

STATE OF NEW YORK  
PUBLIC SERVICE COMMISSION

At a session of the Public Service  
Commission held in the City of  
Albany on October 19, 2017

COMMISSIONERS PRESENT:

John B. Rhodes, Chair  
Gregg C. Sayre  
Diane X. Burman  
James S. Alesi

CASE 17-E-0428 - In the Matter of an Investigation into the  
April 21, 2017 Metropolitan Transportation  
Authority Subway Power Outage and Consolidated  
Edison Company of New York, Inc.'s Restoration  
Efforts.

ORDER DIRECTING STEPS TO SAFEGUARD AND MAINTAIN  
ADEQUATE UTILITY SERVICE TO THE SUBWAY SYSTEM

(Issued and Effective November 10, 2017)

BY THE COMMISSION:

INTRODUCTION

In recent months, increasingly frequent power outages  
have led to failures of infrastructure throughout the  
Metropolitan Transportation Authority's (MTA) rail and subway  
systems. On June 29, 2017, Governor Andrew M. Cuomo declared a  
disaster emergency in the five boroughs of New York City and  
seven surrounding counties that incorporate the MTA region in  
the State.<sup>1</sup> Governor Cuomo also charged the Public Service  
Commission with conducting a joint review of the electrical

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<sup>1</sup> N.Y. Exec. Order No. 168 (June 29, 2017),  
<https://www.governor.ny.gov/news/no-168-declaring-disaster-emergency-five-boroughs-new-york-city-and-counties-dutchess-nassau>.

systems of Consolidated Edison Company of New York, Inc. (Con Edison) and the MTA within 90 days.

On August 16, 2017, the Commission issued an Order<sup>2</sup> directing Con Edison to take certain steps to safeguard and maintain adequate utility service to the MTA Subway System. The August 16, 2017 Order was adopted on an emergency basis and expires on November 13, 2017.

#### BACKGROUND

The 90-day joint review is a continuation of Department of Public Service (Department or DPS) Staff's investigation into the quality of Con Edison's power supply to the MTA system, which began because of an April 21, 2017 power failure that led to significant delays across MTA's subway system. That investigation also extended to two additional power-related incidents that affected the MTA's service on May 7 and May 9, 2017.

The investigation determined that the April 21 outage at the Seventh Avenue subway station was caused by a failure of Con Edison's electricity supply to the station, which led to a loss of the subway signals. In addition, the investigation showed that one of the secondary services to the MTA facility had been improperly rerouted, and further, was not properly documented by Con Edison. Due to the difference between Con Edison's maps and the actual field conditions, it took crews several additional hours to determine the cause of the outage.

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<sup>2</sup> Case 17-E-0428, Investigation into MTA Subway Power Outage and Consolidated Edison Company of New York, Inc.'s Restoration Efforts, Order on Consent Directing Steps to Safeguard and Maintain Adequate Utility Service to the Subway System (issued August 16, 2017).

The Seventh Avenue station is an "interlocking"<sup>3</sup> station used by multiple subway lines; therefore, the loss of power to the signal system at the Seventh Avenue station affected multiple subway lines and caused widespread delays across the subway system. Because of this incident, and at the direction of DPS Staff, Con Edison performed inspections on 102 other "interlocking" MTA stations, designated the highest priority by the MTA, and completed necessary repairs to avoid similar outages at other important stations.

The investigation further determined that the May 7 incident was caused by a failure of Transformer 3 at Con Edison's Farragut transmission substation. There was no resulting loss of power related to the event; however, the change in voltage impacted the MTA's system at the DeKalb station. On May 9, the DeKalb station lost signal power; however, the root cause of this event has yet to be determined.

In the August 16, 2017 Order, the Commission initiated a more comprehensive review and assessment of the electrical systems and equipment of both Con Edison and the MTA. As part of that review, DPS Staff will identify the electrical equipment owned and operated by Con Edison and that owned and operated by MTA, the condition of the equipment, and the party responsible for maintaining the equipment in a state of good repair. The Department is retaining Electric Power Research Institute (EPRI), a consultant that specializes in power quality issues, to assist in this review. Department Staff, EPRI, Con Edison and the MTA will work together to complete this power quality and equipment review.

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<sup>3</sup> Interlocking is defined as an "arrangement of signals and switches such that they are constrained to be operable only in a safe order." Interlockings are designed such that there is no way the controls can be operated, by mishap, malice, or contrivance, to effect an unsafe situation on the tracks.

In this order the Commission adopts a revised version of the August 16, 2017 Order on a permanent basis that enhances the scope of work to be undertaken by Con Edison to safeguard and maintain adequate utility service to the MTA Subway System. Con Edison is directed to work with Department Staff and EPRI to facilitate the timely and effective review and assessment of its electric system and related equipment and the quality of its power supplied to the MTA subway system, and to take other specific actions to designate a team of individuals to assist Department Staff and EPRI in their assessment; conduct and provide results of power quality monitoring data analysis; work to identify locations with frequent power issues; make readily available for review system and equipment design drawings, specifications, and operational procedures; continue the priority work identified by the April 21, 2017 incident investigation to improve the reliability of its electric service to the MTA; complete the electric inspections with the MTA and make necessary repairs to its facilities, with signal equipment as a priority, at all remaining MTA sites used to provide low voltage power to the subway system; identify the source of frequent power supply and reliability issues and expeditiously rectify Con Edison conditions causing such issues; replace aluminum and other high failure rate cables serving the MTA subway stations; install redundant power supplies or improve the reliable design of the service to the stations that do not currently have such redundancy; procure and deploy remote monitoring technology on its low voltage services to the MTA; inspect and repair relay rooms, including automatic transfer panels, circuit breakers and fuses, rectifiers and batteries, transformers and equipment racks; inspect and repair trackside equipment, including signals, stop machines, track switch machines, track circuits, junction boxes, wayside cables and

air-lines; and implement EPRI recommendations, as described herein.

NOTICE OF PROPOSED RULEMAKING

Pursuant to the State Administrative Procedure Act (SAPA) §202(1), a Notice of Proposed Rulemaking (Notice) was published in the State Register on August 30, 2017 [SAPA No. 17-E-0428SP1]. The time for submission of comments pursuant to the SAPA Notice expired on October 16, 2017. No comments were received.

COMPLIANCE ACTIONS TO DATE

The August 16, 2017 Order contained directives for which Con Edison was required to comply by either August 31, 2017 or September 30, 2017.

Ordering Clause 1 required Con Edison to complete by September 30, 2017, all inspections of Con Edison manholes that provide a direct connection to the 462 Metropolitan Transportation Authority (MTA) passenger/signaling facilities in the Con Edison Service territory. Con Edison reports that it completed 268 station inspections by August 31, 2017 and all 462 station inspections by September 30, 2017.

Ordering Clause 4 required Con Edison to correct all design drawings deficiencies identified during the inspections within five days following each inspection. Con Edison reports that it completed all 462 station inspections by September 30, 2017, that during the inspections it identified 196 design drawing deficiencies, and that all the 196 design drawings deficiencies were corrected within five days following each inspection.

Ordering Clause 5 required Con Edison, DPS Staff and MTA to come to an agreement by August 31, 2017 on the scope of

inspections and roles of the parties for the inspection of MTA Property Line Boxes and Electric Distribution Rooms and upon a date certain by which the inspections would be completed. Con Edison reports that Con Edison, DPS Staff and the MTA reached agreement in principle on August 31, 2017 on the scope and roles for these required inspections, and that the agreed-upon date to complete the inspections is February 9, 2018 for 119 priority stations that MTA identified and May 9, 2018 for the remaining stations.

Ordering Clause 7 required Con Edison, DPS Staff and MTA to come to an agreement by August 31, 2017 on the scope of inspections and roles of the parties for the inspection of MTA's interlocking station electric equipment and upon a date certain by which the inspections would be completed. Con Edison reports that Con Edison, DPS Staff and the MTA reached agreement in principle on August 31, 2017 on the scope and roles for these required inspections, and that the agreed-upon date to complete the inspections is May 9, 2018.

Ordering Clause 8 required Con Edison, DPS and MTA to come to an agreement by August 31, 2017 on the scope of inspections and roles of the parties for the inspection of MTA's 221 high voltage substations and upon a date certain by which to complete the inspections. Con Edison reports that Con Edison, DPS Staff and the MTA reached agreement in principle on August 31, 2017 on the scope and roles for these required inspections, and that the agreed-upon date to complete the inspections is September 30, 2017. Con Edison also reports that all five necessary inspections were completed by September 30, 2017.

Ordering Clause 9 required Con Edison to install by September 30, 2017, sensors and monitoring equipment capable of detecting carbon monoxide, water level, and arcing in all the

Con Edison manholes that provide a direct connection to the 462 Metropolitan Transportation Authority (MTA) passenger/signaling facilities in the Con Edison Service territory. Con Edison reports that it completed 244 station installations by August 31, 2017 and all 462 station installations by September 30, 2017.

Ordering Clause 15 required Con Edison to work with the MTA to jointly develop work plans by September 30, 2017 for the 17 high priority locations already identified as opportunities for improved redundancy with respect to Con Edison electric service. Con Edison reports that Con Edison, DPS Staff and the MTA reached agreement on the work plans by September 30, 2017, as required.

Ordering Clause 20 required Con Edison to demonstrate by August 31, 2017, that it has response personnel to provide priority response for power failure issues/impacts affecting the MTA system. Con Edison reports that it provided the required demonstration to DPS Staff and the MTA by August 31, 2017, and it was agreed that Con Edison has sufficient response personnel.

Ordering Clause 21 required Con Edison by August 31, 2017, if deemed appropriate in consultation with DPS and MTA, to coordinate with the MTA to provide a key operating employee as a "virtual presence" on site at the MTA using dedicated secure communications equipment. Con Edison reports that by August 31, 2017, Con Edison, DPS Staff and the MTA reached agreement for the use of a virtual presence and dedicated communications equipment.

Ordering Clause 22 required Con Edison to work with the MTA and participate in a joint response drill on August 10, 2017. Con Edison reports that Con Edison and MTA participated in the joint response drill on August 10, 2017, and that DPS Staff observed the drill.

Ordering Clause 23 directed Con Edison to designate a specific team of individuals to assist DPS and EPRI in their assessment within five business days. Con Edison reports that it designated a team to assist DPS Staff and EPRI with the Power Quality review team within five days of the issuance of the August 16, 2017 Order.

Ordering Clause 28 directed Con Edison to prepare by August 31, 2017, a Project Management Plan to coordinate all its activities related to the MTA system. Con Edison reports that it provided a Project Management Plan to DPS Staff on August 24, 2017.

Ordering Clause 29 directed Con Edison to file with the Secretary a monthly report on all its activities related to the MTA system including performance metrics, progress against targets, and project milestones. On September 18, 2017, Con Edison filed a report covering August 2017. On October 16, 2017, Con Edison filed a report covering September 2017.

In addition, in the August 16, 2017 Order, the Commission noted that DPS Staff advised that it is continuing to identify other needs that may affect Con Edison's service to the MTA or the interplay between the Con Edison and MTA electrical systems. The Commission directed Con Edison to continue to cooperate with DPS Staff and to identify by August 31, 2017 whether there are other specific measures Con Edison could take that would effectively improve the combined reliability of its and MTA's electrical systems and/or to assist DPS Staff in completing the joint review of the Con Edison and MTA electrical systems. On August 31, 2017, Con Edison, DPS Staff and the MTA reached agreement in principle on identifying such other needs and this order reflects the additional scope identified.



DISCUSSION AND CONCLUSION

To protect the health, safety and welfare of the public in New York City and the surrounding suburbs, Con Edison is directed to take the specific steps set forth in the ordering clauses below given the increasing frequency of service outages, derailments and disruptions on the MTA subway system. It is imperative that Con Edison dedicate additional resources to improve the condition of its equipment and the quality of power it supplies to the MTA system.

Adequate performance of these identified measures does not relieve Con Edison of its obligation to provide safe, reliable and adequate service to the MTA system including adequate power quality. Con Edison understands and acknowledges that the loss of power or surges in power adversely affect the operations of the New York City Transit System, possibly affecting millions of riders. Con Edison also knows that it will be held responsible for any such events and/or actions that would not have occurred if Con Edison had exercised prudence in its operation, which also includes their knowledge of prior failures and malfunctions. In addition, failure of Con Edison or its officers, agents and employees to comply with an order imposing these requirements may subject Con Edison to Court-imposed forfeiture of penalties pursuant to Section 25 of the Public Service law or to Commission-imposed assessment of civil penalties pursuant to Section 25-a of the Public Service Law.

To allow the Commission to evaluate the costs associated with the outage and all its activities related to the MTA system as a result of this Order, Con Edison shall separately identify and account for all costs it has incurred and will incur related to its response to the outage, including, but not limited to, its restoration activities, emergency generators, generator fuel, removal and retirement of damaged

cables and equipment, capital expenditures for replacement of cables and equipment, customer damage claims, and contractor services. The segregated costs should include both direct and indirect costs and overheads of all company employees, contractors and mutual aid crews. Con Edison will also separately identify and account for all costs associated with its activities related to the MTA system because of this Order.

This order does not address or provide for any cost recovery. The August 16, 2017 Order and this order will result in a change in Con Edison's annual electric costs or expenses not anticipated in the forecasts and assumptions on which rates in the current rate plan are based. Because in this instance the ten (10) basis point annual deferral threshold in the rate plan creates a perverse incentive for Con Edison to delay work, the Commission will entertain waiving it in this instance if Con Edison can demonstrate that it has sufficiently expedited the emergency work in a cooperative and prudent manner. By compliance with the ordering clauses Con Edison does not waive any of its rights to recover or seek recovery of any prudently incurred costs, and the Commission reserves all of its rights to approve or deny such costs in any future rate case. Any deferral will be considered in light of the level and nature of spending within existing rate allowances.

While some of the ordering clauses below concern deadlines that have already passed and actions that have already been taken by Con Edison pursuant to the August 16, 2017 Order, they are re-adopted here to create a single comprehensive order and to eliminate the possibility of any confusion as to what is being required of Con Edison on a permanent basis.

The Commission orders:

INSPECTIONS AND REPAIRS

1. Consolidated Edison Company of New York, Inc. (Con Edison) will complete by September 30, 2017, all inspections of Con Edison manholes that provide a direct connection to the 462 Metropolitan Transportation Authority (MTA) passenger/signaling facilities. To the extent that the MTA identifies priority inspections, Con Edison should tailor its order of work to accomplish higher priority inspections first.

2. Con Edison will dedicate as many personnel as necessary to complete the inspections.

3. The inspections will include evaluations of overall condition, indications of potential electrical failures, the identification of aluminum conductors, and the verification of the accuracy of design drawings.

4. All design drawings deficiencies identified during the inspections shall be corrected by Con Edison within five days following each inspection.

5. By August 31, 2017, Con Edison, Staff of the Department of Public Service (DPS) and MTA came to an agreement on the scope of inspections and roles of the parties for the inspections of MTA Property Line Boxes and Electric Distribution Rooms and necessary repairs and replacements. Con Edison shall perform the work described in the Appendix to this order under the title "Ordering Clause 5 - Scope of Work" by February 9, 2018 for 119 priority stations that MTA identified and May 9, 2018 for the remaining stations, subject to the MTA providing Con Edison access to MTA's facilities as required.

6. Con Edison will dedicate as many personnel as necessary to the joint inspection of property line boxes and electric distribution rooms.

7. By August 31, 2017, Con Edison, DPS and MTA came to an agreement on the scope of inspections and roles of the parties for the inspections of MTA's interlocking station electric equipment including Relay Rooms, Trackside Equipment, and General work and necessary repairs and replacements. Con Edison shall perform the work described in the Appendix to this order under the title "Ordering Clause 7 - Scope of Work" by May 9, 2018, subject to the MTA providing Con Edison access to MTA's facilities as required.

8. Con Edison and DPS will come to an agreement on what Con Edison's inspection history indicates about the need for additional inspections of Con Edison's area substation equipment serving MTA's high voltage substations. Con Edison will inspect its area substation equipment serving MTA's high voltage substations where indicated by the agreement by June 1, 2018. The inspected equipment shall include but not be limited to area station transformers, circuit breakers, and relays. Further, by August 31, 2017, Con Edison, DPS and MTA will come to an agreement on the scope of inspections and roles of the parties for the inspection of MTA's 221 high voltage substations. Con Edison's role will be to inspect with the MTA, the MTA's maintenance and inspection records and to visually inspect with the MTA its equipment in the field without taking it out of service, and to provide recommendations to MTA by September 30, 2017, subject to the MTA providing Con Edison access to MTA's records and facilities as required. The inspected equipment shall include but not be limited to circuit breakers, disconnect switches, circuit terminations and transformers and rectifiers.

SENSORS AND COMMUNICATIONS

9. Con Edison will install by September 30, 2017, sensors and monitoring equipment capable of detecting carbon monoxide, water level, and arcing in all the Con Edison manholes that provide a direct connection to the 462 MTA passenger/signaling facilities except in a very limited number of conditions where unusual water or other conditions would make the use of the sensors and monitoring equipment infeasible.

10. AMI meters and communications equipment associated with MTA signaling services shall be installed and operable by Con Edison in Manhattan and Brooklyn by January 31, 2018, and in the Bronx and Queens by March 31, 2018, subject to the MTA providing Con Edison access to MTA's facilities as required.

11. Con Edison will work with the MTA to jointly develop by December 31, 2017 both Con Edison and MTA procedures and protocols for communications regarding power and equipment issues, including but not limited to AMI issues. Con Edison's procedures and protocols will be developed and fully implemented by January 31, 2018 in Manhattan and Brooklyn and by March 31, 2018 in the Bronx and Queens.

REMEDICATION AND REPLACEMENTS

12. Any conditions on Con Edison facilities or equipment that it identifies during its inspections required by Ordering Clause 1 that need repair or replacement will be promptly remediated in accordance with Con Edison standards.

13. Con Edison aluminum conductors identified in the inspections required by Ordering Clause 1 will be replaced with copper cable. The 102 locations prioritized "highest" by the MTA as interlocking stations shall be completed by December 31, 2017. Con Edison shall complete the other locations by a date certain established in consultation with the MTA and DPS

following the completion of the inspections required by Ordering Clause 1 above. Any disagreement regarding the "date certain" shall be brought to the Commission for its determination.

14. Con Edison will dedicate as many personnel as necessary to the replacement of aluminum conductors.

15. Con Edison will work with the MTA to jointly develop work plans by September 30, 2017 for the 17 high priority locations already identified as opportunities for improved redundancy with respect to Con Edison electric service. Con Edison shall complete the work for its improved electric service by December 31, 2017 for these 17 high priority locations.

16. Con Edison will work with the MTA to jointly develop work plans by December 31, 2017 to improve the redundancy of Con Edison's electric service and/or install additional redundant Con Edison electric supply options for the rest of MTA's signaling services. Con Edison shall complete the work for the remaining signaling services by a date certain to be established to implement these work plans in consultation with the MTA and DPS. Any disagreement regarding the "date certain" shall be brought to the Commission for its determination.

17. Con Edison will work with the MTA, Electric Power Research Institute (EPRI) and DPS to agree on operational settings for the modernization of Automatic Transfer Panels or related equipment across 88 MTA Stations.

#### BACK-UP GENERATORS

18. Con Edison will establish an inventory of generators such that Con Edison can respond on the scene to restore service with generators on demand. Con Edison will support the MTA's installation of quick connects and other equipment needed to deploy the generators in accordance with the

MTA's schedule. The staging locations for the generators shall be determined by Con Edison, DPS and MTA by December 31, 2017 with the goal that the staging locations are within a radius of 30 minutes for ground transportation from all MTA stations, and they will also consider alternatives to the staging of generators.

POWER ANALYSIS

19. Con Edison will work with the MTA to perform by December 31, 2017 an analysis of power supply and power quality events affecting MTA's signaling services from 2015 to date. The analysis will include the identification of root causes and solutions to avoid or minimize future events.

OPERATIONS RESPONSE

20. Con Edison will demonstrate by August 31, 2017, that it has response personnel to provide priority response for power failure issues/impacts affecting the MTA system.

21. By August 31, 2017, if deemed appropriate in consultation with DPS and MTA, Con Edison will coordinate with the MTA to provide a key operating employee as a "virtual presence" on site at the MTA using dedicated secure communications equipment. The consultation with the DPS and MTA will also consider Con Edison designating and assigning a key operating employee to be on site at the MTA as a part of the critical management team 24 hours a day/7 days a week or as requested by the MTA.

22. Con Edison will work with the MTA and participate in a joint response drill on August 10, 2017.

POWER ASSESSMENT

23. Con Edison is directed to within five business days designate a specific team of individuals to assist DPS and EPRI in their assessment. This team is to include a specific liaison, an executive sponsor, a technical person with working

knowledge of the design and power quality performance of the electrical equipment connected to MTA sites, and personnel to provide access to Con Edison's facilities and perform necessary equipment testing.

24. Con Edison will work with the MTA and EPRI to assist EPRI in the completion of the power quality assessment, including supporting the field inspections, assessing automatic transfer panels and other equipment affecting power quality, and providing any long-term support needed thereafter.

COOPERATION AND ACCOUNTABILITY

25. Con Edison will cooperate with DPS on the DPS Verification Process to ensure that field work is being performed correctly and on time.

26. Con Edison is directed to respond to all DPS correspondence and requests within three business days (in hand or by electronic communication).

27. Con Edison will add to its workforce dedicated to this MTA work, to levels satisfactory to DPS.

28. Con Edison will prepare by August 31, 2017, a Project Management Plan to coordinate all its activities related to the MTA system.

29. Con Edison will continue to file with the Secretary a monthly report on all its activities related to the MTA system including performance metrics, progress against targets, and project milestones.

30. Con Edison will separately identify and account for all costs associated with its activities related to the MTA system because of the August 16, 2017 Order and this order.

OTHER

31. In the Secretary's sole discretion, the deadlines set forth may be extended. Any request for an extension must be



in writing, must include a justification for the extension, and must be filed at least one day prior to the affected deadline.

32. This proceeding is continued.

By the Commission,

(SIGNED)

KATHLEEN H. BURGESS  
SECRETARY

**Ordering Clause 5 - Scope of Work**

Con Edison will use its own workforce and contractors under Con Edison oversight to work with the MTA to visually inspect and infrared the secondary service cables in Property Line Boxes (PLB) associated with signal power and provide necessary repairs and replacements. Where there is no PLB and Con Edison's service terminates in a MTA Service End Box (SEB) the inspection will be performed in the SEB, with access provided by the MTA unless deemed inaccessible by the MTA or Con Edison. The PLB/SEB inspections will be documented on an agreed-upon form. The MTA will supply needed staffing to assist Con Edison to locate, access and jointly participate in the PLB inspections, repairs and replacements.

**A. Property Line Boxes (PLB)**

1. Perform visual inspection of cables and splices. Modify as necessary.
2. Perform infrared (IR) testing. Modify as necessary.

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Con Edison will hire contractors that have related expertise to perform work in MTA Energy Distribution Rooms under MTA oversight and provide necessary repairs and replacements.

**B. Energy Distribution Rooms (EDR)**

1. Identify, inspect & test circuit breakers (CBs) as per EPRI recommendations.
2. Adjust CB time delay settings as per EPRI recommendations
3. Record equipment model/type, including all settings for use in EPRI analysis.
4. Replace all fuses with time delay fuses as per EPRI recommendations.
5. Record fuse type/rating for use in EPRI analysis.
6. Perform IR testing. Modify as necessary.

**Ordering Clause 7 - Scope of Work**

Con Edison will hire contractors that have related expertise to perform the following work under MTA oversight, including providing necessary repairs and replacements. Also, to the extent that the scope of work in any contracts executed between the MTA and a contractor after the Governor's June 29, 2017 Executive Order declaring an MTA State of Emergency but before the date of this Order is for any of the following work in MTA Relay Rooms that was or is to be performed after June 29, 2017, Con Edison will, with respect to such scope of work, issue new contract(s) (or, as it may deem appropriate, assume the portion of the MTA contract(s)) for such scope of work, which work is to be performed under MTA oversight, and make provision for the amount of any prior payments by the MTA, or amounts due, to such contractor for the completed portion of such scope of work to be payable by Con Edison.

**C. Relay Rooms**

1. Transfer Panels
  - i. Replace 73 Automatic Transfer Panels at locations identified by the MTA.
  - ii. At the remaining ATP locations, identify, inspect and test currently installed ATPs. Retrofit and/or repair as needed.
2. Signal Power Locations

At all locations receiving signal power, including those identified in 1 above:

  - i. Install sag correctors to support MTA signal power as needed pursuant to the recommendations in the EPRI report.
  - ii. Replace fuses as per EPRI recommendations.
  - iii. Perform IR testing. Modify as necessary.
3. Protection/Disconnects
  - i. Identify, inspect & test circuit breakers (CBs). Modify as necessary.
  - ii. Adjust CB time delay settings as per EPRI recommendations

- iii. Record equipment model/type, including all settings for use in EPRI analysis.
- iv. Replace all fuses with time delay fuses as per EPRI recommendations.
- v. Record fuse type/rating for use in EPRI analysis
- vi. Perform IR testing. Modify as necessary.
- vii. Install 162 quick connects and other equipment needed to deploy back-up generators, primarily for the elevated subway lines as determined by Con Edison, DPS and the MTA. Review remaining subway signal locations (jointly Con Edison, MTA and DPS) to determine the most effective way to provide alternate electric service following a loss of Con Edison electric service to a signal location.

#### 4. Rectifiers & Batteries

- i. Inspect rectifiers and rectifier settings. Perform modifications as per EPRI recommendations.
- ii. Replace rectifier fuses with time delay fuses as per EPRI recommendations
- iii. Identify, inspect and test currently installed batteries state of health. Perform modifications as per EPRI recommendations.
- iv. Perform load testing of batteries after EPRI has reviewed and agreed with the MTA inspection procedure.
- v. Replace all fuses with time delay fuses as per EPRI recommendations.
- vi. Perform IR testing. Modify as necessary.

#### 5. Transformers

- i. Perform visual inspection of transformers.
- ii. Record equipment data for use in EPRI analysis.
- iii. Perform IR testing. Modify as necessary

#### 6. Equipment Racks

- i. Perform inspection of racks
  - 1. No pinched, broken or damaged wires
  - 2. Proper terminals used for application
  - 3. Equipment properly secured
  - 4. Sufficient thread through nuts
  - 5. Washers & lock washers under all nuts
  - 6. American Association of Railways (AAR) terminals have proper hardware

7. Verify ground stud on rack, test, modify as necessary
8. Replace all fuses with time delay fuses as per EPRI recommendations. Perform IR testing. Modify as necessary.

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Con Edison will hire contractors that have related expertise to perform work on Trackside Equipment under MTA oversight and provide necessary repairs and replacements.

**D. Trackside Equipment (Includes Interlocking's)**

1. Signals
  - i. Perform inspection. Modify as necessary.
    1. All insulating nuts installed
    2. All equipment securely installed
    3. No scraped, pinched, broken or damaged wires. All wires tight
    4. Terminal boards have proper hardware and are not damaged
    5. Case watertight
    6. Sufficient thread through bolts
    7. Case properly grounded, test
    8. Cable entrance grommeted
    9. Conduit bushings installed
    10. Unused openings sealed
    11. Grounding rod installed, test
    12. Wires properly crimped
    13. Adverse conditions
2. Signal Cables  
Modernize and replace signal cables at high priority locations as determined by MTA, Con Edison and DPS.
3. Stop Machines
  - i. Perform inspection, collect data for EPRI analysis
    1. Stop properly gauged
    2. Back stop bolt properly adjusted
    3. Contacts tight, no burns, circuit controller free of debris (washers, nuts, etc.)

4. No scraped, pinched, broken or damaged wires. All wires tight
  5. Stop motor quick connect tight/secure
  6. Buffer spring protruding
  7. Snow melter functional (where required)
  - ii. Replace capacitors where applicable.
4. Track Switch Machines
- i. Perform inspection. Modify as necessary.
    1. Switch properly fastened
    2. Contacts tight, no burns, circuit controller free of debris (washers, nuts, etc.)
    3. No scraped, pinched, broken or damaged wires
    4. Wiring neat & secured
    5. Sufficient slack in wires
    6. All wires properly crimped
    7. American Association of Railways terminals have proper hardware
    8. Cable entry sealed
    9. Circuit controller properly adjusted
    10. Circuit controller properly wired
    11. Switch cable entrance fitting installed
    12. Snow melter functional (where required)
5. Track Circuits
- i. Perform Track Circuit Inspection and Tests. Modify as necessary. Record all data for EPRI analysis.
    1. Ground test
    2. Inspect negative return and jumper bonds
    3. Ballast leakage test
    4. Shunt sensitivity, test/adjust
    5. Test for shorts
    6. Test track circuit voltage
    7. Test power supply voltage
  - ii. Replace all signal wire connections to rails (Bootleg Pins)
  - iii. Inspect and test all Insulated Joints (IJ's)
6. Junction Boxes (Includes signal & switch machines)
- i. Perform inspection. Modify as necessary.
    1. Wire mesh breathers installed & free of obstructions
    2. Case intact, no cracks

3. Cable access covers and gasket screws installed
  4. Cable served properly
  5. Cable entry sealed
  6. Cable strain installed
  7. Wiring properly dressed
  8. All wires properly crimped
  9. AAR terminals have proper hardware
  10. Case grounded, test
  11. Door gasket seals properly
  12. Vents in case clear
7. Cables & Airlines
- i. Perform inspection of wayside cables and airlines. Modify as necessary.
    1. Inspect wayside cables/wiring and hardware for defective insulation, rust, corrosion, missing components, damage, and loose or broken connections, and for damage caused by standing water, water leaks, or retention.
    2. Inspect air supply piping and fittings for evidence of leakage, damage, cracks or corrosion
    3. Inspect all mounting hardware, such as bolts, nuts, washers and retaining mechanisms, for proper attachment.