02 Long Island Rail Road

Passenger vehicles and yards

Passenger stations

Right-of-way

Signals, power, and communications

Overview of agency and assets

The largest and busiest commuter railroad in the nation, the Long Island Rail Road (LIRR) comprises 126 passenger stations, more than 700 miles of electrified and non-electrified track, and 11 branches stretching from Montauk on the eastern tip of Long Island to Penn Station and Grand Central Madison in Manhattan, nearly 120 miles away. On weekdays, the LIRR provides up to 250,000 trips per day, which represents almost 75% of its ridership prior to the COVID-19 pandemic.

The LIRR has a rich history dating back to 1834, making it the oldest continuously operating commuter railroad in North America. Some of our infrastructure has even been around since those early days, like the Atlantic Avenue Tunnel, portions of which were built in 1905. Given our age, we have significant work to do to rebuild and rehabilitate aging assets so we can boost reliability and provide our community with world-class service.

The LIRR by the numbers

- **Weekday ridership: Approximately 230,000**
- **Approximately 1,100 electric multiple unit (EMU) passenger railcars, 134 coaches, 45 passenger locomotives, 33 work locomotives**
- **Six shops and 32 yards**
- **126 passenger stations**
- **700 miles of track**
- **56 overgrade bridges, 504 undergrade bridges, four tunnels, 29 viaducts**
- **578 mainline switches**
- **129 power substations**

Cherry Valley Avenue Bridge

Investment needs highlights

Over the next 20 years, our priority investment needs include:

- **Passenger vehicles and yards**
  - Purchasing new railcars to meet expanding service needs and replace aging cars to improve reliability, accessibility, and passenger experience.
  - Advancing MTA sustainability goals by replacing locomotives with new dual-mode locomotives.

- **Passenger stations**
  - Achieving full ADA accessibility for 100% of our stations.
  - Rehabilitating or replacing deteriorating station components such as platforms, canopies, and station buildings throughout the system.

- **Right-of-way**
  - Fixing the Atlantic Avenue Tunnel through structural rehabilitation, waterproofing and enhanced lighting, fire safety, and security systems.
  - Replacing or rehabilitating 60-100 bridges and 11-23 viaducts to bring our all bridges and viaducts into good condition.
  - Improving service reliability by completing the reconfiguration of track at Jamaica to alleviate bottlenecks, reduce delays, and help trains move faster.

- **Signals, Power and Communications**
  - Renovating or replacing substations to ensure reliable traction power throughout electrified territory.
  - Improving customer communications, ensuring reliability, and increasing safety and security by installing new digital signage and upgrading the control systems that serve stations.
  - Modernizing approximately 50 miles of signal systems and replacing aging and/or obsolete components with latest-generation electronics providing modern and more reliable signal systems.

Mineola Station

Long Island Rail Road appendix structure

The LIRR appendix provides an overview of the agency's assets, their current condition, and expected investment actions t.to maintain and improve them over the next 20 years. The appendix is divided into asset groupings, based on how our asset categories function together. For example, our passenger vehicles are supported by our shops, yards, and facilities, so together they form an asset grouping. We provide a summary of each asset grouping, describe how the asset categories support each other, and then provide a 20-year vision for their maintenance and enhancement. Each asset category section then provides a more detailed description of the asset, an inventory showing asset ages or the percentage of assets in poor or marginal condition, followed by the agency's investment needs and priorities for the next 20 years.

Our asset rating methodology

We perform regular and comprehensive inspections of all of our assets. Through these inspections, all assets are given a condition rating on a scale of 1 to 5, based on various factors, including age, condition assessment, performance, reliability, safety history, and location. Assets with a rating of 1 (poor) or 2 (marginal) help us identify where we need to focus investment needs the most. This rating scale is consistent with the Federal Transit Administration's Transit Economic Requirements Model scale. A brief description of the rating scale is provided below.

1. Poor (Deteriorated): Critically damaged or in need of immediate repair, well past useful life. Assets are operable with extraordinary maintenance, but have serious functional deficiencies and/or can be expected to experience potentially unacceptable stoppages over the next five years, which could have serious negative impacts on service within the existing maintenance framework. Assets require operating-funded interventions, which may include more frequent inspections and/or repairs that may include removing the asset from service until repairs can be performed. Capital investment in these assets is needed on a priority basis.

2. Marginal (Deficient): Deteriorated, in need of replacement, and may have exceeded useful life. Assets have functional deficiencies and/or can be expected to experience above-normal stoppages over the next five years, but severity of customer impacts or changes to operational practices can be held within acceptable bounds for a time within the existing maintenance framework. If capital investment is/was deferred for these assets, added maintenance and operating expenses would be expected.

3. Adequate (Acceptable): Moderately deteriorated, but has not exceeded its useful life. Assets that are not necessarily meeting all current technical and functional standards, but are considered adequate for service and can be expected to experience normal stoppages that can be fully accommodated within the existing maintenance framework. These assets may require cyclical replacement in the next five years.

4. Good: No longer new, but in good condition and still within its useful life. Assets may be slightly deteriorated, but are overall functional within the normal maintenance practices.

5. Excellent (Modernized): No visible defects, new or near new condition and may still be under warranty (if applicable). Considered to meet most or all important technical and functional standards.

It is important to note that an asset condition rating is not an indicator of safety. Safety and risk assessments are performed separately from asset condition ratings and are addressed on an ongoing basis.

PASSENGER VEHICLES AND YARDS

02

The LIRR operates passenger service with a fleet of roughly 1,300 railcars. When these trains are not running in passenger service, they are either staged at one of our 22 passenger fleet rail yards or they are at one of our six shops, where they are cleaned, inspected, or undergoing maintenance.

To ensure passenger safety, federal regulations and LIRR procedures require testing and inspections of railcar and locomotive components and systems such as braking and power systems, lights, wires, cables, doors, air conditioning, radios, and more, each day they are in service. These basic inspections take place at our yards before trains are put into service. Railcars also undergo regular interior and exterior cleaning and more comprehensive inspections and scheduled maintenance at recurring intervals at our shops to ensure reliability. In the rare event of a mechanical failure, unscheduled maintenance for all railcars is also performed at these shops. In addition to our 22 yards and six shops dedicated to passenger railcars, we have five yards and one shop dedicated to the maintenance, storage, and inspection of work trains, including materials and support equipment we use to make repairs to our tracks, bridges, and other railroad infrastructure.

To deliver high quality, safe, comfortable, and reliable train service to our passengers, it is necessary that we have a modern and well-maintained fleet, as well as yards and shops with adequate capacity and that are in a condition that allows us to work safely and efficiently. Toward that end, we must continue to invest in new railcars, and we must invest in our yards and shops so that we can maintain our fleet effectively and meet our service guidelines.

Our investment needs over the next 20 years include:

- Purchasing new electric railcars to meet expanding service needs and replacing aging cars to improve reliability, accessibility, and passenger experience.
  - The expanded fleet is needed to support increases in train service made possible by the opening of Grand Central Madison and Main Line Third Track.
- Upgrading our coach fleet through the replacement of the aging C3 Bilevel as they reach the end of their service life later in the 20 year timeframe.
- Replacing of all locomotives, which are nearing the end of their 30-year “useful life,” with new Tier IV dual-mode units that will use more electric power and less diesel than current locomotives.
- Rehabilitating or replacing existing components in various LIRR maintenance shops and yards, and renovation or expansion of electric fleet maintenance facilities to ensure that facilities are safe and are adequate for future operational needs.
  - Renovating, expanding, and adding shops and yards to care for the technologically evolving and expanding fleet.
  - Ensuring these facilities are climate-resilient—to address risks like increased flooding and heat—and sustainable to advance MTA’s goal to reduce greenhouse gas emissions 85% by 2040.

Passenger vehicles

The majority of the time that our customers spend with us is on board our passenger vehicles, and thus the condition and performance of our passenger vehicles is a major determinant of overall customer experience and satisfaction, as well as a major factor in our ability to deliver safe and reliable service. Our passenger vehicle fleet is comprised of four distinct types of railcars: two that carry passengers and two types of locomotives.

EMU
Short for electric multiple unit, this is our most common type of passenger railcar. Electricity from a third rail powers these self-propelled carriages which are grouped into "married pairs" (permanently linked pairs of cars) that share equipment, currently including M9, M7, and M3 railcars; they do not require a locomotive.

Double Decker Coach
A push-pull railcar that carries passengers on two levels; one or more coaches make up a train propelled by a locomotive.

DE-30 Locomotive
A diesel-powered vehicle that pulls and pushes double decker coaches; the locomotive's motor is powered by a diesel engine that can operate in electrified track territory, but still runs on diesel. These trains cannot run in the East River Tunnels between Queens and Manhattan.

DM-30 Locomotive
A dual-mode (DM) powered vehicle that pulls and pushes double decker coaches; has a motor that can be powered by a diesel engine or third rail electricity, allowing these trains to operate in the East River Tunnels between Queens and Manhattan.

For the railcars that carry passengers, we have a need to replace them as they reach the end of their useful life. For our locomotives, upgraded dual-mode engine technology will maximize the use of electric, third rail power instead of diesel whenever possible. This will reduce our use of fossil fuels and decrease our greenhouse gas emissions.

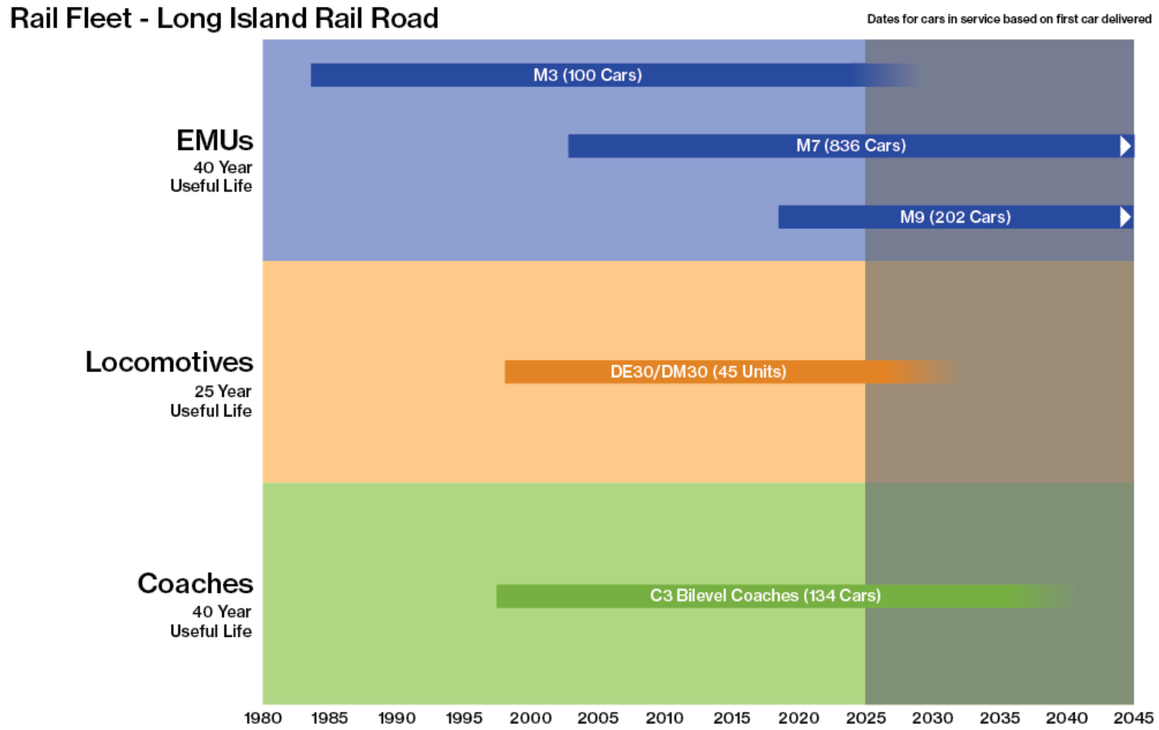
Right, on board LIRR train

Asset inventory and status

We use two primary indicators to assess the condition and performance of our railcars, which together guide decisions on when further investment or replacement is warranted.

- **Useful life:** Older railcars are more prone to break down, generally require more extensive and costly maintenance to keep in service, and are less comfortable for our passengers due to worn interiors. Any railcar over the age of 40 is considered past its useful life, though for some models this number may be as low as 25 years or as high as 40 years. Railcars built prior to the enactment of the federal Americans with Disabilities Act (ADA) do not meet current standards for accessibility. We plan to replace railcars before they reach the end of their useful life.

- **Mean Distance Between Failures (MDBF):** This is a measure of reliability that expresses the railcar's mean (average) operating distance mileage traveled between all relevant train delay failures. The MDBF measure is used to inform decisions about how and when to perform maintenance. Our maintenance plans and our program for continued replacement of old cars have resulted in great fleet reliability successes. In 2022, the MDBF for the entire fleet was 229,824 miles, a vast improvement over the 50,000-mile MDBF from 2005.



Investment needs

Over the next 20 years, we will focus our upcoming fleet investments to achieve two objectives:

1. **Keep up with the normal replacement of the passenger railcar fleet and expand the fleet to support increases in train service made possible by the opening of Grand Central Madison and Main Line Third Track.**

    - Complete the fleet expansion to support service increases made possible by opening of Grand Central Madison and Main Line Third Track.
        - M3s have been in service since the 1980s and are past their useful life.
        - New cars would be a significant improvement over the M3s in multiple ways: they will be equipped with amenities to improve customer experience and safety including better accessibility, wider seats, electrical outlets, and multimedia screens.
        - The M7 fleet (67% of the total fleet) will reach the end of its useful life at the end of the 20-year period. We must prepare for the replacement of the M7 railcars or risk less reliable service and increased operating cost.
        - The C3 Bilevel reach the end of their service life later in the 20 year timeframe and will need to be replaced.

2. **Transition to a locomotive fleet comprised fully of DM locomotives, and cease operating any diesel-only locomotive.**

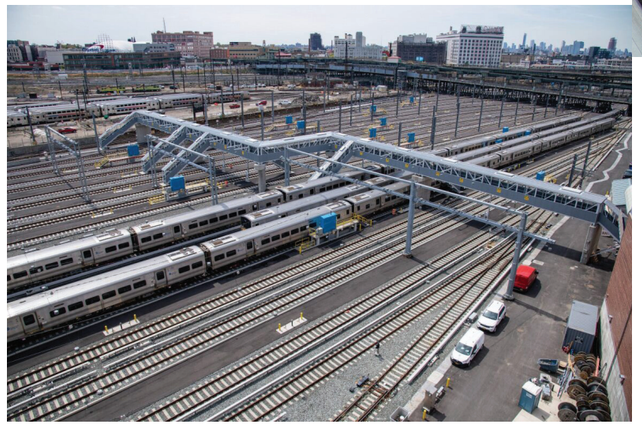
    - We plan to replace all locomotives that are or will be beyond their useful life with locomotives that have the newest DM engine technology, which enables traction power motors to be powered from both diesel and third rail. In addition to improved reliability, replacing aging diesel locomotives with DM technology is key to the MTA's climate commitment.
        - New DM locomotives maximize use of third rail electricity and minimize use of diesel, thus reducing both greenhouse gas emissions and local air quality pollutants.
        - The new Tier IV final engines (or latest EPA standard) reduce emissions of local air quality pollutants like particulate matter and nitrous oxides by over 97% and 86%, respectively.

Shops, yards, and facilities

The primary purpose of rail yards is for railcar staging or inspections, while our shops fall into two distinct categories based on function:

- **Maintenance of Equipment (MOE) shops and yards are where our employees perform comprehensive inspections, cleaning, repairs, component changeouts, retrofits, and overhauls of the passenger railcars.**

- **Maintenance of Way (MOW) shops and yards are where we store or maintain equipment and materials needed for maintenance of track and other right-of-way infrastructure.**



For the purposes of this assessment, we are also treating MOW assets such as work trains as a subset of MOW shops. In addition to shops and yards, we have several other employee facilities that support various operational or maintenance functions. We assess the condition of the various building systems and components that make up these facilities.

Above, West Side Yard, Manhattan
Left, Mid-Day Storage Yard, Queens

Asset inventory and status

Condition assessments of the employee facilities and shops (except rolling stock support equipment) within this category are performed every five years. During inspection, a rating is assigned to all components, such as building exteriors, building interiors, electrical systems, plumbing, HVAC, etc. We can then understand condition trends, set priorities, and begin to identify the required capital investments—as well as maintenance activities—by either component type or facility location.

Rolling stock support equipment includes all the machinery within a shop that is used to maintain our railcars and locomotives. Most of our rolling stock support equipment is located within the Hillside Maintenance Facility and has not been replaced since the facility opened in the late 1980s.

In addition to measuring the age and condition of our shops and yards, we also measure these assets by their performance. Asset performance considers the ability of the shops and yards to support the fleet and meet maintenance needs. Facilities that are unable to meet these fleet and maintenance needs will be upgraded and reconfigured, or in some cases replaced, with replacement targeted toward poor performing components that are likely to impact fleet reliability or operations..

Inventory and status

	Asset	Total	Percent in Poor/Marginal Condition
Employee Facilities	Conveyance (elevator and escalators)	5	0%
	Electrical (electrical - load, panels, light)	16	31%
	Shop Equipment (generator/ATS/UPS)	3	67%
	Fire Protection, Security	15	33%
	HVAC (heating, ventilation, and air conditioning)	31	32%
	Interior (interior walls, stairwells, restrooms.)	39	46%
	Plumbing (sanitary waste, drainage, etc.)	16	13%
	Shell (roof, doors, windows, facade)	62	34%
	Site (roadways, parking lot, pedestrian bridge, platform, sidewalk, walkway, sidewalk/ramp, etc.)	48	19%
Shops	Conveyance (elevator and escalators)	3	0%
	Electrical (electrical distribution, lighting, etc.)	10	30%
	Shop Equipment	6	17%
	Fire Protection, Security	8	38%
	HVAC (heating, ventilation, and air conditioning)	19	5%
	Interior (walls, restrooms, stairs)	19	16%
	Plumbing (sanitary waste, drainage, etc.)	10	20%
	Shell (structure, floor, windows, doors, etc.)	39	13%
	Site (sidewalks, ramps, parking lot, security fence)	21	14%
	Rolling Stock Support Equipment	1,105	84%
Yards	Electrical (electrical distribution, lighting, etc.)	6	17%
	Fire Protection, Security	3	0%
	HVAC (heating, ventilation, and air conditioning)	12	25%
	Interior (walls, doors, stairs)	12	25%
	Plumbing (sanitary waste, drainage, etc.)	6	17%
	Shell (structure, floor, windows, etc.)	22	23%
	Site (roadways, misc. structures, etc.)	13	23%
Work Vehicles	Work Locomotives	33	94%

Babylon Train Car Wash
Right page, West Side Yard, Manhattan

Investment needs

In order to provide optimal support for our train fleet, we require shops and yards that are modern, safe, and have adequate capacity and equipment to meet our evolving fleet maintenance needs. Equipment should be in a condition that allows for work to be carried out safely and efficiently, and our facilities must be safe and adequate for staff needs. We must also make investments to mitigate the effects of climate change on our assets.

We will prioritize investments in our assets based on asset condition and asset performance.

Over the next 20 years, we need to:

- Replace poor condition, marginal condition, or over-age components throughout storage yards, heavy equipment within maintenance shops, and components of buildings and building systems for each of these asset categories.
- Upgrade and reconfigure support shops and facilities to meet evolving maintenance needs in conjunction with the procurement of new railcars, such as new work locomotives and new fleet expansion of the M9 and M9-A.
- Ensure that maintenance facilities are properly equipped to store, inspect, maintain, and clean rolling stock by replacing outdated and underperforming equipment in Hillside and other shops. Ensure maintenance facilities meet the needs of our future fleets:
  - Explore the benefits of renovating and expanding maintenance facilities in the next 20 years to better support our fleet. For example, Hillside Maintenance Complex is currently the only location equipped to fully maintain the electric train fleet, creating operational inefficiencies and adding to operating cost.
  - Rebuild the Morris Park locomotive turntable and refurbish train wash facilities.
  - Make operational improvements to Arch Street Shop and Yard Facility to better support network needs following the opening of Grand Central Madison, including establishing an engineering headquarters and employee facility in Long Island City.
- Replace work locomotives that are in poor condition.
- Fortify shops, yards, and facilities likely to be affected by climate change impacts.
  - Arch Street Shop and the West Side Shop are in coastal flood zones and face an increased risk of flooding.
  - Sheridan Car Shop, Morris Park Shop, and the Hillside Maintenance Complex are at risk of stormwater flooding from extreme rainfall. Where relevant and necessary, facilities will be hardened to enhance drainage systems, install backflow valves, implement pumping mechanisms, floodproof or elevate assets, install perimeter protection, add heat monitoring equipment to assets, and ensure access to back-up power.
- Use asset replacement opportunities to conserve energy, reduce fossil fuel use, and generate renewable energy on-site. By integrating these practices into normal investment cycles, we will maximize the long-term operational cost savings that are generated through updated building systems that reduce fossil fuel dependence and reduce demand for grid electricity.
- Install electric vehicle charging equipment dedicated for LIRR use in appropriate locations to meet MTA goals of transitioning to 100% zero-emissions light-duty non-revenue vehicles by 2035 and medium/heavy-duty non-revenue vehicles by 2040.

PASSENGER STATIONS

02

Our 126 passenger stations are a rider's first and last point of contact with the LIRR system. Each station is unique, and there is a wide range in the level of complexity of stations across the network, from simple at-grade platforms to the massive underground complex of Penn Station.

Passenger stations contain numerous interrelated systems and individual elements, all of which must be maintained so that customers can safely access trains. Stations contain several types of stuctures including buildings with waiting rooms, restrooms, and agents, as well as platforms with shelters, stairs, ramps, overpasses, public address systems, and digital display signage. Station assets also include elevators, escalators, walkways from local streets to the platform, parking lots, security cameras, and numerous other amenities to make it more safe, convenient, and comfortable to wait for or access trains. Communication systems inform riders of train arrivals, departures, and delays; make safety announcements; and provide other information to help passengers complete their journey. Beneath it all are the structural elements of the station, which must be kept in safe condition for millions of annual riders.

Our investment needs over the next 20 years include:

- **Replacing platforms or platform components that are not in good condition.**
  - **Replace all platform components with structural deficiencies identified in annual inspections.**
- **Rebuilding and rehabilitating station buildings.**
  - **Repairing and replacing station building components including doors, windows, HVAC, restrooms, roofs, fire safety systems, and more at approximately four stations per five-year program.**
- **Keeping our new facilities at Grand Central Madison in good condition and continuing to improve facilities that LIRR customers rely on in Penn Station.**
- **Investing in communication systems to improve real-time train information and providing improved audio and visual communications in stations.**
- **Improving systemwide station accessibility.**
  - **Making 100% of our stations accessible by completing ADA projects at seven stations.**
  - **Adding new elevators at 13 stations and replace 17 elevators to keep them within their useful life.**

Passenger stations

Inventory and status

Asset		Total	Percent in Poor/Marginal Condition
Platform Components	ADA Ramp	152	7%
	Platform Substructure	206	19%
	Platform Slabs	206	19%
	Platform Joints	206	15%
	Platform Railing	157	5%
	Platform Waiting Room	29	0%
	Canopy	100	24%
	Shelter	182	6%
	Stairs	751	5%
Elevators & Escalators	Elevators	50	32%
	Escalators	19	63%
Station Building Components	Station Building Exterior	88	3%
	Station Building Interior*	88	1%
Paving	Walkways/Sidewalks	260	5%
Parking	Parking (surface lot)	151	20%
	Parking Structure	1	0%
	Parking (garage)	3	0%

** Station Building Interior includes doors, windows, floor, walls, restrooms, security systems, HVAC systems, and fire suppression systems.*

Islip Station

Asset inventory and status

Condition assessments of station assets are performed annually. During inspection, a rating is assigned to all components of the station such as building exteriors, building interiors, escalators, platforms, and lighting. Based on these component ratings, an overall rating is assigned to each station. We can then understand condition trends, set priorities, and begin to identify the required capital investments (as well as maintenance activities) to preserve and maintain the integrity of assets and their components.

Examples of age-based and condition assessments for station components are:

- **Useful life:** Older assets are more prone to break down and generally require more extensive and costly maintenance to keep in service. For example, an elevator over the age of 20 is considered past its useful life.
- **Condition:** The amount of deterioration in each component of the station building and platform is assessed by a qualified inspector and assigned a numerical rating.

The results of a condition-based assessment of station assets and components are shown here in a table. (This table excludes Penn Station and Grand Central Madison, which are each assessed separately.)

Wyandanch Station

Investment needs

For stations other than Penn Station or Grand Central Madison,[3] we will continue to prioritize making all stations accessible and rehabilitating stations that have platforms and station buildings with significant structural deterioration while addressing other poorly rated components.

Over the next 20 years, we need to:

- Replace platforms that are in poor or marginal condition, prioritizing locations that have platform integrity or structural issues.
  - Similar to accessibility projects, where feasible, when performing major platform structure work, we will seek to replace all related assets that are in poor or marginal condition like overpasses, platform lighting, signage, security systems, etc. at the affected stations.
  - Platforms that are being rebuilt or repaired and that are shorter than standard platforms will be evaluated to determine if it is cost effective and operationally beneficial to lengthen to allow for all-car boarding.
  - When platforms are being replaced, we will take advantage of the opportunity to install tactile edging to improve platform safety.
- Rehabilitate station building assets such as building doors, windows, roofing, restrooms, HVAC systems, boilers, sewer systems, lighting, painting, signage, security, fire suppression systems, and CCTV security systems.
  - Improve accessibility by adding ADA-compliant bathrooms and egress.
  - Invest in historic station building restoration.
- When upgrading stations, maximize opportunities to conserve energy and reduce fossil fuel use, and explore the feasibility to deploy solar photovoltaics for on-site renewable energy generation.
- Where possible, incorporate climate resilience strategies alongside necessary repair work, including:
  - Floodproofing or elevating station assets that are already or will soon be vulnerable to flooding due to climate change.
  - Investing in improved drainage such as larger culverts, stormwater retention, pumps, and/or backflow prevention.
- Advance accessibility at East New York in Brooklyn; Kew Gardens, Mets-Willets Point, Douglaston, and Hunterspoint Ave in Queens; Bellerose in Nassau; and Cold Spring Harbor in Suffolk County to achieve 100% of stations being fully accessible.
  - Where feasible, as accessibility enhancement projects are planned and executed, other station projects will be bundled with the accessibility projects to increase construction efficiency and time savings. The additional work can include critical infrastructure replacement work, normal component replacements, and climate resilience improvements.
  - Replace elevators as they approach the end of their 20-year useful life.

3. Due to their complexity, size, and importance to the network, Penn Station and Grand Central Madison are each discussed individually below.

Passenger station public communications and security

Audio/visual paging systems (AVPS), public address systems, security cameras, intercoms, radios, real-time information digital signs, and countdown clocks improve our riders' experience by providing important service updates to passengers, enhancing security within our stations, and facilitating fare payments. The backbone of this technology is our extensive fiber optic network, which is discussed separately within the Communication Infrastructure section below. Recent investments in the fiber optic network have made it possible to upgrade to next-generation technology on downstream systems and equipment such as station public address systems and ticket vending machines.

AVPS includes station public address systems and digital displays at branch line stations, as well as audio public address systems at LIRR terminals. AVPS provides schedule-based information in combination with real-time status as it reflects projected arrival and departure times including information about the nature and casues of delay.

Inventory and status

Asset	Total	Percent in Poor/Marginal Condition
AVPS Color Signs	230	0%
Platform, Large, Indoor, Parking & Safety Signs	506	99%
Public Address	122	0%
Security - Access Control Readers	699	100%
Security - Cameras	2,987	7%
Security - Network Video Recorders	292	68%

Asset inventory and status

Several prioritization factors are considered for communication investments and are evaluated in concert with a paced, continuous replacement cycle. Asset age compares the actual age of the communication equipment to its lifespan; when the equipment is close to exceeding its maximum age, it is prioritized for replacement. Asset obsolescence prioritizes installing new technologies; as communication technology changes, obsolete technology becomes more difficult to maintain, and parts are harder and more expensive to acquire. Asset condition defines the physical state of the communication equipment, based on number and frequency of repairs and tickets. Asset criticality includes factors such as a role in maintaining safety, sustaining LIRR operations, and supporting corporate data needs.

Legacy AVPS screen

Communication and security upgrades are a focus for the LIRR as we strive to incorporate the latest technologies into our integrated public communications and internal train location information systems.

Additionally, one of our biggest obstacles in implementing new communication and security components is the speed at which technologies change. If we wait too long to shift from a functional but older technology system to a new technology system, we risk obsolescent parts, delays in repair schedules, and decreased system compatibility. We will evaluate emerging technologies so we can ensure compatibility with existing systems. We strive to balance immediate needs with long-term scalability and compatibility requirements, which requires careful planning and evaluation.

The results of a condition-based assessment of public communication and security assets and components are shown in the inventory and status table. For electronic assets, such as electronic signs, a rating of poor or marginal does not necessarily indicate that they are not able to perform their intended function. However, they may be functionally obsolete, meaning they are unable to incorporate recent technological improvements, their parts are no longer easily obtained, or maintenance is becoming increasingly challenging or costly. Likewise, for security assets, a rating of poor or marginal does not mean they cannot perform their intended function.

Investment needs

Over the next 20 years, we need to:

- Install new interior and exterior color AVPS signs and implement the station technology upgrade program to replace station signage throughout the LIRR system. Station technology upgrades will enhance the customer experience in numerous locations.
- Repair or replace assets in poor or marginal condition, replace assets that are approaching the end of their useful life, and upgrade obsolete systems to new technologies (in particular older generation AVPS signage, security access control readers, and video recorders).
- Improve customer communication, ensure reliability, and increase safety and security by upgrading the control systems for all station audio/visual communication systems with fully redundant systems that are also integrated with LIRR's centralized train control system.
- Improve security by replacing or upgrading security cameras at station buildings and platforms.
- Seek to incorporate climate resilience strategies when improvements are made, so these assets have reduced risk of being damaged by extreme heat, flooding, or heavy winds.

Penn Station East End Gateway

Penn Station

As the busiest terminal in our network, it is vitally important that the station meets the needs of our operations and of the LIRR passengers who use the station. While Penn Station is owned by Amtrak, the LIRR has capital responsibility for assets and systems within the portion of the station that we operate. A recent major improvement, our spacious new LIRR Concourse at Penn Station opened in 2022, elevating the experience of nearly half of Penn Station's users who walk through this concourse daily. Planning continues for Penn Station Reconstruction, which would modernize the passenger experience throughout the entire station. It is also critical that, separate from the improved concourse, other portions of the station that are leased by the LIRR have numerous assets and integral systems that are in poor or marginal condition and need LIRR investments.

Inventory and status*

Asset		Total	Units	Percent in Poor/Marginal Condition
Structural/ Architectural (Concourse Ceilings, Floors, Walls, etc.)	Structural Platforms (platforms and tactile edging)	**149,800**	Square Feet	**100%**
	Interior Finishes	**496,500**	Square Feet	**10%**
	Architectural Elements (canopy, doors, staircases, etc.)	**111**	Each	**60%**
	Offices/Rooms	**15,235**	Square Feet	**20%**
Communications	Communications (station announcement control board, video recording system)	**11**	Systems	**100%**
	Passenger Information Assets (display boards, signs, clocks, etc)	**317**	Each	**53%**
	Passenger Information Systems	**3**	System	**67%**
Fire and Life Safety	Fire Protection Assets (FS Dampers, Fire Suppression)	**35**	Each	**9%**
	Fire Protection Linear Assets (standpipes)	**2.6**	Miles	**100%**
	Fire Protection System	**1**	System	**0%**
Electrical	PSCI Lighting	**1**	System	**0%**
	Cables/Wiring	**149**	Miles	**97%**
	Equipment (panels, lighting fixtures, switches)	**6,386**	Each	**91%**
Mechanical	Mechanical System	**2**	System	**0%**
	Mechanical Assets (heaters, boilers, pumps, generators, lifts, etc.)	**68**	Each	**8%**
	Mechanical - Elevators	**6**	Each	**0%**
	Mechanical - Escalators	**14**	Each	**0%**
	Mechanical/ HVAC System	**1**	System	**0%**
	Mechanical/HVAC System Assets (fans, air handlers, fan coil units, etc.)	**166**	Each	**17%**
Plumbing	Pipes	**34**	Miles	**65%**
	Equipment (ejector pumps, fixtures, valves, etc.)	**337**	Each	**84%**

This inventory does not include new assets added to Penn Station during 2023 concourse construction.

Investment needs

We plan to do work to replace or repair assets that are in poor or marginal condition. Over the next 20 years we plan to:

* Replace all the HVAC air handlers.
* Rehabilitate the building electrical and plumbing systems.
* Rehabilitate platforms in poor structural condition and their associated components, such as staircases and lighting.

In addition, many assets that are currently in good condition, such as elevators, escalators, station lighting, flooring, and restrooms, will require cyclical replacement during the 2025-2044 period, as they reach the end of their useful lives.

Penn Station

Grand Central Madison

This new station, which integrates connections to the subway and Metro-North Railroad, has opened new travel options for tens of thousands of daily LIRR riders. Passengers now have direct access and shorter commutes to Manhattan's East Side, the most transformative change to LIRR service in over a century. In less than two months of being open with full service, the LIRR surpassed one million customers traveling in or out of Grand Central Madison.

Investment needs

Investments over the next 20 years will focus on maintaining the opening day standard of the new Grand Central Madison station. All components of the station are currently relatively new and are in good condition. However, assets with useful lives of less than 20 years will be due for cyclical replacement during the 2025-2044 period. Keeping up with these normal replacement cycles will ensure Grand Central Madison remains in good condition.

Components slated for normal replacement over the next 20 years include HVAC units, signage, elevators, escalators, and platforms. We will also ensure that operational facilities, tools, and equipment needed to continue maintenance of Grand Central Madison facilities are adequate. Additional improvement priorities include new operational equipment for LIRR trains, and portable HVAC units for use within the tunnel, vent plants, and terminal areas.

Above and below, Grand Central Madison

RIGHT-OF-WAY

02

Right-of-way infrastructure is a grouping of asset categories that make up the physical railroad right-of-way, namely what we call “line structures” and track. Line structure assets include bridges, viaducts, and tunnels. Also included in this asset category are culverts and retaining walls. Culverts are structures that allow water to flow under the right-of-way and must be right-sized to ensure there is adequate drainage capacity. Retaining walls hold soil in place when the railroad is at a different elevation from the adjacent property. Proactive maintenance of line structure assets mitigates the need for extensive repairs or costly rehabilitations in the future. Track includes the rails and ties, as well as switches, grade crossings, and ballasts. These assets, which also support the freight operations that transport goods throughout the region, are subject to heavy use and continuously exposed to harsh and changing weather conditions.

Our investment needs over the next 20 years include:

- Renew the Atlantic Avenue Tunnel through structural rehabilitation, waterproofing, enhanced lighting, fire safety, and security systems.
- Replace or rehabilitate 60-100 bridges and 11-23 viaducts, and apply state-of-the-art protective surface coating and deck waterproofing at up to 100 locations, decreasing future maintenance needs and increasing the lifespan of our structures.
- Improve service reliability by completing the reconfiguration of track at Jamaica to alleviate bottlenecks, reduce delays, and help trains move faster through some of our most congested locations.
- Continue cyclical programs to replace and modernize track components across the network and invest in resilience with new retaining walls and drainage systems.
- Install high security fencing in critical locations to keep the right-of-way secure.

Line structures

Our line structures are crucial for the proper functioning of our system through, over, or under obstacles like roadways, water bodies, or along varying terrain. This includes undergrade bridges, overgrade bridges, viaducts, and tunnels, which are the most critical structures, as well as other structures including culverts, lattice towers, and retaining walls.

Asset inventory and status

The line structures category is primarily focused on undergrade and overgrade bridges, viaducts, and tunnels, as well as less critical structure such as retaining walls, culverts, and structures that support signal utility lines. To maintain their physical integrity, they need considerable and regular investments in maintenance rehabilitation or replacement when they begin to exhibit structural deterioration. To keep our structures in a safe and reliable condition, we conduct annual inspections for critical structures like bridges and viaducts, and perform comprehensive inspections every five years for other structures.

Inventory and status

Asset	Total	Percent in Poor/Marginal Condition
Undergrade Bridge (structure)*	504	13%
Undergrade Bridge (waterproofing)	409	69%
Undergrade Bridge (painting)	390	69%
Overgrade Bridge	56	19%
Tunnel	4	75%
Viaduct	29	24%
Retaining Wall	103	18%
Signal Tower	86	19%
Lattice Tower	277	13%
Culvert	163	20%

For Undergrade Bridges, total units differ based on category of work. Depending on type and location, not all Undergrade Bridges receive waterproofing or painting.

During these inspections, a qualified inspector carefully examines and documents elements of each structure. The many components related to each structure—like steel girders, beams, and abutments—are comprehensively assessed to identify steel or concrete corrosion, decay of wooden timbers, or other signs of deterioration. The results of condition-based assessments of line structure assets indicate that several bridges are showing increasing levels of structural deterioration that, if not addressed, could result in unsafe conditions. While it hasn't grown, this percentage has not decreased in recent years. In addition to overall structural condition, undergrade bridge steel painting and deck waterproofing conditions are documented, as these could have significant impact on the structural condition down the road. Most bridges have paint and/or waterproofing that is in poor or marginal condition. Seven viaducts, encompassing 256 individual spans, are in poor or marginal condition. This quantity has grown in recent years due to deferred rehabilitation work. In addition, three of four tunnel segments have never had significant structural rehabilitation investments since they were constructed and are in marginal condition. The results from the 2022 condition assessment are shown in the inventory and status table.

Investment needs

Over the next 20 years, we will address the condition of the structures most critical to safe operation of service including bridges, viaducts, and tunnels, while focusing on preservation methods, such as painting and waterproofing, to maintain the integrity of our existing structures and prevent structural deterioration. Priority rehabilitations or replacements are identified based on poor or marginal conditions, as well as structures with defects requiring immediate attention which could impact operations or that are in critical locations. In many cases, the structural components can be rehabilitated to bring the structure to an acceptable condition overall. However, if this type of investment will not effectively improve the condition to an acceptable level or additional investments will be required a short time later, the structure will likely need to be replaced.

Over the next 20 years, we need to:

- Increase the pace in preventative maintenance on structures through increased deck waterproofing and structural steel painting.
- Bring all bridges into good condition through our structures rehabilitation/replacement program by frontloading approximately three to five high-priority bridges and three to six viaducts in each program based on their physical condition and load capacity rating. Rehabilitate tunnel components in the worst condition in the initial part of the next 20 years and then transition to investments that preserve the structures.
- Redesign or retrofit line structures to better withstand future climate hazards in the coming years. Climate resilience strategies include sizing culverts for anticipated future rainstorms and flows, and stabilizing or fortifying retaining walls in areas where steep slope exposure and extreme precipitation is more likely to result in run-off, erosion, and landslides.

Undergrade bridges
Allow an obstacle to pass under the railroad (i.e., the track(s) are on the bridge structure).

Overgrade bridges
Allow the obstacle to pass over the railroad (i.e., the roadway is on the bridge structure).

Tunnels
Underground passages or channels that provide the means for our rail to traverse underneath bodies of water or highly developed neighborhoods.

Viaducts
Provide separation of the railroad from the surrounding community or allow our rail system to traverse a wide valley with a bridge-like structure.

Retaining walls
Built to hold back soil and provide support for our elevated structures or keep steeply sloped surfaces from collapsing onto the adjacent track bed.

Culverts
Are designed to allow water to flow underneath tracks to manage drainage and prevent flooding.

Track

Our track system is made up of several elements:

- **Ties:** These are the cross-members that hold the rails at a fixed width to form the track structure. They're usually made of wood or concrete. In some places, like the Atlantic Avenue Tunnel, we use half-ties. On certain viaducts we use direct fixation or bridge timbers on open deck bridges and viaducts.

- **Rail:** This is what provides a running surface for the train wheels. Together with the ties, they form the track structure.

- **Ballast:** This is the crushed stone that supports the track structure.

- **Switches:** These are arrangements of ties and rails that allow trains to move from one track to another.

- **Crossings:** These are either concrete or rubber pads installed to allow vehicles to travel over tracks at ground level.

Right, Montauk Branch Track Assets, Source: Google Streetview

LIRR Third Track

Asset inventory and status

Our track assets are assessed by age, condition of the asset, and based on operating conditions. When prioritizing track assets for replacement or improvement, we consider different factors by component. Track assets are generally replaced on a cyclical basis based on age or remaining lifespan.

- Rail assets are replaced based on the age of the rail and based on use. Rail that is more frequently traveled requires more frequent replacement.
- Ties are replaced based on age, which ranges from 30 years for wood ties to 50 years for concrete.
- Switches are evaluated for replacement based how much use and wear they receive.
- Crossings are prioritized for replacement based on site and asset conditions. Grade crossing replacements are often coordinated with the local authority responsible for roadway maintenance.
- Yard track and switches require an age-based or conditions-based approach to repair or rehabilitate.
- Track maintenance equipment such as cranes, machines for installing ties and rail, and vehicles used to carry track components are prioritized for replacement based on Federal Railroad Administration requirements.

To ensure all components are meeting our high standards we conduct weekly visual track inspections, quarterly inspections to determine the need for track resurfacing, and ultrasonic testing to detect internal defects in the rail.

Because they must uphold a high standard to support rail service, we schedule replacements for most track assets on a cyclical, age-based replacement based on their lifespan. Each asset has a lifespan that varies from 15 to 50 years. The inventory and status table contains track inventory and quantities that will be coming due for replacement in the upcoming capital programs.

Inventory and status

Asset	Total	Units	Percent Due for Replacement
Ballast	**500**	Track Miles	**35%**
Grade Crossing	**417**	Each	**64%**
Rail	**5,374,021**	Linear Feet	**16%**
Switches	**916**	Each	**26%**
Tie	**1,519,134**	Each	**20%**
Construction Equipment	**372**	Each	**35%**

Investment needs

We evaluate track components individually and together over segments of the railroad to coordinate track work for fewer service disruptions. To facilitate our track asset replacement program and perform work in a more cost-effective manner by addressing longer spans of track at one time, we must occasionally interrupt regular service. As we have limited opportunities to complete replacements without impacting our riders, we must plan track outages carefully and provide advance notice to potentially impacted riders. We have been continuously maintaining our track assets based on our cyclical track program.

Over the next 20 years, we need to:

- Continue cyclical track maintenance program by replacing:
  - Approximately 35,000-40,000 wood ties per year.
  - 18 rail miles of continuous welded rail per year.
  - About 13 mainline switches per year.
- Replace grade crossings at an accelerated pace of about 30 per year for the next few years to address the large number of grade crossings that are due for replacement and then continue a steady pace of about 12 per year after that.
- Continue the pace of investment in track construction equipment that supports track work.
- Plan to upgrade some assets as we replace them, where feasible.
  - Continue the effort to upgrade our busiest branches from wood to longer-lasting concrete ties.
- Construct or reinforce right-of-way retaining walls.
- Install of right-of-way fencing along with targeted track replacement efforts within West Side Yard, Hillside, Penn Station, and other selected areas.
- Improve drainage, where needed, to protect tracks from coastal flooding or heavy rainfall.

Jamaica Capacity Improvements

While planning for normal replacement of assets, we also assess other component or asset improvement opportunities at or around the affected work areas to be as efficient as possible. As an example of this, we are in the process of completing a series of interrelated improvements to track and switch layout at Jamaica that will greatly improve operations and reduce train congestion and delays.

The Jamaica Capacity Improvements will build upon the Hall Interlocking upgrades with additional reconstruction and expansion within Jamaica Station and Jay Interlocking located west of the station. This will greatly improve train routing flexibility and reliability through Jamaica Station and accommodate growing ridership through this busy hub that serves all but one of LIRR's branches. The new signal system will support higher speed switches and streamline the track routes. Jamaica platforms will be extended to accommodate 12-car trains, as well as extending the E Yard of Jamaica. There will also be construction of a new wayside signal system. Throughout the station, there will be ongoing projects to improve passenger accessibility. This includes enhanced signage and implementing various customer amenities to make JFK AirTrain more easily accessible to the LIRR and subway passengers. In addition, new design efforts will take place to improve customer flow and improve passenger accessibility between platforms.

SIGNALS, POWER, AND COMMUNICATIONS

02

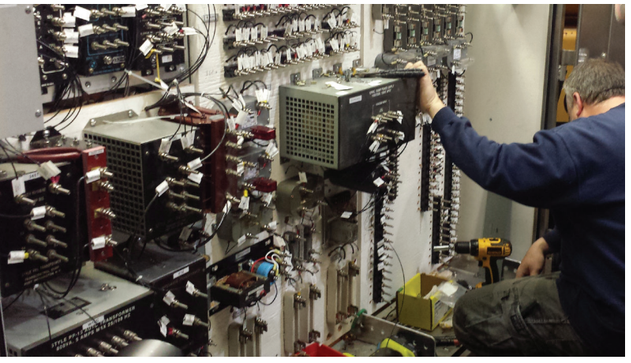
Signal, power, and communication systems work together so trains can run smoothly, safely, and frequently throughout the network. Signals ensure that trains follow the proper route at safe speeds maintaining proper distances from other trains. Our power assets ensure stable and sustainable traction power that provides propulsion for our electric railcars, and the power system provides an energy supply needed to run our signaling and communication infrastructure, as well as station lighting and electrical systems. Our communication systems consist of miles of cables, electronics, network components, displays, and other assets to provide information throughout the system. Upkeep and upgrading of these systems and their components are required for safe and reliable rail service, and investments in technological advancements for these systems will improve customer experience.

Our investment needs over the next 20 years include:

- Modernizing approximately 50 miles of signal systems and replace aging and/or obsolete components with latest-generation electronics providing modern and more reliable signal systems.
- Replacing about 10-14 substations in each capital program and replace or upgrade critical components at other substations. Third rail will also be upgraded to current standards and utility poles, power lines, building lighting, and electrical systems will be replaced.
- Installing up-to-date communication systems and components that will allow us to effectively monitor the system, provide information to LIRR crews and customers, and manage vast amounts of data in a technologically robust system.

Signals

Our signal systems enforce safe speeds and spacing of trains; they consist of interrelated components including cables, track relays, batteries, switch machines, cases and huts, and grade crossing mechanisms. We have multiple types of signal systems, ranging from the recently installed state-of-the-art signal technology on the Montauk Branch between Speonk and Montauk, to obsolete legacy systems installed during the Pennsylvania Railroad era.



Signal case

Asset inventory and status

Inventory and status

Asset	Total	Percent in Poor/Marginal Condition
Switch Machine	970	24%
Signal	812	51%
Supervisory and Control	174	37%
Equipment Location - Huts and Cases	1,374	59%
Gate Mechanisms	851	28%
Air System	17	82%
Battery	1,088	57%
Cable	7,979	54%
Electronic Equipment	283	6%
Wayside Interface Units (WIUs– PTC signal component)	171	24%
Transponders (PTC signal component)	4,500	26%

Metrics used to identify assets and components slated for replacement or upgrade are a combination of high-level age-based condition assessments supplemented with more granular assessment considering defects, criticality, performance, maintenance, and other metrics. When prioritizing network segments for signal modernization and normal replacement, we will emphasize replacing signal segments that are beyond their expected maximum age, obsolete, or have a high percentage of components rated poor or marginal.

Lines and interlockings (an interconnected system of signals and signal appliances that prevent conflicting train movements) that experience higher train traffic volumes are also assigned a higher priority for maintenance or replacement. For interlocking modernization, we prioritize replacing switch machines and electronic supervisory control systems in concert with track renewal programs. For full signal system replacements, we prioritize branches or a segment of a branch where the system is obsolete, or a majority of the signal assets are in poor or marginal condition. For segments that are not part of a complete signal system replacement project, the normal replacement program addresses the lowest-rated components. We consider age, lifespan, obsolescence, structural conditions of the cases or huts that the components are housed in, operational impacts, failure rates, testing, and vendor support availability when we prioritize signals for normal replacement. Shown here is an inventory and status of major signal assets.

Above, standard LIRR signals system annotated with signals components

Investment needs

In order to ensure high levels of safety and efficiency for trains moving throughout the network, we need to address assets in poor and marginal condition, as well as invest in technology and signaling upgrades so that the system is capable of reliably meeting current operational demands. Some segments of signal infrastructure are more than 60 years old, some have been upgraded recently, and some are at substantial risk of premature failure due to exposure to climate-change-related impacts of increased flooding, heat, and wind events.

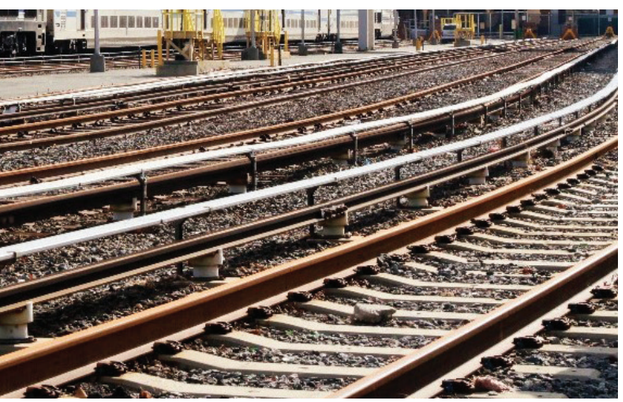
We are focused on improving signal condition through asset and component replacements, modernizing corridors to achieve new safety and efficiency standards and preparing corridors for the effects of climate change. Over the next 20 years, we need to:

- Upgrade approximately 50 miles of signal systems in segments where 50%-75% of the signal components are rated poor/marginal on portions of the Port Jefferson, Far Rockaway, Port Washington, Oyster Bay, and Montauk branches.
- Continue normal replacement of relays, cables, batteries, switch machines, huts, and signals while examining all opportunities to combine normal replacement activities with signal modernization.
- Invest further in PTC, which will yield long-term safety benefits for the entire rail network and provide an additional layer of safety protection, particularly in situations where human error or unexpected circumstances may pose risks to train operations.
- Complete implementation of Centralized Train Control (including creating an emergency back-up location), which will give us the ability to monitor all trains from a central location, improving operations, communication, and the ability to respond to service disruptions.
    - The centralized system also replaces our legacy train tower control system, reducing operating costs and future capital costs by eliminating the need to maintain towers and their related communication systems.
- Assets that are exposed to flooding, extreme temperatures, wind, and erosion will be prioritized for climate resilience protections. For signals at risk of flooding, this may include asset elevation and/or waterproofing.

Power

Our power system provides power to our electric railcars via third rail traction power, and it also provides electricity for our signal, lighting, and electrical systems at stations and yard buildings. Power assets, including substations, motor generators, cable, third rail, protection boards, lighting systems, cables, poles, and numerous other elements, are critical to providing reliable train service. Without a stable flow of power from our traction power substations to reliable third rail systems, our electric railcars can't move. Substation condition and capacity are the most critical elements within the power asset category. Substations typically house transformers and other equipment that convert electricity from the electrical grid to the proper current and voltage so it can be used by railcars.

Our power assets also include various third rail system assets, electric light and power assets—including our communication huts and cases, and lighting in station buildings, platforms, tunnels, and yards—as well as high tension assets including high-tension towers, power poles, and power lines. Without reliable electric power and lighting systems at facilities and the assets to carry electricity throughout the system, these facilities would not be functional.



Inventory and status

Asset	Total	Units	Percent in Poor/Marginal Condition
Substation Overall (age based)	129 (incl. ESA)	Each	52%
Substation Components	2,826	Each	22%
Electrical System*	13,217	Each	52%
High Tension Cable, Feeder, and Power Lines	494	Miles	17%
High Tension Equipment	7,805	Each	9%
Third Rail Bracket	42,098	Each	19%
Third Rail Cable	1,247,000	Linear Feet	19%
Third Rail Fiberglass Protection Board	1,662,000	Linear Feet	48%
Third Rail Wood Protection Board	15,000	Linear Feet	0%
Third Rail Reactor	115	Each	66%
Third Rail – Aluminum	79,000	Linear Feet	0%
Third Rail – Composite	1,108,000	Linear Feet	0%
Third Rail – Conventional	55,000	Linear Feet	97%

** Includes bridge electrical systems, tunnel and yard lighting, emergency generators, wayside power, communication rooms and huts, station building electrical systems, and station and platform lighting.*

Left page, third rail. Above, New Cassel Substation

Asset inventory and status

Evaluation factors used to determine investment priority for power assets include age, location, power demand, equipment obsolescence, and lack of redundancy. This system helps ensure assets that are more crucial to our operations are evaluated for major overhaul or replacement before less critical ones, even if the less critical assets and components have been in service longer.

More than half of our substations were constructed in the early 1970s, and these have all exceeded their 35-year lifespan. While they still function safely, their critical components such as transformers and rectifiers, require additional maintenance and are more prone to failures. Substation replacements are necessary to ensure the proper movement of trains and comply with safety regulations—and they are major undertakings. They must be scheduled so the transfer from an old substation to a new one does not interrupt system power flow, and so the pacing aligns with the production levels of equipment manufacturers.

For substation power demand improvements, we have completed a Traction Power Load Study that evaluated the electrical capacity of our power infrastructure and helps to inform an investment strategy for future capital investments. Traction power simulations of future train operations were performed during the study to identify deficiencies and make recommendations to address these concerns. When performing normal replacements, we have been upgrading third rail from a composite to higher-performing aluminum rail, and we have been upgrading wood third rail protection board to fiberglass.

Investment needs

Our most critical power investment priority is the cyclical replacement of substations. Over the next 20 years, we need to:

- Replace the most critical substations that are beyond their useful life with greater frequency of failures.
- Continue to replace poorly performing critical components within substations to maintain a larger percentage of substations in good condition for a longer period.
  - Prioritize component replacements at substations that don't meet current standards or provide adequate power to meet demand.
- Continue cyclical replacement of third rail systems:
  - This includes cables, disconnect switches, protection board, and the third rail itself, along with replacement of negative reactors, and short tie extension brackets.
  - Third rail negative reactors will perform normal replacement by appromixely 20 per capital program.
- Improve the capacity of our traction power system by implementing recommendations from the Traction Power Load Study:
  - Construct up to two new substations (Penn Station and Malverne on the West Hempstead Branch) to prevent the adjacent substations from being overloaded.
  - Expand Jamaica substation to meet demand.
  - Raise voltage at 22 existing substations.
  - Install additional cables at 60 third rail feeders and 84 negative feeders.
  - Upgrade 49 negative reactors, as well as third rail sections to aluminum in 12 key territories.
- Replace approximately 16,000 linear feet of conventional third rail with higher-performing aluminum rail in every capital program (3,200 linear feet/year) as well as high tension and third rail components.
- Replace tunnel lighting at Atlantic Avenue and upgrade station and building electrical systems.
- Incorporate climate resilience strategies, including asset elevation and/or waterproofing for those that are susceptible to water inundation.

Below, installation of communications ductwork

Communication infrastructure

Communication infrastructure allows effective information flow to keep our rail system running safely and smoothly. Fiber optic and other cable networks support power and signal systems; facilitate clear and timely communication between train operators, control centers, and station personnel; and allow us to make public address announcements and provide train arrival/departure information to our customers.

Some of the main components of the communications network also include communication poles/towers, fiber optic and copper cables, PBX (internal telephone network), radio networks, and communication components that support the customer communication systems. These assets comprise the various networks for continuous transmission of voice and data communications. As communication technology continues to evolve, dependence on reliable and readily available communication services continues to grow.

Radio systems include units onboard trains or carried by railway workers that are used for operations and maintenance. They support police activity, train operations, maintenance efforts, and emergency services.

Inventory and status

Asset	Total	Percent in Poor/Marginal Condition
Wooden Poles	9,998	17%
Fiber Optics (current standard)	225 Miles	0%
Cable - SM Fiber (old standard)	635 Miles	0%
Cable - Copper	720 Miles	100%
Communication Support System	5,796	28%
Outside Plant	622	22%
PTC System	4,178	0%
Radio Base Stations	270	69%
Communication Huts	398	26%
Radio Equipment	3,465	39%
Radio Cable	23 Miles	57%

Asset inventory and status

Our investment strategy focuses on deploying a more consistent generation of technology throughout the LIRR system to improve coverage and replace aging and obsolete components. We prioritize assets for replacement or upgrade when they are outdated or in poor or marginal condition. Assets with safety issues or regulatory compliance problems are given higher priority, as well as those with a higher criticality to operations and management.

Rapid advancements in communication technologies have wide-ranging benefits but can pose challenges when selecting and implementing the most suitable solutions. Emerging technologies will be evaluated so that we can ensure compatibility with existing systems. We will also need to accommodate a phased approach and utilize redundant systems. As communication assets become more interconnected and dependent on digital infrastructure, we will work with experts to ensure our communication assets are protected against cyber threats and safeguarded from unauthorized access to sensitive data. Inventory of major communication assets and their condition status is shown in the inventory and status table.

Wooden poles
These communication poles carry the cable lines providing services to the LIRR communications systems.

PTC system
Positive Train Control System. (transponders, workstations, radio cases, dispacth center.

Above, PTC transponder, Source: Google Streetview

Radio base stations
Exist at numerous locations to provide individual block operators with the capability to communicate with trains entering the block.

Communication huts
Supports increased network capacity needs with CCTV video service at stations at other locations.

Investment needs

Investments in the fiber optic network and the cyclical replacement of communication pole lines form the core of the communication infrastructure needs. The fiber optic network will be installed with new equipment that will replace obsolete hardware and address assets currently in poor or marginal condition.

Over the next 20 years, we need to:

- Install new fiber optic station nodes to replace legacy equipment at 57 stations.
- Replace the Head End Radio Equipment with Voice over Internet Protocol technology that will remove the last legacy fiber optic network from service.
- Continue the ongoing effort to replace 1,000 communication poles per every five-year program to address deteriorated line poles.
- Invest in our communication component replacement program, alleviating the backup of assets in poor or marginal condition like Volt Direct Power plants, battery backup plants/uninterruptible power supplies, HVAC in communication rooms and huts, radio and antenna assets, and much more.
- Implement new land/wireless communication networks to support expanding business needs such as remote data collection, grade crossing and onboard cameras, and heat-on-rail detection.
- Upgrade 10-15 small communication huts and 4-5 large communication hut per capital program to support network capacity needs.
- Continue to invest in upgrading and modernizing our computer systems to support modern signal and communications systems that rely heavily on computer networking and processing.
- Protect communication infrastructure assets from climate change by elevating or waterproofing equipment at high risk for flooding. We are also considering future risk to communication assets from prolonged extreme heat in specifications and design of capital projects, and in parallel with regular replacements of assets.

Communications room interior