmware are installed on each R179 car.

5. The R179 subway cars with upgraded software/firmware and with appropriate inspection and maintenance performed by NYCT will define a baseline condition that shall, at a minimum, remain in place during the transition of the entire R179 fleet to revenue service. Additional software/firmware upgrades or changes to the baseline configuration of the R179 cars (other than routine maintenance or replacement of consumables) shall not be authorized unless the upgrade or change in configuration is needed to address a safety issue – and then, only with concurrence of the NYCT Chief Mechanical Officer.

Simulated Service:

6. The first 8 R179 eight-car trainsets (20% of the fleet) shall be run in simulated service in accordance with NYCT's simulated service strategy document to confirm proper operation of all train systems including software and firmware upgrades. Simulated service shall run for eight hours, without a disqualifying failure. NYCT shall determine the definition of a disqualifying failure.

7. If the eight hour simulated runs conducted on the first 8 trainsets do not indicate systemic issues with the R179 equipment, then simulated service run times for the remaining trainsets shall be reduced from 8 hours to one round trip, without a disqualifying failure.

8. Each R179 trainset shall be released for unrestricted revenue service after successful completion of the 8-hour or round-trip simulated service run, as appropriate.

9. The R179 trainsets shall be returned to revenue at a rate where NYCT staff can sustain scheduled maintenance, simulated service, and failure monitoring throughout the program.

Performance Monitoring:

10. NYCT shall track and record significant failures experienced in the R179 fleet and report the failures daily to the Panel members by email.

11. NYCT shall issue a weekly report and establish a weekly meeting with the R179 Panel to discuss R179 fleet performance. At a minimum, weekly reporting shall include a summary of prior reports for the week and identify any concerns or trends for discussion during the weekly meeting

12. NYCT shall also report Mean Distance Between Failure (MDBF) and Mean Distance Between Component Failure (MDBCF) monthly or as available.

13. Monitoring of R179 car performance shall continue until confidence in car performance is restored.

The Panel members stand by these recommendations to the New York City Transit Authority and believe that this measured approach is appropriate to restore confidence in the R179 fleet as the fleet is safely transitioned back to revenue service.