Appendix E

New Jersey Transit Newark Light Rail (NLR)

Description and Contacts

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Newark Light Rail (NLR) system

The NLR system is owned by New Jersey Transit (NJ TRANSIT) and operates for approximately 5.9 route miles of double-track between Bloomfield, NJ and Newark, NJ. The NLR line provides service to approximately 22,000 people daily while running 20 hours a day, 7 days a week. From seventeen designated NLR stations, passengers can connect to NJ TRANSIT bus and rail lines as well as Port Authority New York and New Jersey (PATH) and Amtrak rail service.

Description of Line

The double-tracked light rail line includes 1.7 miles of in underground light rail with 4 stations and 4.7 miles above ground or in depressed open cut right-of-way and twelve stations. The light rail stations in the underground tunnel proceeding outbound are located at Penn Station, Military Park, Washington Street and Warren Street. Continuing outbound, the stations in open cut and at grade are Norfolk Street, Orange Street, Park Avenue, Bloomfield Avenue, Davenport Avenue, Branch Brook Park, Silver Lake and Grove Street. The stations proceeding outbound in the street-running segment are NJ PAC, Atlantic Street, Broad Street and Washington Park on the inbound alignment. A special event stop is provided at the Riverfront Stadium, a raised sidewalk provides accessibility to the light rail vehicles (LRVs). Embedded track is used in the street-running segment and the critical curves are protected with girder rail.

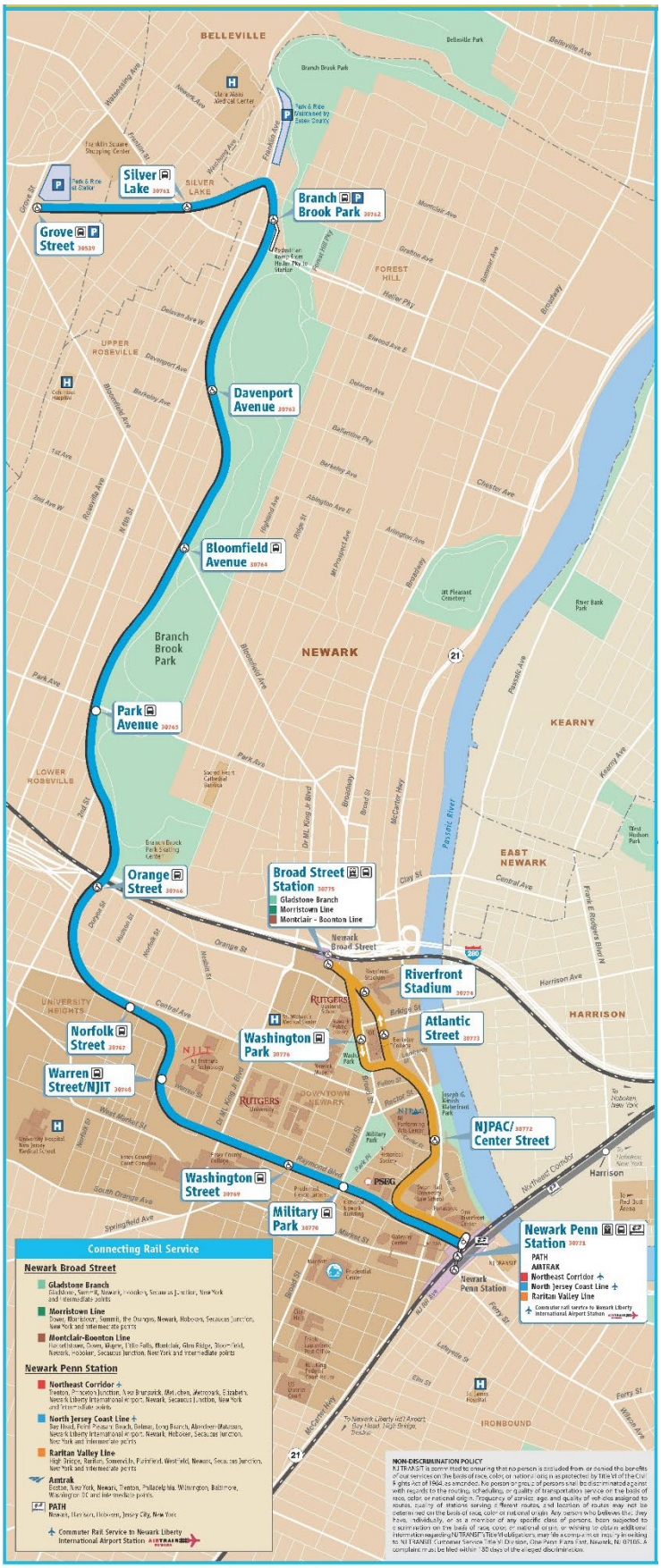
FRA Shared Right-of-Way

Access to the NLR Vehicle Base Facility (VBF) extends along a portion of the Norfolk Southern (NS) Orange Industrial Track (MP-9.156 and MP-9.83) of which a 0.24 mile portion is utilized by both NLR and the freight carrier. This portion is under FRA Waiver 2000-7335 (expiration: 12/31/2040).

Bridges

There are nine overhead auto bridge crossings of the NLR right-of-way. Fencing and screening have been added to all crossings to reduce the possibility of a person throwing or discarding objects onto the vehicles or the right-of-way. The NLR system crosses over the NJ TRANSIT Morris & Essex commuter rail lines at Orange Street in Newark. The two bridges are equipped with high-fencing to minimize trespassing and throwing objects on to the commuter rail-right-of-way. Iron rod, fluted panels, steel plates and concrete parapet walls have been used as fencing. Wire mesh is used to supplement the fencings in areas where there is a high rate of incidents.

The 750 volt DC overhead contact system (OCS) is insulated from the bridge structure through the use of K&M arms mounted on either wood or inverted fiberglass U-channels. The channel is continuous for the length of the OCS and extends on both sides of the crossings to reduce the chances of objects hitting or contacting the wire.


BELLEVILLE
Silver Lake
Branch Brook Park
Grove Street
FOREST HILL
UPPER ROSEVILLE
Davenport Avenue
Bloomfield Avenue
NEWARK
Branch Brook Park
Park Avenue
LOWER ROSEVILLE
KEARNY
EAST NEWARK
Orange Street
Broad Street Station
Gladstone Branch
Morristown Line
Montclair - Boonton Line
Riverfront Stadium
HARRISON
Atlantic Street
Norfolk Street
Washington Park
Warren Street/NJIT
UNIVERSITY HEIGHTS
DOWNTOWN NEWARK
NJPAC/ Center Street
Washington Street
Military Park
Newark Penn Station
PATH
AMTRAK
Northeast Corridor
North Jersey Coast Line
Raritan Valley Line
IRONBOUND
Connecting Rail Service
Newark Broad Street
Gladstone Branch
Morristown Line
Montclair-Boonton Line
Newark Penn Station
Northeast Corridor
North Jersey Coast Line
Raritan Valley Line
Amtrak
PATH
Commuter Rail Service to Newark Liberty International Airport Station
NON-DISCRIMINATION POLICY

Electrification

The purpose of the electrification system is to supply and distribute electric traction power for the NLR system. The electrification provides all related functions including conversion and switching of traction power, negative return, and auxiliary power. Critical physical components of the electrification include: Sub-station connections to incoming utility (Public Service Enterprise Group – PSE&G) power, connections at the rialto impedance bond leads and traction power bonding, and connections to the auxiliary power equipment located in train control, station and shop systems as well as line feed switches and jumpers. Traction power stations are protected with a fire detection system and security intrusion alarms. Overhead Catenary isolation switches are located along the right-of-way to control power to sections of the power distribution system.

The major components within the electrification system include but are not limited to:

- Substation and power distribution – including all traction power feeder cables to the OCS as well as the return cable.
- Overhead Catenary System – including catenary poles, overhead wire, and sectionalized by-pass switches, pole mounted surge arrestors. And cast-in-place foundations. The overhead catenary wire is installed within the dynamic outline of the tracks with a vertical height from top of rail between 12.3 to 22 feet.
- Stray current mitigation – including bonding and isolation equipment, which includes rail bonding.

Traction Power Substations (TPSS) are spaced along the right-of-way at approximately 1-1/2 mile intervals. The NLR system has a total of six (6) substations, the Substations have traction power rectification equipment and switch gear to supply 750 volts DC to the OCS. Normal operations can be maintained with one TPS inoperative and/or out of service. All Traction Power Stations are equipped with an internal fire detection system and an intrusion alarm system that is monitored by the NLR OC through the SCADA network.

SCADA/Supervisory System is remotely connected to train control, traction and ventilation systems. It allows OC to monitor in real-time, the status of aforementioned systems including the train movements. Certain remote control functionalities of the systems are allowed as long as they do not violate the fail-safe principle configured on each system. The supervisory system is considered “non-vital” because it cannot override the vital systems in the field

The Penn Station and Grove TPSS are equipped with two (2) power feeds from separate circuits from the local power supplier. All other TPSs have a single power supply from the local power company.

Each TPS is equipped with an automatic trip resent feature. Tripped circuit breakers will automatically resent, after a brief interval, two (2) times before they must be manually reset.

The power distribution system conducts current from the traction power substation to the vehicle pantograph. The track system forms the return side of the circuit back to the substation due to its role in the interaction between the pantograph and the contact wire.

All metallic system elements that support the OCS are grounded and provide protection against the buildup of electrical ground faults.

Emergency Trip Stations (ETS) are located at each traction power substation and at the rail entrances to the Shop Building and LRV Storage Shed at the VBF. At the substations, the ETS are mounted on the building wall adjacent to the entrance door and are secured in a locked box. When the button is pushed, the track current to the catenary is de-energized. The ETS for the Shop Building and LRV Storage Shed act only on the single DC breaker supplying the catenary in the respective building. ETS are intended for the rapid de-Energization of the OCS by maintenance or possibly emergency response personnel.

Regular visual and functional tests of traction power equipment are accomplished in accordance with best industry practice. The NLR Superintendent is directly responsible for inspection and testing activities as well as preventative maintenance of the electrification system.

Train Control

The Train Control System provides the primary functions of train routing at the five (5) interlockings and the power operated crossovers on the NLR Systems as well as train separation at all locations other than in the yard. The system also provides the function of on-board speed sensor enforcement through the cab signaling system acting on the LRV's traction power and braking control system. The train control system is an audio frequency track circuit controlled system which displays the necessary commands in the vehicle cab. The vehicle is manually controlled by an operator who must comply with the displayed commands. In the event that the operator does not comply with the displayed commands, an audible warning sounded to alert the operator to take appropriate action. Further disregard of the displayed command results in the system bringing the train to a safe condition automatically.

The Automatic Train Protection (ATP) provides full train "stop: protection and speed control in either direction on either track. The NLR operation is bi-directional with reverse signaling. The available speeds for operation are in increments between 5 and 50 MPH.

The train control system also ensures that conflicting routes cannot be set, either manually or automatically. Once a train is routed, all other conflicting moves are prevented by the automated system. These features are provided at all controlled track switches where conflicting train movements cold be initiated, otherwise known as interlockings. These interlock locations are also equipped with wayside signals which provide additional visual directions to the operator. Noncompliance with a wayside signal will result in activation of the ATP.

The train control system also includes Train-to-Wayside (TWC) communications which provides for routing requests at interlockings and supplemental information regarding train location.

A functional check of the operation of all signaling and train control equipment and verification of software integrity is performed as required to meet safety and service availability requirements. The NLR Superintendent is responsible for the inspection and verification of train control equipment.

Traffic Operating System

This system includes all traffic control software, computer hardware, and devices which control the movement of LRVs and motor vehicles at highway and track intersections. The Traffic Operating System (TOS) interrupts the normal motor vehicle traffic control device cycle (via use of pre-emption or priority) upon approach of an LRV. The traffic control device is cycled to stop motor vehicle traffic to allow passage of the LRV. LRV movements are governed by a separate bar signal system that is displayed perpendicular to the motor vehicle traffic control devices. All NLR LRVs and special purpose vehicles stop at all highway/track intersections and proceed after visual verification that all motor vehicles have stopped clear of the intersection.

All trains, stations and communications (normal and emergency) are monitored through Controllers in the Operations Control Center. Controllers are responsible for all operations on the tracks and at the stations. Transportation Clerks have the ability to communicate with passengers through CCTV cameras and phone connections at multiple station locations, to help aid in decisions for safe operation, answer questions or direct actions during station platform emergencies. The Alternate Operations Control Center is located in Newark Penn Station and is exercised by NLR controllers once a month. The software was upgraded since the last Triennial Survey in 2014. The Survey Team acknowledges the importance of keeping the Alternate Operations Control Center active and up-to-date.

Track

The primary purpose of the fixed guideway is to provide support and guidance to trains. NLR utilizes three types of track which are:

- Ballasted Track – consisting of 115 lb. AREMA rail installed on wood ties fastened with a spring-loaded Pandrol clip
- Slab (Direct Fixation) – consisting of 115 lb. AREMA rail fastened directly to cast-in-place track plinths. The rail rests on resilient plates which are in turn bolted to the plinths. Special effort is made to provide electrical isolation of the rai from the concrete.
- Embedded Track – consisting of 115 lb. AREMA girder rail implanted into the guideway so that it is flush with the roadbed.

Switches/Crossovers

Electric crossovers are located throughout the system to provide operational flexibility. LRV movements through these power operated crossovers are automatically routed from normal operation through the Train Control System. Wayside home signals are present to provide the LRV Operators with color aspects that indicate stop and wait as well as aspects for turn-out and through moves. Train to Wayside (TWC) equipment on board the LRV and antennae receivers near the crossovers allow the LRV Operator to align the switches for either turn-out or through movements. An Automatic Train Protection (ATP) system with positive train stop prevents conflicting LRV movements at interlocking and crossovers. In Penn Station, the crossovers are controlled by electro-pneumatic switch machines.

Maintenance and Storage Areas

The Vehicle Based Facility (VBF), located in Bloomfield, NJ, is the primary maintenance facility for the LRV fleet. The VBF site includes the LRV Maintenance Shop, the LRV Storage Building, Maintenance of Way (MOW) Storage, an electrical substation, and three (3) Central Instrument Houses (CIHs).

The LRV Maintenance Shop is a one story building with a mezzanine. The maintenance shop contains four (4) tracks and all the necessary shop equipment and service pits to accomplish all maintenance and repairs of the LRV fleet, including: paint booth, car wash, car inspection/repair area, heavy repair area with car lifts, wheel truer, and parts/supplies warehouse. Since the major components are located on the roof of the LRVs raised platforms have been installed to provide access to the roof, additionally, and electric hoist, on a fixed guideway, has been installed to transport components from the LRV roof to the repair area. OCS isolation switches are provided to control power to the individual shop tracks. Lock Out/Tag Out procedures are established to ensure employee safety when working near the high voltage catenary wires.

The LRV Storage Building provides weather protection for the fleet. This building has three (3) tracks and is open at either end to allow the free movement of LRVs through the building. Peak service pull outs typically occur from the storage building. Additionally, off-peak interior cleaning and pre-trip inspection are performed in this area.

The MOW Storage Building provides additional storage for larger components and allows forklift access to storage racks.

Light Rail Cars

NLR uses a fleet of twenty-one (21) bi-directional LRVs for revenue service. The LRVs are 70% low floor articulated vehicles, 9 feet wide, and 12 feet high. The LRV is equipped with doors on each side of the vehicle to allow passenger access/egress and one door on each side to the Operator's compartment. The vehicle has spaces for wheelchairs and is compliant with the accessibility provisions of the Americans with Disabilities Act (ADA).

	3-CAR CONSIST	5-CAR CONSIST
MANUFACTURER	KINKISHARYO International	KINKISHARYO International
QUANTITY	11	10
YR. DELIVERED (LAST)	1999/2004	2015/2016
BODY TYPE	6 axle double articulated	8 axle quadruple articulated
TRAIN LENGTH	90 ft. (27 m)	127ft. (39 m)
EMPTY WEIGHT	99180 lbs. (45000 kg)	128000 lbs. (58059 kg)
SEATS	68 passengers	102 passengers*
MINIMUM RADIUS	60 ft. (18 m)	60 ft. (18 m)
VOLTAGE (VDC)	750 DC	750 DC
MAXIMUM SPEED (BALANCE)	50 MPH	50 MPH
FULL ACCELERATION	3.0 mphps (1.34 m/s2)	3.0 mphps (1.34 m/s2)
DECELERATION, SERVICE	3.0 mphps (1.34 m/s2)	3.0 mphps (1.34 m/s2)
HIGH/LOW PLATFORM	Low	Low
ADA ACCESSIBILITY	Level Boarding	Level Boarding
MAXIMUM CARS TO TRAIN LINE	3	3
NOISE LEVEL AT 40 MPH & 50F	75 dBA	75 dBA

**denotes 40% increase in passenger seating capacity.*

The vehicle may operate at speeds up to 50 MPH and is powered by 750 volts DC by means of a pantograph contacting the overhead catenary system. The vehicles are equipped with several braking systems. At higher speeds, the braking action is achieved by the dynamic brakes which use the resistance of the traction motors to slow the vehicle. The dynamic brakes are blended with mechanical disc (friction) brakes as low speeds are reached until all braking is supplied by the disc brakes as the train comes to a full stop. In the event of an emergency requiring maximum braking effort, the dynamic and disc brakes are supplemented by the track brakes. The track brake is operated by a console push button and applies a magnetic iron core to the running rail surface.

Tunnel Safety Features

The underground tunnel, is built of concrete and steel, is approximately 1.7 miles in length starting at Penn Station, Newark proceeding to Warren Street, Newark. An 800' section of tunnel was added as part of the Broad Street alignment extension with the portal located at Center Street in Newark.

A dry standpipe system has been installed in the tunnel for use by the Fire Department for fire suppression activities. The standpipe system is not connected to a water source and must be supplied by fire apparatus. Six (6) Fire Department connections are strategically located to charge the standpipe system. Standard 2-1/2" outlets are provided in the tunnel at approximately 300' intervals for Fire Department hose connections. The outlets are equipped with pressure reducers to provide safe operating pressure for Fire Department personnel.

The tunnel is equipped with a mechanical ventilation system designed to aid in fire and smoke control. The system has an environmental mode for routine ventilation. The system incorporates 115 bi-directional axial fans and 10 bi-directional jet fans to achieve optimal flexibility and air flow management. Critical system components are hardened to withstand high temperature for a minimum of one hour. Materials for electrical conduits, raceways, ducts, equipment enclosures, and their surface finish materials can withstand elevated temperatures for a minimum of one hour and will not support or contribute to combustion.

Power for the ventilation system is provided from two separate and distinct utility sources fed from different power grids. The primary power source is from the Warren Street sub-station and a secondary feed from the Mulberry Street sub-station is totally isolated from the main system feeds to provide a reliable redundant power supply.

Thirty-three (33) of the axial fans have two-speed capability. These fans may be used for routine environmental ventilation as well as smoke control and extraction.

Fluorescent lighting is provided throughout the tunnel and station areas. Each light fixture contains two fluorescent tubes normally powered by the auxiliary AC power distribution system. One tube in each fixture is powered from a battery back -up for emergency lighting in the event of a power outage.

Right-Of-Way Safety Features

From Warren Street to the VBF, the track way is located either in depressed open-cut or at grade right of way. The entire mainline segment is fenced to deter access to the right of way and secure non-operating sections of the platforms, except where the line crosses city streets at grade. A gate is located in the vicinity of the Bloomfield Avenue Station for maintenance and emergency access.

Inter-track fences are located at seven (7) stations. These sliding gates allow passengers to cross the track in the event of an emergency.

The Broad Street Extension (BSE) is a mixed street-running segment where automobile traffic operates parallel to the guideway. The guideway is separated from the traffic lanes by a mountable granite curb 6" high. The extension alignment has fourteen grade and pedestrian crossings. These intersections are protected by traffic control devices that are integrated with the train control system to give priority to the LRVs and to prevent conflicting signals and unsafe vehicular movement. Each intersection is marked in accordance with the provisions of the US Department of Transportation Manual of Uniform Traffic Control Devices and the NJ Department of Transportation diagnostic team recommendations.

Station Platforms

Closed Circuit Television (CCTV) units ae used to monitor activity on the station platforms. CCTV transmissions are monitored at the NJ TRANSIT Police Central Communications Center and the NLR Operations Control Center.

Each station platform edge is identified by a high-visibility safety line or with a tactile surface. Frequent Automated public address announcements e made to remind customers of safety-related advisories. Additionally, warning signs and No Trespassing signs are located at the ends of each station platform and at pedestrian crossings to deter unauthorized access onto the right-of-way.

NLR Contacts

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NLR Minimum Standards for Safety

MINIMUM STANDARD	DOCUMENT DESCRIPTION	DOCUMENT DATE	DOCUMENT VERSION NO	SSI
SSOPS	**NJDOT Fixed Guideway SSO Program Standard**	**10/2021**	**Version 2.0**	**FALSE**
ASP	Agency Safety Plan (ASP) – The ASP contains the requirements for the safety program and related activities at the RTA/RFGPTS.	8/3/2020	1.0	FALSE
CMP	Configuration Management Plan (CMP) – the Configuration Management Committee and processes are a required element/function within the RTA/RFGPTS safety program, along with safety and security certification and system modifications.			TRUE
EOP	Emergency Operations Plan (EOP) – this document provides the coordination and preparedness activities inside and outside of the RTA/RFGPTS.			TRUE
I&M	Inspection and Maintenance (I&M) Manuals, SOPs, and Standards – these documents provide the requirements for inspection and maintenance of the rail system, including facilities, infrastructure, and related vehicles. These documents should have the customized safety standards integrated.			FALSE
Investigation Procedures	Investigation Procedures at the RTA/RFGPTS – this procedure includes a description of the types of events that need notification and investigation, who will perform those requirements, causal factor analysis, hazard analysis, and development of recommendation.	6/1/2019	Accident Investigation Guide for NJ Transit, Book #20	FALSE
RORB	Rail Operating Rule Book (RORB) – these are the rules that operators and others working around the rail system must follow.			FALSE
RWP	Right-of-Way or Roadway Worker Protection (RWP) Plan – this document is related to the RORB from the perspective of the protections and procedures for workers on the rail right of way.	10/4/2017		FALSE

MINIMUM STANDARD	DOCUMENT DESCRIPTION	DOCUMENT DATE	DOCUMENT VERSION NO	SSI
SOPs - Command and Control	Command and Control/Train Control Standard Operating Procedures (SOPs) – these SOPs are used by the command and control staff/supervision to manage operations on the rail system for both usual and unusual operations, as well as managing maintenance and workers on the right of way. These SOPs should include troubleshooting information for frequent problems and managing emergencies on the rail system. These SOPs include the function of load control/management.		Newark Light Rail – Route Learning System (2/28/2017)	TRUE
SOPs - Field Supervision	Field Supervision SOPs – these SOPs are for supervision out on the rail system for support of service delivery, responsiveness to passengers, and safety. The field supervisors will often be the first supervision to arrive at the scene of a safety event on the rail system and provide at least initial investigation of events on the rail system.			FALSE
SOPs - Safety	Procedure requiring review of SOPs related to Safety – this procedure requires that the minimum safety standards at the RTA/RFGPTS are also required to be reviewed, agreed to, and approved by the Safety Department.			FALSE
SSCP	Safety and Security Certification Plan (SSCP) – this plan provides the required activities from the RTA/RFGPTS safety program for assuring that safety and security certification is completed for certain capital projects for new equipment/infrastructure or refurbishment of existing equipment/infrastructure. The main topics for safety and security certification are related design criteria, participation of the Safety Department, and a process of the RTA/RFGPTS assuring that all safety and security design criteria exist, were comprehensive, and were properly addressed including integrated testing of the final products.			FALSE

MINIMUM STANDARD	DOCUMENT DESCRIPTION	DOCUMENT DATE	DOCUMENT VERSION NO	SSI
SSP/SEPP	System Security Plan (SSP)/Security and Emergency Preparedness Plan (SEPP) – this security program document describes the requirements for system security and emergency preparedness at the RTA/RFGPTS. Note that the new SSO Rule no longer defines the content of the SSP/SEPP and its processes and procedures. However, the NJDOT SSO program will now consider this security program document as a minimum safety standard in terms of its overlap with the safety program at the RTA/RFGPTS (risk assessment and management, and emergency preparedness). The NJDOT SSO program no longer has requirements for the content of the SSP/SEPP, but does require that the RTA/RFGPTS develop an appropriate security program document and the NJDOT SSO program will provide oversight of that document and the processes that it represents, but only from the safety program (all-hazards) perspective.			FALSE
TAM	Transit Asset Management (TAM) Plan – this is a new plan now required for RTAs/rail properties and it is related to the CMP, but with a larger context.			FALSE

Updates:

- March 5, 2018 – initial version
- July 6, 2020 – minor word changes, update of NLR contact information, updates to the status of minimum standards for safety table
- September 22, 2020 – minor updates from the RFGPTS and NJDOT
- May 26, 2021 – minimum standard updates
- October 1, 2021 – ASP SSI flag set to “False”; NJDOT SSOPS date updated to 10/2021.