National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials Investigations
Washington, D.C. 20594

End of Track Collision
Long Island Rail Road
Atlantic Terminal, Brooklyn, New York
January 4, 2017

NTSB Accident Number DCA17FR005

System Safety Group Factual Report
Georgetta Gregory, Group Chairman

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The Accident

NTSB Accident Number:	DCA17FR005
Date of Accident:	January 4, 2017
Time of Accident:	End of Track Collision
Type of Train:	Passenger
Railroad:	Long Island Rail Road
Train:	Train No. 2817
Fatalities:	None
Injuries	113
Location of Accident:	Brooklyn, New York, Long Island Rail Road Atlantic Terminal

1 Accident Summary

For a summary of the accident, refer to the *Accident Summary Report* in the docket for this investigation.

2 The Accident

The Long Island Rail Road (LIRR) train No. 2817 originated at Far Rockaway Station and terminated at the Atlantic Terminal. The train consisted of three married pairs of M7 multiple unit passenger cars.[1] The train was travelling in a westward direction from Far Rockaway to Atlantic Terminal Station and traveled 15.5 miles.

Figure 1 illustrates the route and signal indications for train No. 2817 with the route highlighted in green and the signal locations, the signal aspect, and the distance between signals in red. After passing through Brook 2 interlocking the train received a Restricting Signal at Brook 1 Interlocking on Brook 1 track 1 that required the Locomotive Engineer to slow the train to Restricted Speed not exceeding 5 mph. The train then crossed over from Brook 1 track 1 to Brook 1 track 2 at Restricted Speed, not exceeding 5 mph. As the train continued west towards the station on main track 2, the train encountered another Restricting Signal. Maximum authorized speed through Brook 1 Interlocking and Station Track 6 was 5 mph. Under this circumstance, the Locomotive Engineer must comply with restricted speed, that part reading, "being prepared to stop in one-half the range of vision…" but also not exceed 5 mph. Then the route for the train was on Station Track 6. Once on Track 6, Train no. 2817 reached the end of

[1] The abbreviation for multiple unit is MU and refers to the ability of the diesel and electric locomotive or multiple units joined together and controlled from one control station.

the track and collided with the bumping post structure. The train continued until the end of the first car came to rest on top of

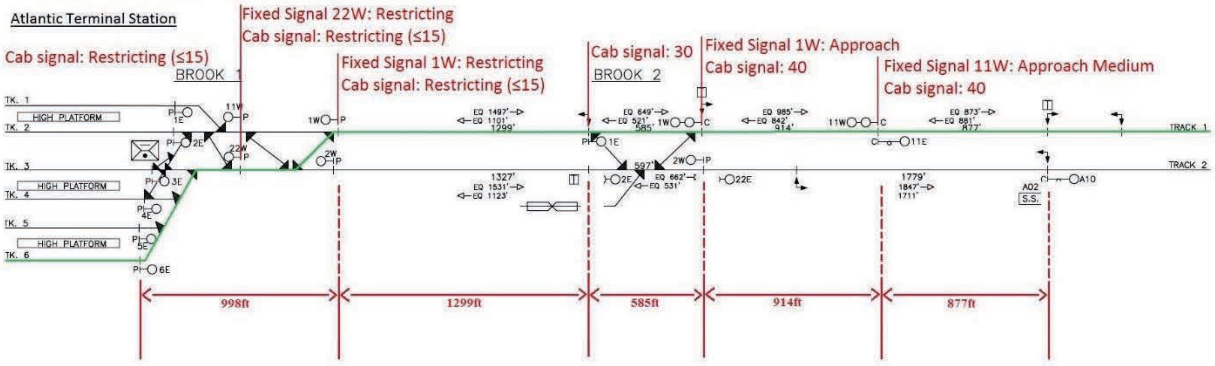

Figure 1. Track Chart of Atlantic Terminal

the concrete structure at the end of the track. The concrete was level with the platform that runs parallel to the station track. The end of the lead car also pushed through a wall that the Long Island Rail Road had installed for an "employee only" area. (See Figure 2.)

Figure 2. Resting point of Train no 2817 after collision.

3 Long Island Rail Road System Safety Program Plan

The Long Island Rail Road (LIRR) implemented its System Safety Program Plan (SSPP) effective May 14, 1986, and last revised the plan in February 2014, voluntarily using the American Public Transportation Association (APTA) *Manual for the Development of System Safety Program Plans for Commuter Railroads* (manual) as guidance in developing this plan.[2] (See Section 4 for more information on the APTA manual.) The LIRR took this action in anticipation of federal rulemaking requiring commuter railroads to develop and implement system safety program plans.

The SSPP includes the elements named in the APTA manual. The State of New York Department of Transportation Public Transportation Safety Board (PTSB) recertified the LIRR in PTSB Resolution #2098, dated May 15, 2014. The LIRR complied with the industry standard as good practice. Also, every three years, LIRR had APTA audit its SSPP, with the last audit being in 2014. The LIRR planned for an outside consultant to conduct an audit of its program in 2017.

Section 5.1, *Hazard Management Process*, of the LIRR SSPP describes the hazard identification, resolution process, and mechanism available to all levels of the organization. This process was the means the LIRR used to identify hazards, analyze the potential impact on the operating system, and resolve those hazards in a manner acceptable to management. The LIRR defines risk,

[2] Long Island Rail Road System Safety Program Plan, effective May 14, 1986, last revised April 2014. The New York State regulatory requirements dictated a system safety program plan in 1986.
American Public Transportation Association (APTA) *Manual for the Development of System Safety Program Plans for Commuter Railroads*, Revision 2.4, May 15, 2006, (APTA, Washington, DC).

> …associated with the expected value of loss. Just as a hazard can result in an accident, the risk is related to the probability that frequency, intensity and duration of a stimulus that will be enough to transfer the hazard to the state of loss. Risk is the probability of a mishap in terms of hazard severity and hazard probability.

Elements of this process included announced and unannounced inspections and audits by the Corporate Safety Department. The intent of this task was to identify unsafe conditions and practices, analyze and assess the degree of hazard and aid in selecting applicable hazard mitigation. Additionally, LIRR departments participated by conducting inspections of equipment and infrastructure in accordance with but not limited to the following documents:

- Engineering Department Quality Management System Manual and Procedures
- Instructions for Making Tests of Signal Apparatus – CS 227
- Traction Power and Distribution Charts
- Long Island Rail Road Substation Charts
- Power Directors Instruction Manual (Operational Procedures)
- Signal Reference Plans
- Bridge, structure and facility fire/safety inspection procedures
- Branch line station safety audits

The LIRR SSPP section 5.1 includes a section describing the risk index, a process to generate a hazard rating by combining severity and probability. The process allowed LIRR to prioritize hazards basing on the risk index. This section described 4 methods and the order of preference to mitigate hazards:

1. Design for minimum hazard
2. Safety devices
3. Warning devices
4. Procedures and instructions

The SSPP also provided descriptions of actions for each hazard rating (Priority), ranging from Priority 1: stopping operations until correction or control of the identified hazard to an acceptable level; to Priority 5: further study the condition.

The LIRR SSPP in Section 5.3, *Safety Data Acquisition Analysis* also discussed hazard management, referencing hazard identification as a principle to prevent errors before they happen. This section described how data from accidents, risk and risk rating, and trends are elements of hazard management, using a statistical analysis approach. Data gathered from multiple sources, including accident investigations, employee and passenger injury reports, employee and customer form, customer letters, police reports, notice of claims, the employee "Safety One-Call Number", and external agency data such the federal government and the industry contributed to this analysis.

The LIRR established corporate policy and procedure BPM 003 – Management Control Review wherein managers of control assessment coordinate, supervise, and ensure that the manager maintains the proper documentation by who assess risks to their activities, evaluate management controls and establish corrective action plans for identified weaknesses.

The Deputy Chief Safety Officer (DCO) said in an interview that the LIRR SSPP was,

> …based on an APTA standard. The APTA standard is a consensus standard. There are discrete elements that are identified therein. We use – we put those elements into our plan and then we expound upon them to describe the basis for the flag hazards on the Long Island Rail Road and resolving those.

When asked how the SSPP and the APTA elements addressed the Atlantic Terminal, he responded:

> There's various sections that would apply. Mostly the sections on emergency response would describe how we plan for and train on emergency response actions. There are sections for various departments and how they deal with the hazards down at the facility. So the transportation folks specific to the incident. There's various descriptions on how qualify our train crews, how we train them. There are standards that they're are expected to hold, the tests and audits that the department does in order to ensure that those standards are upheld….

The DCO answered the question, "…has the Atlantic Terminal, through either the walks or through the APTA standards, been identified as a potential hazard with the possibility of a single point failure of a trainman losing control of the train coming into the station?" as,

> I don't know that the plan specifically identifies that particular issue. It identifies the methods by which we identify those hazards. So in the past, when the signal system was designed, those – and rules that were put into effect were probably considered.
>
> We use the plan in order to prioritize the hazards that we encounter for mitigation. That specific hazard was not identified in the plan, was not the document for that.

4 Previous Long Island Rail Road Bumping Post Collisions

The LIRR provided data between 1996 and 2010 of collisions with bumping posts, reporting 15 previous end of track accidents. Two of these collisions happened at Atlantic Terminal. The LIRR determined that in 14 of these collisions that crew failure to control the train movement was the cause of the accident and one involved the failure of the crew to use hand brakes and coupling with fully charged service brakes while coupling equipment. Injuries to two employees and no passengers occurred in these bumping post accidents; however, in this accident on January 4, 2017, 9 employees and 105 passengers reported injuries.

On September 29, 2016, New Jersey Transit (NJT) train 1614 collided with the bumping post at the NJT Hoboken station while travelling at 21 mph. The cab car overrode the bumping

post and struck the wall of the terminal building. The collision resulted in transporting 108 passengers and 3 crewmembers to local hospital. While this is an on-going NTSB investigation, the FRA published Safety Advisory 2016-03 on December 5, 2016, urging railroads to, "take more robust action to address human factors that may cause accidents and to enhance protection of railroad employees and the public."[3]

In response to the FRA Safety Advisory 2016-03, the LIRR developed General Notice No. 2-52 (notice) that was to be effective at 5:01 p.m. on the day of this accident, January 4, 2017. The notice was an added requirement to the LIRR Time Table Special Instruction and required the positioning of the Conductor or a qualified and authorized crewmember on the head end of the train with the Locomotive Engineer when approaching stations with stub-end tracks, including Long Island City, Greenport, Montauk, Atlantic Terminal, Far Rockaway, Long Beach, Port Washington, Hempstead, and West Hempstead. The Conductor or other crewmember was to assist the Locomotive Engineer in complying with all applicable rules and/or special instructions including but not limited to calling out signals, checking switch points for proper positioning, and to confirm compliance of the Locomotive Engineer with the maximum authorized speed for the train. The notice required that the Locomotive Engineer stop the train prior to entering the yard or interlocking prior to one of the named stations if the Conductor or other crewmember was not on the head end of the train. The DCO said that prior to this notice, the LIRR held the philosophy that the, "Locomotive Engineer cab was to be kept sterile", meaning that there was to be no distraction to the Locomotive Engineer.

The LIRR also distributed the FRA Safety Advisory 2016-03 to its workforce.

[3] Federal Register Vol. 81, No. 233, December 5, 2016: 887649.

In response to the interview question about any LIRR consideration of energy-dissipating bumping posts, the DCO responded that all the bumping posts were under evaluation by their Engineering Department. The Vice President Corporate Safety clarified that this evaluation began prior to this accident and was a system-wide effort by their Engineering Department, including the capabilities of the bumping posts.

5 Federal Railroad Administration

The Federal Railroad Administration (FRA) began work on a broad range of actions to enhance the safety of passenger train operations. In September 1994, the DOT Secretary announced that the FRA would develop passenger equipment safety standards in two phases: 1) initial regulations dealing with the most critical issues in three years; and 2) final regulations dealing with all related safety subjects in five years. In November 1994, Congress passed the Federal Railroad Safety Authorization Act of 1994 and section 215 requiring the Secretary to meet a three-year deadline to develop rail passenger equipment safety standards and final regulations within five years.[4]

The FRA began a rulemaking for comprehensive passenger equipment safety standards. The Rail Safety Advisory Committee (RSAC) Passenger Equipment Working Group (Working Group) began work on June 6, 1995, on the proposed rules.[5] An Advanced Notice of Proposed Rulemaking (ANPRM), published on June 17, 1996, sought public comment on the need for particular safety requirements to address the inspection, testing, and maintenance of passenger equipment; equipment design and performance criteria related to passenger and crew

[4] Federal Railroad Safety Authorization Act of 1994, Pub. L. 103-440, 108 Stat. 4619.
[5] Rail Safety Advisory Committee (RSAC) -- see FRA RSAC website: https://rsac.fra.dot.gov/tasks.php

survivability in the event of a train accident; and the safe operation of passenger train service, supplementing existing railroad safety standards.[6]

The Association of American Railroads (AAR) sets industry standards for the design and maintenance of freight equipment that add materially to the safe operation of this equipment. However, the AAR does not develop or maintain passenger equipment standards.

Topics covered in the ANPRM included system safety programs and plans, along with passenger equipment crashworthiness; inspection, testing and maintenance requirements; training and qualification requirements for mechanical personnel and train crews; excursion, tourist and private equipment; commuter equipment and operations; train make-up and operating speed; tiered design standards based on a system safety approach; fire safety; and operating practices and procedures.

Among the Working Group's scope of effort was: 1) determine and prioritize safety risks; 2) determine steps or corrective actions to reduce risks; and 3) optimize safety benefits. The expected outcome from the Working Group Two was two rulemakings; the first NPRM being in response to the ANPRM mentioned above and the second being an NPRM for passenger equipment power brake standards. The FRA also established an additional RSAC working group, the Emergency Preparedness Working Group for rail passenger service, at this same time.

The FRA published Emergency Order No. 20, Notice No. 1, on February 22, 1996, with added clarification published in Notice No. 2, on March 5, 1996, following train accidents in Secaucus, New Jersey on February 9, 1996, and in Silver Spring, Maryland on February 16,

[6] Federal Register Vol. 61, No. 117, June 17, 1996: 30672

1996, claiming fourteen lives, to compel steps to reduce the risks to passengers and crews.[7] Prior accidents investigated by the National Transportation Safety Board (NTSB) to Secaucus and Silver Spring also illustrated potential risk. On August 1, 1981, in Beverly, Massachusetts, a commuter train engineer died and 28 passengers were injured when a commuter train collided head-on with a freight train due to dispatcher error.[8] On November 12, 1987, in Boston, Massachusetts, a commuter rail train struck the locomotive at the end of a preceding train traveling in the same direction on the same track, causing injuries to three crew members and 220 passengers.[9] In Gary, Indiana, on January 18, 1993, two EMU consists struck in a cornering collision at the approach to a gauntlet bridge, resulting in seven fatalities and injuries to 95 persons, due to the failure of one of the engineers to observe signal indications.[10]

Emergency Order No. 20 required interim safety plans and required commuter railroads to evaluate their passenger operations with a view toward enhancing the safety of those operations in developing those interim plans. The order required all railroads operating scheduled intercity or commuter rail service to conduct an analysis of their operations and file an

[7] Federal Register Vol. 61 No. 36, February 22, 1996: 6876
Federal Register Vol. 61 No. 44, March 5, 1996: 8703
National Transportation Safety Board, Near Head-on Collision and Derailment of Two New Jersey Transit Commuter Trains Near Secaucus, New Jersey, February 9, 1996, RAR-97-01, (Washington, DC: National Transportation Safety Board, 1997).
National Transportation Safety Board, Collision and Derailment of Maryland Rail Commuter MARC Train 286 and National Railroad Passenger Corporation Amtrak Train 29 near Silver Spring, Maryland on February 16, 1996, RAR-07-02, (Washington, DC: National Transportation Safety Board: 1997).

[8] National Transportation Safety Board, *Head On Collision of Boston & Main Corp Extra 1731 East & MBTA Train No. 570 on Former Boston & Main Corp. Tracks,* August 1, 1981, RAR-82/01, (Washington, DC: National Transportation Safety Board, 1982).

[9] National Transportation Safety Board*, Rear-end Collision of Amtrak/Massachusetts Bay Transportation Authority Commuter Trains, Boston, Massachusetts,* November 12, 1987, RAR-88/05, (Washington, DC: National Transportation Safety Board, 1988).

[10] National Transportation Safety Board, *Collision Between Northern Indiana Commuter Transportation District Eastbound Train 7 and Westbound Train 12, Gary, Indiana,* January 18, 1993, RAR-93/03 (Washington, DC: National Transportation Safety Board, 1993).

interim safety plan with the FRA. The FRA encouraged these railroads to implement identified opportunities for risk reduction immediately.

The FRA required that the interim safety plans included train-to-train collisions, the hazard of impact with fixed structures, and collisions with heavy vehicles at highway rail grade crossings and the following minimum opportunities for risk reduction:

a) Use of cab car/MU car
b) Operating rules
c) Adverse Conditions
d) Short-term technology enhancements
e) Crew management
f) Highway-rail grade crossings
g) Emergency exit notification

The FRA issued two regulations as part of a broad effort to promote the safety of passenger rail travel. The *Passenger Train Emergency Preparedness* regulations, 49 CFR Part 239, published on May 4, 1998, and the *Passenger Equipment Safety Standards*, 49 CFR Part 238, published on May 12, 1999, having requirements for emergency systems on passenger trains, in addition to other requirements such as for structural design and fire safety.[11] These regulations were elements of a comprehensive effort by the FRA to improve the safety of rail passenger service. The intent was incorporation of these requirements into the individual railroad overall system safety planning process previously agreed upon by the commuter authorities.

[11] Federal Register Vol. 63, No. 85, May 4, 1998, 24630
Federal Register Vol. 64, No. 91, May 12, 1999, 25540

The FRA presented Task Statement: *Review of Passenger Safety Issues*, to the Rail Safety Advisory Committee (RSAC) on May 20, 2003.[12] The RSAC established the Passenger Safety Working Group to further address passenger train safety issues.

The Rail Safety Improvement Act of 2008 (RSIA) in section 109 mandated system safety programs (SSP) for all intercity and commuter railroads.[13] The SSP is a structured program with proactive processes and procedures developed and implemented by commuter and intercity passenger railroads to identify and mitigate or eliminate hazards and the resulting risks on the railroad's system. An effective SSP encourages a railroad and its employees to work together to proactively identify hazards and to jointly determine what, if any, action to take to mitigate or eliminate the resulting risks.

The FRA published its SSP in an NPRM on September 7, 2012.[14] The FRA said in the NPRM although it has, "issued safety regulations and guidance that address many aspect of railroad operations, gaps in safety exist, and hazards and risks may arise from these gaps." They further expressed the belief that railroads are better positioned to identify some of the gaps and take the necessary action to mitigate or eliminate the arising hazards and resulting risks. The FRA reopened the comment period on November 26, 2012 and extended it until December 7, 2012.[15]

[12] The FRA established the RSAC pursuant to Section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92-463) to provide advice and recommendations to the FRA on railroad safety matters in March 1996.
Rail Safety Advisory Committee (RSAC) Task Number 2003-01, *Review of Passenger Safety Issues*. See FRA RSAC website: https://rsac.fra.dot.gov/tasks.php

[13] Pub. L. 110-432, Division A, 122 Stat. 4848; 49 U.S.C. 20156, and 201189-20119.

[14] Federal Register Vol. 77, No. 174, September 7, 2012: 55372.

[15] Federal Register Vol. 77, No. 227, November 26, 2012: 70409.

On August 12, 2016, the FRA published its final rule at 49 *Code of Federal Regulations* (CFR), Part 270, *System Safety Program*.[16] The FRA said that "A SSP provides a railroad with the tools to systematically and continuously evaluate its system to identify hazards and the resulting risks gaps in safety and to mitigate or eliminate these hazards and risks."

The FRA published a stay of regulation on February 10, 2017 delaying the effective date of 49 CFR Part 270 until March 21, 2017.[17] On March 20, 2017, the FRA published another stay of regulation until May 22, 2017.[18] Effective May 18, 2017, the FRA again stayed the regulation until June 5, 2017.[19] Most recently, the FRA published a stay of regulation effective June 2, 2017 until December 4, 2017.[20] The FRA provided supplementary information in the latest stay of regulation saying that "the stay was consistent with the new Administration's guidance issued January 20, 2017, intended to provide the Administration and adequate opportunity to review new and pending regulations". This review includes petitions for reconsideration of the SSP final rule.[21] Additionally, the FRA said that it planned outreach with interested parties to help inform its decisions raised in the Petitions. The FRA has announced its intent to hold a meeting of the RSAC General Passenger Safety Task Force, Passenger Safety Working Group, and state partners in October 2017.

[16] Federal Register Vol. 81, No. 156, August 12, 2016: 53850
[17] Federal Register Vol. 82, No. 28, February 13, 2017: 10443.
[18] Federal Register Vol. 82, NO. 53, March 21, 2017: 14476.
[19] Federal Register Vol. 82, No. 97, May 22, 2017: 23150.
[20] Federal Register Vol. 82., No 108, June 7, 2017: 26359
[21] See SSP rulemaking docket for these petitions at: https://www.regulations.gov/docket?D-FRA-2011-0060

6 The American Public Transportation Association

The American Public Transportation Association (APTA) members are public organizations that engage in the areas of bus, paratransit, light rail, commuter rail, subways, waterborne passenger services, and high-speed rail. Its members also include companies who plan, design, construct, finance, supply, and operate bus and rail services worldwide. Government agencies, metropolitan planning organizations, state departments of transportation, academic institutions, and trade publications are also part of APTA's membership.

The APTA standards program publishes documents using a consensus based process with industry volunteers serving on working committees that develop those standards. These standards are an importation program that supports the public transportation industry. Existing APTA standards include Standard for *Row-to-Row Seating in Commuter Rail Cars*, *Recommended Practice for Fire Safety Analysis of Existing Passenger Rail Equipment, Standard for Attachment Strength of Interior Fittings for Passenger Railroad Equipment, Recommended Practice for Passenger Equipment Roof Emergency Access, Standard for the Inspection and Testing of Roller Bearings on Passenger Equipment After a Derailment, Recommended Practice for Diesel Electric Passenger Locomotive Dynamic Brake Control, Standard for Period Inspection and Maintenance of Passenger Coaches,* and many more standards addressing safety, security, and maintenance issues.[22] One such document is the APTA *Manual for the Development of System Safety Program Plans for Commuter Railroads,* initially adopted in 1998.

[22] See the American Public Transportation Association webpage for these publications at: http://www.apta.com/resources/standards/press/Pages/default.aspx

The commuter rail industry, jointly with the FRA and the DOT, developed the APTA 1998 edition of the its *Manual for the Development of System Safety Program Plans for Commuter Railroads* (manual) to improve the overall safety of commuter railroads by building upon comparable efforts used in rail transit. At the time of this accident, the 2006 edition of the APTA *Manual for the Development of System Safety Program Plans for Commuter Railroads* was the APTA standard to guide commuter railroads in develop their system safety plans.

The intent of the APTA manual was to:

- To provide a primer for both new-start and established commuter railroad systems with regard to the definition of the elements recommended for inclusion in a commuter railroad System Safety Program Plan;
- To establish a recommended format for a System Safety Program Plan;
- To assist commuter railroad systems with established System Safety Program Plans in the continuing development and definition of their respective programs;
- And to provide tangible evidence to passengers, public, and governmental oversight agencies that the commuter railroad industry possesses the means and expertise required to develop sound, effective, pro-active safety programs designed to further reduce accident potential and increase the efficiency of commuter railroad operations.

This manual was the creation of the APTA Commuter Rail Committee to implement guidelines for system safety program plans identified in the FRA Emergency Order 20. The manual incorporates by reference applicable FRA regulations and other applicable APTA standards. APTA said that a, "well-written SSPP will provide the basis for identifying all hazards that might interfere with customer and employee safety, as well as the public at large." The methodology called for safety reviews of capital improvements, changes in equipment, and changes in operating practices and the

inclusion or reference to concrete methods for eliminating, minimizing, and otherwise mitigating hazards.

Section 5.1 of the manual discusses the hazard management process, referring to the hazard identification/resolution process as the heart of the system safety program. The section refers to the hazard management process as a formalized procedure for risk acceptance by the commuter railroad management staff. This section calls for a systematic hazard identification process and a coordinate hazard effects minimization process.

END OF REPORT

7 Group Member to the Investigation - Acknowledgment Signatures

The undersigned designated *Group Member to the Investigation* representatives attest that the information contained in this report is a factually accurate representation of the information collected during the on-scene phase of this investigation, to the extent of their best knowledge and contribution in this investigation.

_____ Date _____
Georgetta Gregory, NTSB

_____ Date _____
Joe Gordon, NTSB

_____ Date _____
Peter Lapré, FRA

_____ Date _____
Timothy Doddo, LIRR