Modernizing Signals:
Making Service More Reliable

An MTA 2050 Report | November 2026



Metropolitan Transportation Authority

Contents

Letter from the MTA Chair and CEO 3

Executive Summary 4

Vision for 2050 8

Introduction 10

How Our Signal System Works 12

How Signal Modernization Projects Work 14

How Our Signal System Evolved 16

Our Plan to Complete Signal Modernization 24

Modernize the Numbered Lines 26

Finish Modernizing the Lettered Lines 32

Looking Ahead to 2050 36

Conclusion/Next Steps 43

Appendix 44



Letter from the Chair and CEO

Janno Lieber, Chair and Chief Executive Officer of The Metropolitan Transportation Authority



The subway's signaling system is mostly invisible to riders but it serves as the central nervous system of New York City Transit, directing every train movement across 763 miles.

On too much of the system, we're still relying on signal technology developed when the subway first opened 122 years ago—technology that operates with components that date back to the 1930s. Riders feel the consequences of relying on this nearly ancient infrastructure; signal-related issues are the number one cause of asset-related delays in our subway system.

In the early 2000s, we began modernizing signaling with the introduction of Communications Based Train Control (CBTC) that gives precise, real-time information about where trains are located. It is the difference between navigating with an old-fashioned paper map and navigating with GPS. With continuous, live train location data, CBTC allows us to run trains faster, closer together, and more reliably.

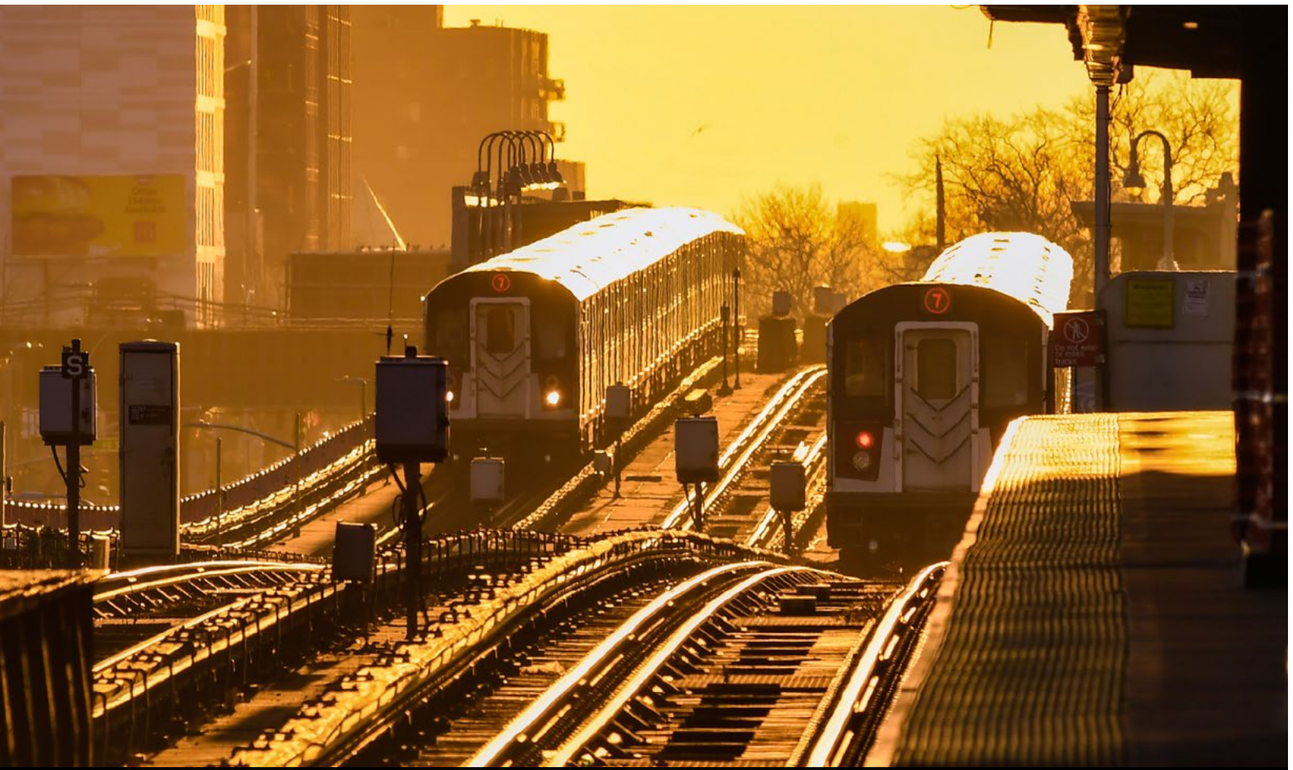
The results are clear: Riders on the L and 7, which run on CBTC, have seen faster trips, more reliable service, and shorter waits. And thanks to improvements in project delivery, we are now installing CBTC faster and cheaper than ever, advancing projects this decade at four times the pace of earlier eras.

But modernizing portions of the system isn't enough. We need a plan that extends these benefits across the entire subway network. That's what this report delivers.

For the first time, we are laying out a comprehensive roadmap to modernize signals across the entire subway system by 2050. It outlines how we plan to bring modern signals to the 1 2 3 4 5 and 6 lines to align with the purchase of new R262 railcars, to complete end-to-end modernization across critical corridors we have already started, and to accelerate project delivery through new technologies and innovative construction methods.

The timing could not be better. We are in the middle of a historic investment in new rolling stock. Advances in next-generation communications technologies like 5G are making signal installation and operations more efficient. And we now have both the experience and the momentum needed to scale modernization across the entire network.

This report is the latest in the series that lays the foundation for our next 20-Year Needs Assessment and sets the standard for where the greatest transit system in the world should be at the halfway mark of the 21st century.



Executive Summary

R188 trains on the Flushing 7 line in Queens

A comprehensive plan to modernize signals across the entire subway system and provide faster, more reliable service.

The MTA is advancing its first systemwide plan to modernize the New York City subway's signal network, replacing all 763 miles of legacy signals with Communications-Based Train Control (CBTC) technology by 2050. Building on this summer's report on physical bottlenecks, this second MTA 2050 report examines how signal modernization can expand capacity across the entire subway system. The report reflects on nearly three decades of signal modernization work, documenting the benefits already achieved, the challenges that have slowed progress, and the operational and technological breakthroughs that now make a systemwide modernization strategy possible.

The signal system is the foundation of subway operations, helping dispatchers track trains and manage service. Built over 120 years ago with a highly manual "fixed block" system, traditional signals rely on track circuits to detect whether a train occupies a section of track which can extend more than 1,000 feet. Lacking more precise location tracking, the system requires us for safety reasons to leave large buffers between trains, limiting frequency of service.

This legacy system has served New York well, but it's been largely unchanged since the subway was created. It's *old*: 24% is overdue for replacement. It's *unreliable*: signal issues are the leading cause of asset related subway delays. And it's extremely *expensive* to maintain: in some cases, the components aren't even manufactured anymore.

Modern CBTC technology is the solution to these challenges. CBTC allows us to see the exact location of trains— enabling faster, more reliable, and more frequent service. Benefits already seen on CBTC-equipped lines include:

- Faster trips, with speed improvements of 5-10% on the 7 E F M R & L lines.
- More reliable service and improved on-time performance.
- More predictable service, including a 15% reduction in excess wait time on the L line.

While CBTC holds great potential, the rollout over the past few decades has been far from efficient. Rather than fully commit to the new system, early projects simultaneously replaced the old, legacy signals while also installing the new CBTC system. In some parts of the system—particularly on the numbered lines—we did not have enough railcars that could be equipped with CBTC, limiting the reach of CBTC to certain corners of the system.

In recent years, the MTA has adopted a new approach that fully prioritizes CBTC technology, allowing us to cut per mile costs by over a third and quadruple the pace of modernization.

This report builds on that progress, laying out a comprehensive plan to modernize all signals across the entire subway system by 2050.



An R62 1 train in Upper Manhattan

Our Plan:

Modernize the 1 2 3 4 5 6 lines to align with new railcar purchases, so that as more new cars arrive, we can run more of the system under CBTC.

Unlock end-to-end benefits for the lettered lines, with the G next to be completed. With the projects in the 2025-29 Capital Plan, we will have modernized more than 60% of the signals on the lettered lines ("B Division."). We are prioritizing projects that can deliver the earliest benefits to riders and be installed in parallel to priority corridors on the numbered lines.

Accelerate the pace of modernization. We will continue streamlining projects to increase speed, advancing innovations like equipping work trains with CBTC technology to simplify infrastructure installation.

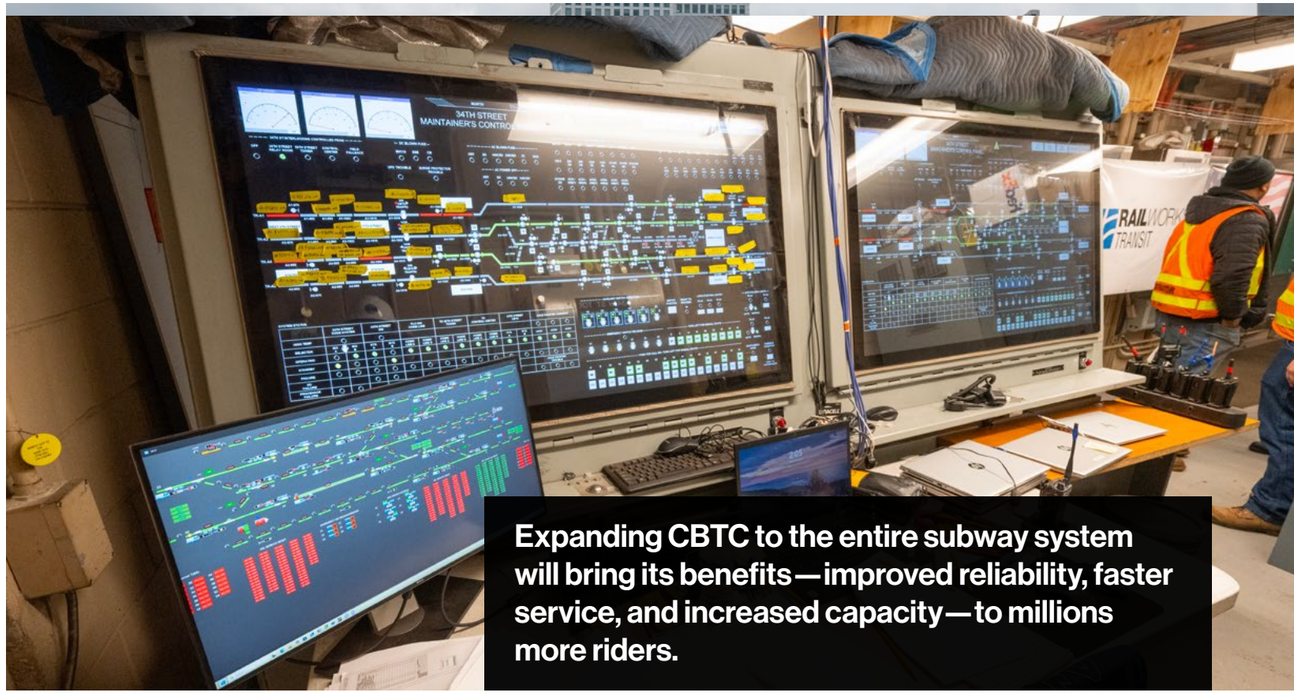
Initial actions include:

Make 100% of our rolling stock CBTC-enabled, taking advantage of the historic R262 railcar purchase to add carborne equipment before new trains are placed in service.

Bring CBTC to the Bronx branches of the 1 and 4, syncing physical upgrades with the arrival of new cars. This allows us to test and refine the system more efficiently and put these corridors in service in the early 2030s.

Bundle CBTC software and infrastructure improvements across multiple projects, advancing software integration earlier in the process. By treating CBTC projects as a single networked system, we can reduce transition points, simplify implementation, and deliver a more reliable final product.

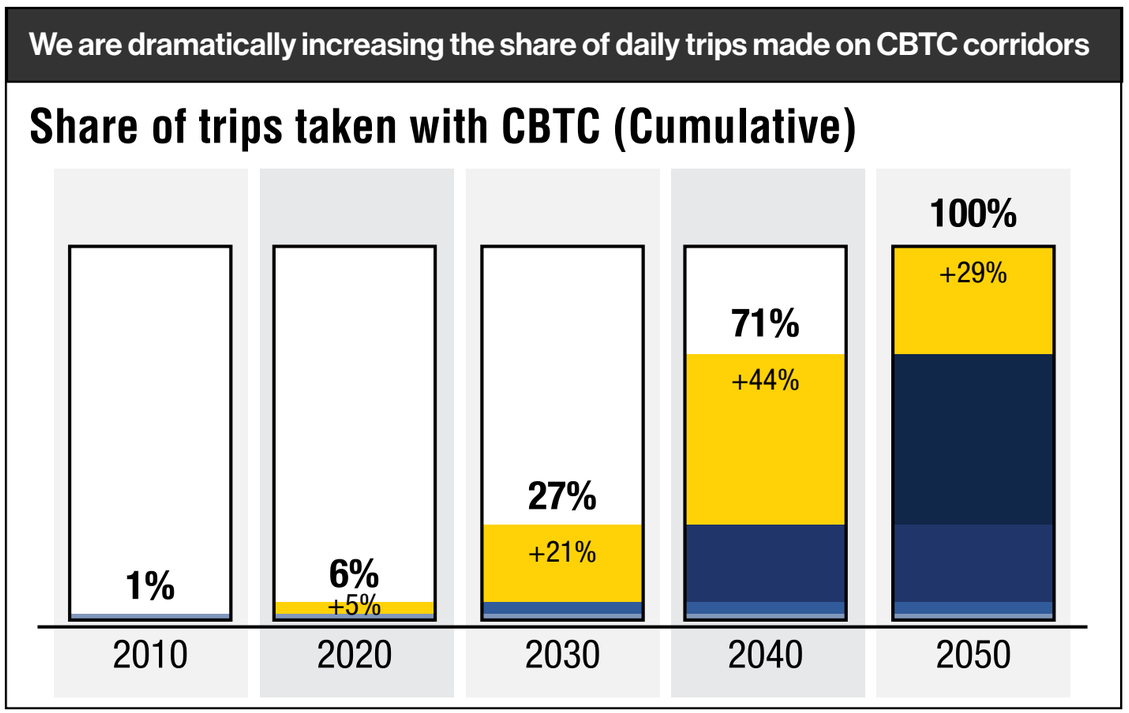




Expanding CBTC to the entire subway system will bring its benefits—improved reliability, faster service, and increased capacity—to millions more riders.

A maintenance control panel on the 8 Av A C E CBTC project

We are dramatically increasing the share of daily trips made on CBTC corridors





We have big plans for the future of the MTA. This report is the second in a series that will define the MTA's vision for 2050 and lay down a marker for where we think the greatest transit system in the world should be at the halfway mark of the 21st century.



In recent years, the MTA has made tremendous progress and transformed the way we do business to deliver projects better, faster, and cheaper for our riders. Under the leadership of Governor Hochul, the MTA is on more solid footing than ever, partly thanks to funding from the first-in-the-nation Congestion Pricing Program. Since 2020, the MTA has saved more than $4.2 billion on capital projects while increasing our pace of work dramatically.

This progress is the result of reforms and improvements throughout the entire organization—starting with better planning to pick the right projects in the first place.

Take our most recent 20-Year Needs Assessment, covering the period 2025–2044. In unprecedented detail, it established a new standard of how we assess the MTA's long-term capital needs. We evaluated the condition of nearly six million individual assets across the entire subway, bus, railroad, bridge, and tunnel transportation system. We rated these assets on a consistent scale across agencies and published the results in greater detail than any previous report, along with our strategic and tactical thinking on how to address challenges and move toward a State of Good Repair.

This planning progress led directly to the 2025-2029 MTA Capital Plan, shaping the most ambitious investment in State of Good Repair in MTA history. Thanks to the data analytics and strategic thinking in the 20-Year Needs Assessment, the Capital Plan was tailored to, for example, rebuild aging power substations to protect subway service, repair critical parts of the Grand Central Artery to keep Metro-North running, and replace outmoded railcars to keep Long Island Rail Road service flowing. It also helped identify the most promising expansion projects, leading to progress on the Interborough Express and 125 St Subway.



We're just getting started. In October 2028, we will be releasing our next 20-Year Needs Assessment, *MTA 2050*, which will provide a forward-looking vision of the capital needs, strategies and investments for the transit system. Leading up to the release of *MTA 2050*, we are taking the opportunity to reexamine the challenges and opportunities facing the region and consider how the transit system must evolve to meet the needs of its riders.

Each study will take a closer look at how discrete parts of the network function today, the challenges that limit their performance, investments needed to preserve and modernize existing infrastructure and opportunities available to improve how the system operates. Together, these studies will help inform future capital planning and encourage a broader conversation about investments that can unlock capacity, improve reliability, reduce travel times, strengthen connections, and deliver better service for riders across the region.

Signals are a crucial part of this process. Most of the subway still runs on a century-old "fixed-block" signal system, which forces trains to stay far apart and limits how many can run each hour. This analysis-driven report looks at where we can upgrade aging equipment to a modern communications-based train control (CBTC) system, delivering more frequent service, fewer delays, and less breakdown-prone equipment. By grouping these upgrades with other ongoing modernizations across the subway system, we're able to cut costs and limit disruptions to riders.



Modernizing signals is just one of many topics that deserve this deeper level of analysis. Over time, we expect this planning series to explore a range of systemwide challenges and opportunities, such as:

- **Stations** - modernizing our century-old stations to improve passenger experience
- **Station Systems & Technology** - keeping up with technological progress to unlock new capabilities throughout the system
- **Bottlenecks** - eliminating physical constraints that can cause delays that cascade throughout the system
- **Shops and Yards** - upgrading dated facilities to unlock greater productivity and better conditions for our workers
- **Sustainability and Energy** - aligning capital spending with opportunities to cut energy use and reduce greenhouse gas emissions
- **Regional Mobility** - conducting a deeper look to identify possible expansion projects that can be included in our next iteration of Comparative Evaluation

No single study will define the future of the transit system. Instead, each contributes another piece of the larger picture, helping build the knowledge, analysis, and public understanding needed to support future investment decisions. These studies will help connect decisions on infrastructure investments to the outcomes our riders care about most: fewer delays, shorter waits, greater accessibility, improved resilience, cleaner air, and a system prepared to serve the needs of the region for decades to come.

This is only the beginning. We look forward to continuing the conversation as we prepare for 2050—and beyond.



Introduction

Legacy signal equipment on the 8 Av A C E line in Manhattan. Later replaced with new CBTC equipment.

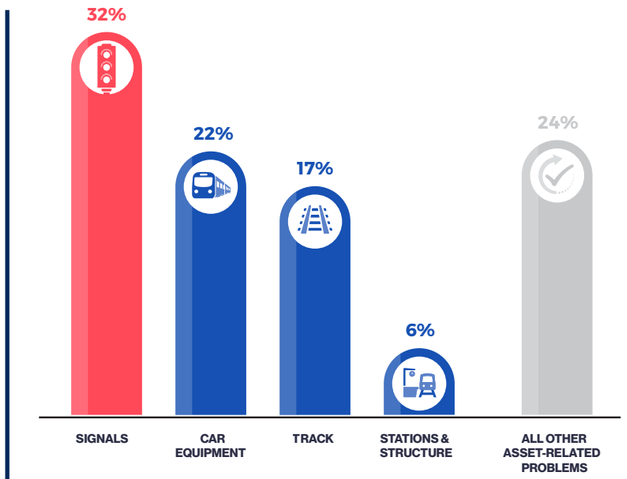
Upgrading our signal system is key to improving reliability, reducing delays, and increasing capacity.

The signal system is critical to keeping the subway moving safely. Much like traffic signals on the streets, our signal system directs the safe movement of trains through our system. Functioning as the subway's "nervous system," the signal system provides key information to operations teams about where trains are located, allowing us to monitor and manage service to keep trains moving.

As our infrastructure ages, it becomes more challenging to maintain—even as riders continue to rely on it. And for much of our history, we lacked sufficient capital funding to keep up with the pace at which our equipment aged. Riders will remember the 2017 Summer of Hell, when infrastructure failures stemming from the greater strain placed on aging infrastructure contributed to some of the worst subway's worst performance since the fiscal crisis of the 1970s. This underlined the need to accelerate capital investment into key infrastructure, like the signal system—so riders today get the reliable service that they deserve, and so the subway is prepared for the riders of the future.

Signals caused the largest share of asset-related subway delays in 2025

Today, signal issues are a leading cause of asset related delays on the subway—causing an average of more than 11,000 train delays per month and delaying the average rider over 13 minutes per incident.

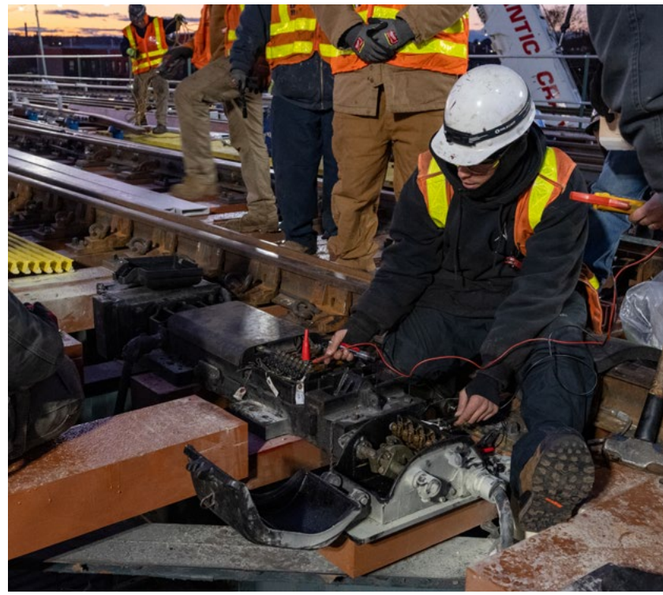


System delay data from 2025

With signals, we are not just replacing old infrastructure like-for-like. CBTC represents a major step forward in the function of the signal system which will allow us to run better service than is possible with our "legacy" fixed-block signals. Our previous MTA 2050 report, Eliminating Bottlenecks: Speeding Up Your Ride, talks about how our legacy signal system is often a bottleneck to faster and more reliable service. CBTC allows trains to safely operate closer together, increasing capacity and allowing service to recover from disruptions more quickly. CBTC also allows more accurate monitoring and management of train movement—and, therefore, more accurate customer information.

We currently have signal modernization projects underway on 120 miles of tracks: the 8 Av A C E line, the Queens Blvd East E F line, the Crosstown F G line, the Fulton-Liberty A C line, and the 6 Av-63 St B D F M line. When completed, we will have brought a modern signal system to 2.3 million daily riders.

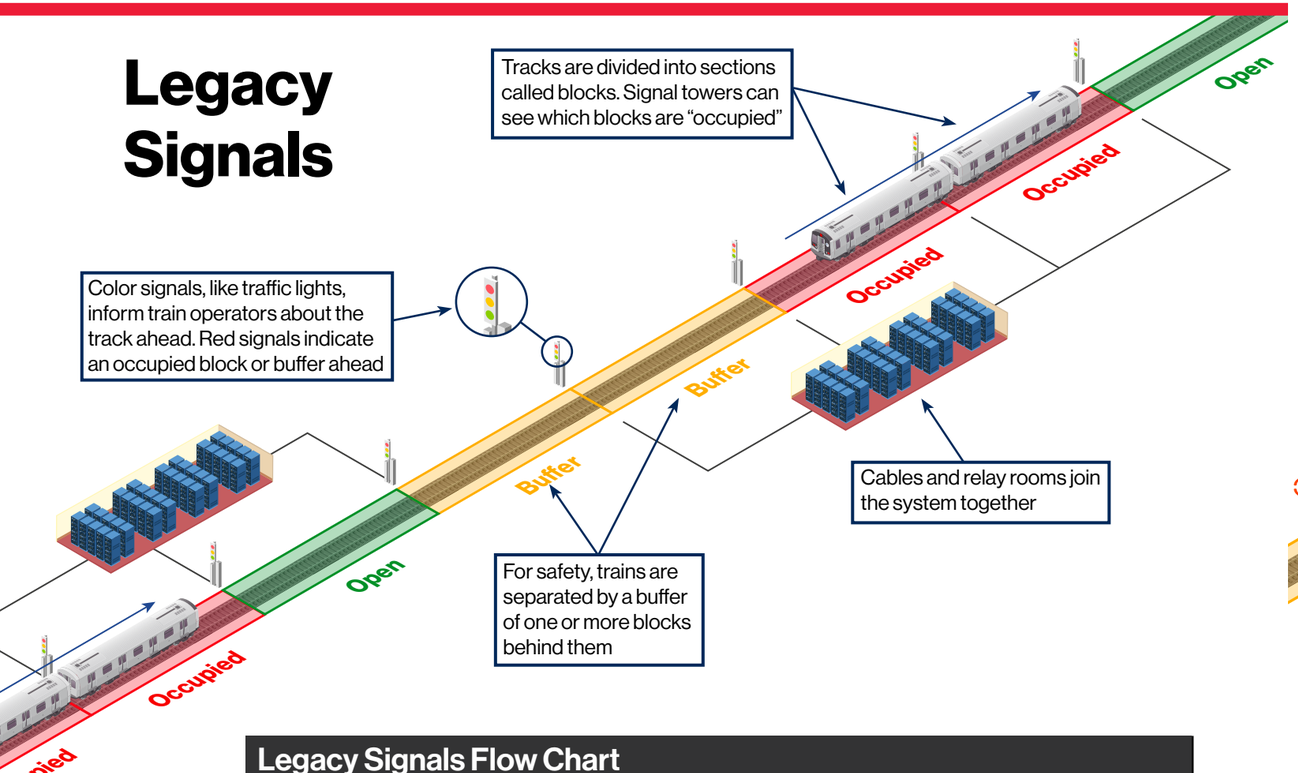
Those projects are part of a strategy that will roll out CBTC to the entire subway system by 2050. As we expand the amount of the system covered by CBTC, we will have train service that is faster, more reliable, and more predictable.



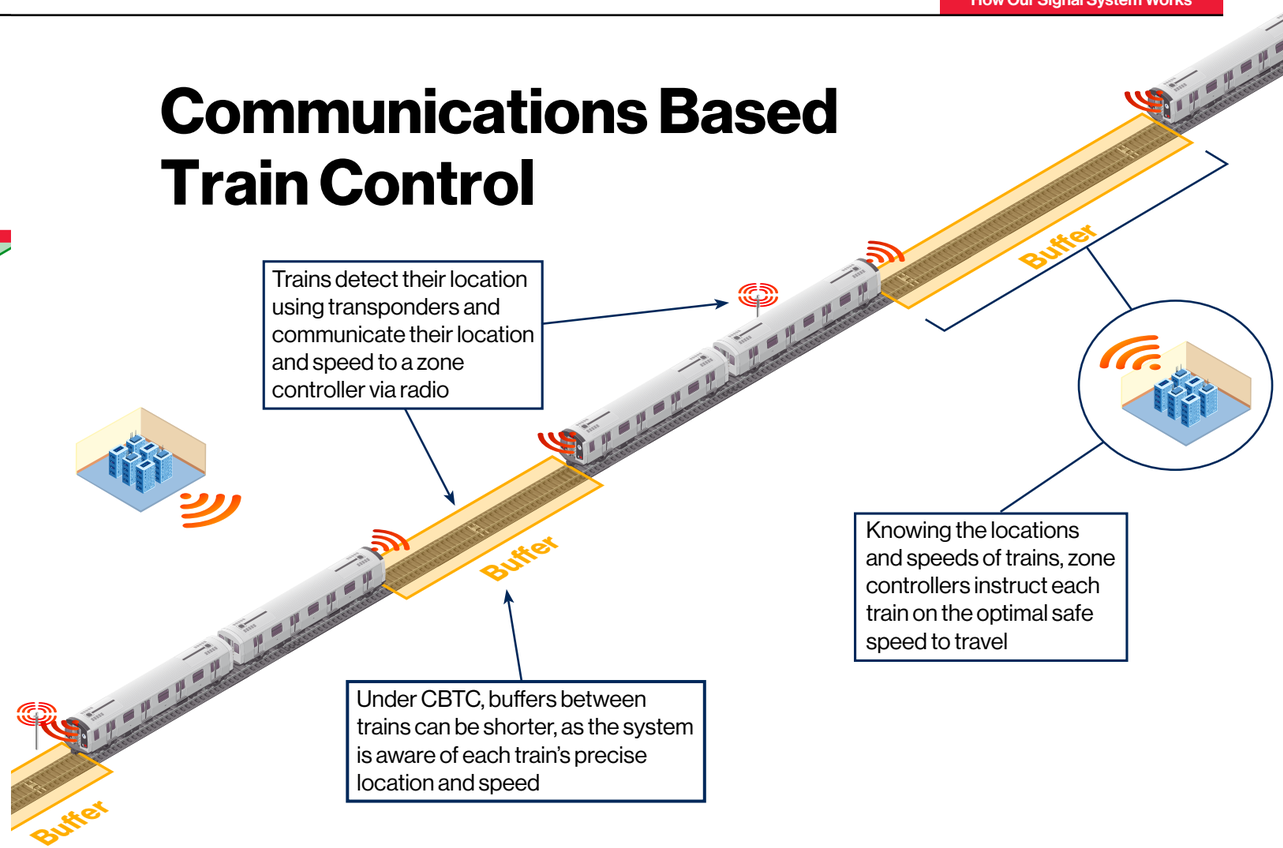
Testing a new switch near 104 St A as part of the Fulton-Liberty CBTC project

HOW OUR SIGNAL SYSTEM WORKS

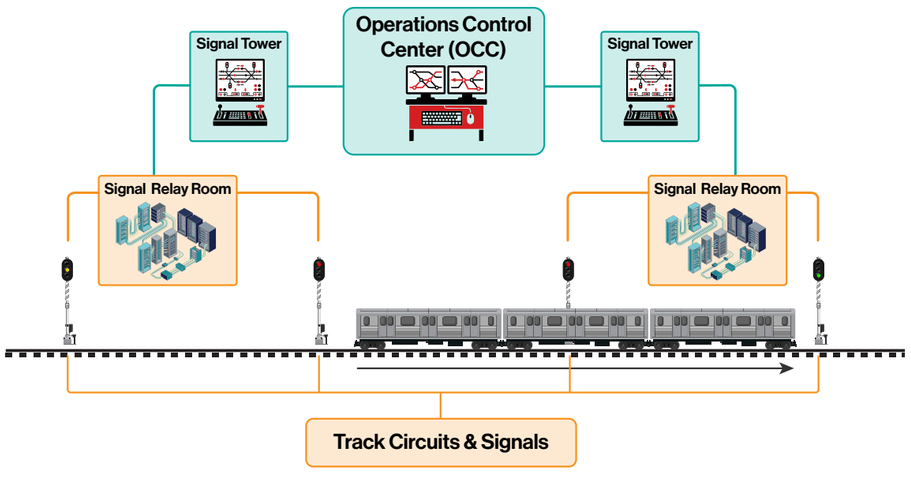
Legacy Signals



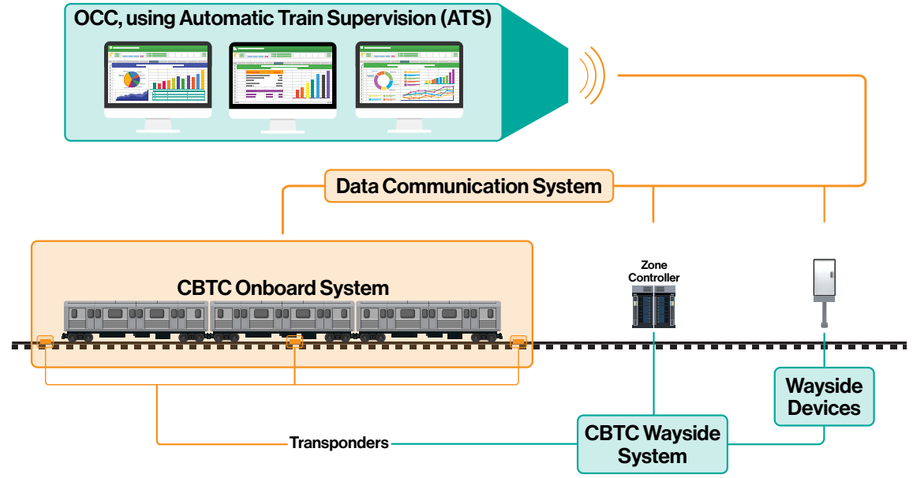
Communications Based Train Control



Legacy Signals Flow Chart



CBTC Flow Chart



How Signal Modernization Projects Work

To modernize our signal system, we must do significant work on and near the tracks. This often means that subway service is diverted or interrupted. When trains aren't running, we can work on:

1. **Surveying the line**, collecting data on track geometry and infrastructure to determine the placement of new equipment.
2. **Development and testing of software,** initially conducted offsite while construction takes place in the field.



Initial surveying on the Fulton-Liberty A C line project



Installing wayside equipment on the Flushing 7 line

3. **Installing new equipment**, including transponders, radio units, and miles of cables that tie this system together and connect it to our control centers. To date, the MTA has bundled this work together with other construction, including upgrading tracks and and switches.

We are examining our approach to this step and taking advantage of technology to streamline and shorten this step for future CBTC projects.

4. **Deploying the CBTC system,** done in stages along the line to accommodate rigorous testing. Signals are the most important safety measure we have on the subway, so we put this system through rigorous testing. Putting CBTC in-service on an area with many switches and complex operation can require tracks to be taken out of service.



Testing a new switch on the Crosstown F G line project

How CBTC Improves Service

When the work is done, we get a signal system that can improve service for riders today and—by unlocking more capacity in the infrastructure we already have—ensures that our subway system can keep up with New York City as it grows into the future.

- **Faster service:** we have seen speed improvements of 5-10% on the 7 E F M R L trains after the introduction of CBTC to the Canarsie, Flushing, and Queens Blvd lines.
- **More frequent service:** With the additional capacity provided by CBTC, we increased rush hour 7 train service by 2 trains per hour after the implementation of the Flushing line CBTC project.
- **More reliable service:** CBTC provides higher track capacity and centralized control to help us recover normal service more quickly when delays do occur—and modernizing our signal system means fewer delays caused by "signal problems" in the first place.
- **More predictable service:** We are using CBTC on the L train to automatically keep trains evenly spaced apart and improve your wait time. Since this feature was introduced in 2025, excess wait time has been reduced by 15%.



A 2 train pulling into 149 St-Hostos

HOW OUR SIGNAL SYSTEM HAS EVOLVED

1904-1999
The Legacy Signal System



A signal in the Rutgers Tube

The basic structure of our legacy signal system has remained the same since the opening of the subway over 120 years ago.

Our legacy signal system is known as a fixed-block system. This system divides the track into sections, called blocks, each of which is a separate electrical circuit. When the steel wheels of a railcar enter a stretch of track, they interrupt the circuit, allowing us to "see" where that train is located. This allows us to monitor and manage the location of trains—but imprecisely, as this old technology can only tell us that some part of a train is occupying some part of a fixed block, which can be over 1,000 feet long.

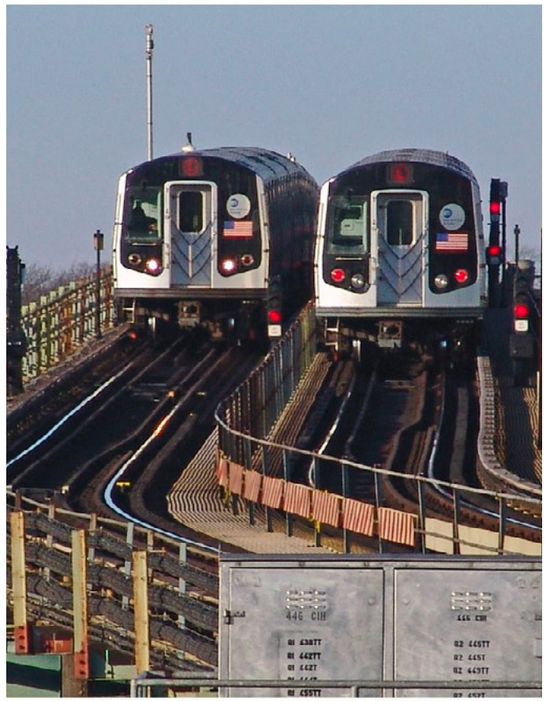
Without more detailed information about train location and speed, these blocks are a blunt tool to space trains out and keep our operations safe. This system relies on a tremendous number of circuits and relays, and thousands of miles of cables, making it difficult to detect the source of equipment failure. And as parts age, this equipment gets harder to maintain. Today, some parts must be rebuilt in-house as they are no longer manufactured.

Under this system, routing trains through the subway's busy tracks and junctions relies on tower operators, who monitor service and manipulate switches and signals at dozens of locations around the system. These tower operators can only see and manage trains in a part of the system near their tower, not the entire network—making it more challenging to manage the even spacing of trains across our complex system.

2000s
Beginning Signal Modernization

CBTC represents a historic change in the structure of the signal system.

By introducing continuous communication between equipment on trains and along the tracks, instant and precise information about train locations and speed can be delivered to the train operators and to our dispatchers who centrally manage service. Using that information, CBTC determines the optimal safe speed for that train in real-time and provides an appropriate safety buffer to separate that train from others on the same track. This lets us safely run trains faster and closer together, and enables Automatic Train Operation, which boosts speed and reliability even more. CBTC also centralizes the monitoring and management of an entire line, or group of lines, to a single location—giving our operations teams better tools to direct service at a network-wide level.



R143 (L) trains near Sutter Av, 2005

Our first CBTC project upgraded the Canarsie (L) line. This was the first project in North America where CBTC was retrofitted to an already-operating system, and one of the first CBTC implementations to employ radio-based communication between trackside and on-train equipment. Following the success of the (L) deployment, we continued the CBTC rollout on the Flushing (7) line. These lines were selected both due to the age of their previous signal systems, and because these lines don't have merges with other subway lines that complicate their operation. The benefits to riders have been clear: since installing CBTC, **the (L) and (7) trains have maintained the highest on-time performance of all subway services.**

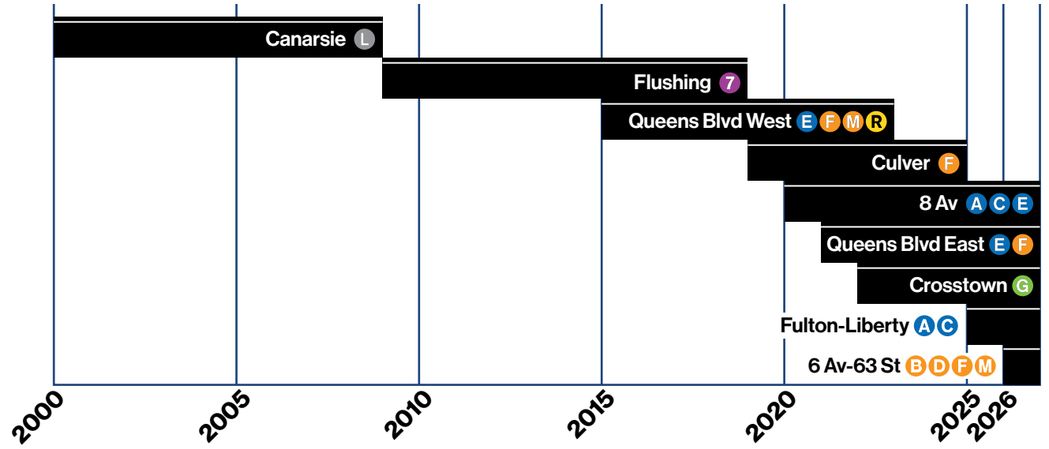
At the same time, we introduced a new Automatic Train Supervision (ATS) system to the 1 2 3 4 5 6 lines. While this does not change the structure of the signal system, it centralizes the dispatching of trains and management of service on those lines at our Operations Control Center—one of the key advantages of our signal modernization program. Controlling service centrally, rather than through towers scattered throughout the system, allows for faster and simpler response to incidents, and gives our operations teams new tools to automatically manage the spacing of trains to reduce delays.

These initial projects proved the case for signal modernization. In the years ahead, we will deliver the combined benefits of both CBTC and ATS to the entire subway system.



An R142 train on the Jerome Av 4 line

We've accelerated the pace of signal modernization, and we want to go even faster.



2010s
Tackling the Interlined Subway

The extensive interlining in our system affects service. This characteristic of our system shapes our approach to rolling out CBTC.

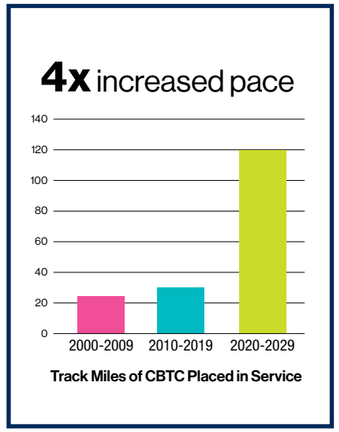


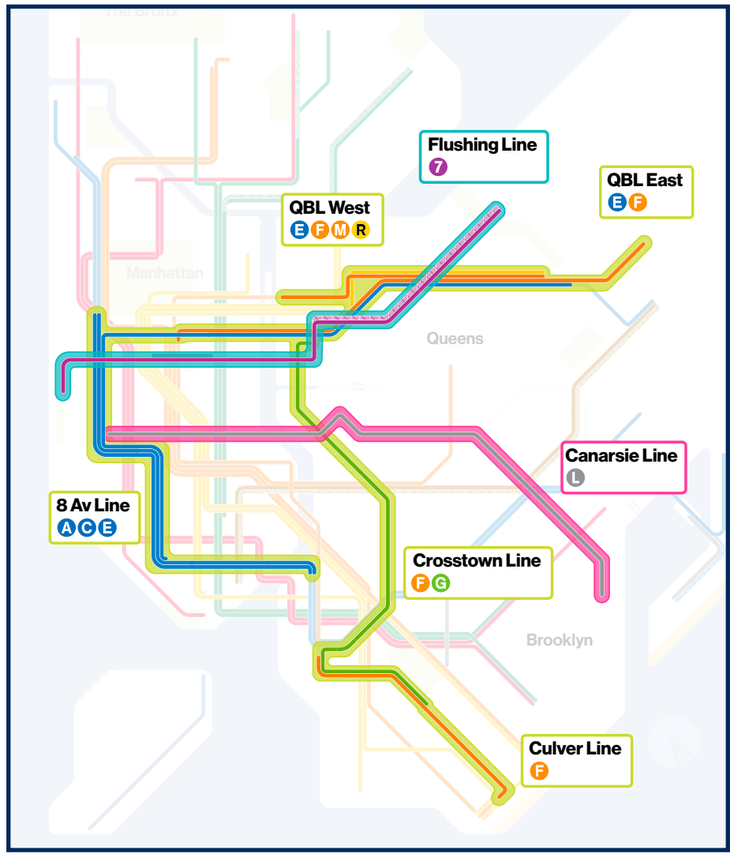
A CBTC warning sign on the Culver F line

Most subway lines in our system share tracks with others for parts of their journeys—this is called interlining. This means that signal modernization work on any stretch of track will likely affect multiple subway services. Rather than being able to roll out CBTC one subway line line at a time, we must be able to work in different parts of the system simultaneously, stitching together subway service as the rollout progresses. It means that all our subway cars must eventually be able to communicate with any trackside equipment around the system. And to complete this rollout at an adequate pace, we need a high capacity for the supply of equipment and delivery of projects. To achieve this, we developed a standard interoperability framework for the subsystems that compose CBTC. This framework specifies a common language used by the components of CBTC system to communicate with one another. This helps build our capacity to deliver CBTC while keeping costs down.

This framework was demonstrated on a highly busy and interlined corridor, the Queens Boulevard E F M R line (QBL)—between 50 St/8 Av and Kew Gardens-Union Turnpike—and several expansions are in progress or completed, including the E F between Kew Gardens-Union Turnpike and Jamaica-179 St, the A C E between 59 St-Columbus Circle and High St, Brooklyn, and the F between Church Av and West 8 St in Brooklyn.

The 2020-2024 Capital Program represented a dramatic increase in the scale and pace of our CBTC work. We have started work on the Crosstown F G and Fulton-Liberty A C projects—a total of over 70 miles of signals. **By the end of 2026, we will award the contract for the 6 Av-63 St B D F M line, an additional 43 track miles that includes the busy DeKalb Interlocking in Brooklyn.**



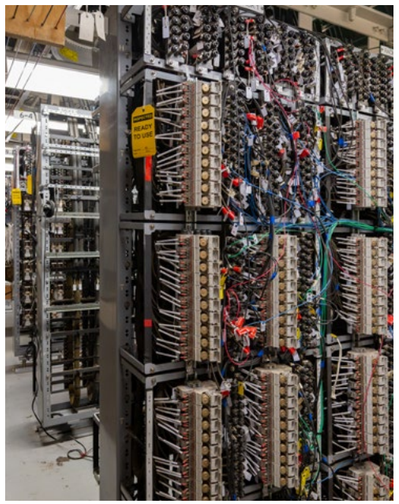




An R211 train on the Liberty Av A line near 88 St

2020s
Streamlining Our Projects

Our previous CBTC projects were highly complicated: these projects involved first renewing the legacy signaling system, and overlaying CBTC over the same renewed signals.



New legacy signal equipment on the Queens Blvd East E F project

This provided a fallback system, necessary because not all our trains, particularly our work trains, were equipped with CBTC. It was also important to have a backup in place as we built trust in the reliability of a CBTC system.

But this approach made projects cost more and take longer to deliver. On the Queens Blvd East E F project, work on the backup legacy signal system has been the primary source of delay. That is why, with confidence in this modern system, we're taking action to simplify and streamline our CBTC projects. On our most recent projects, we are replacing the track circuit system described earlier with axle counters, a cheaper and easier system to maintain. Rather than the system of electrical circuits in the rails described earlier, axle counters use a sensor next to the rail to detect the passage of trains.

On the Crosstown F G, Fulton-Liberty A C, and 6 Av-63 St B D F M CBTC projects, control of interlockings—the switches that allow trains to change tracks—was placed directly with the CBTC system, rather than being handled through a separate machine, as it was historically. **This has helped to drive costs down: per mile, the Crosstown F G project is half as expensive as earlier CBTC projects.** This will be the template for all future CBTC projects, saving costs in the long term as we move to a simpler system with modern components.

What's Next

Beginning Implementation



In the 2025-2029 Capital Plan, we funded over 75 miles of additional CBTC implementation—including the Liberty Av A C line and the busy DeKalb Av interlocking, where work is already beginning. **Our plan, on the following pages, outlines how we can build this momentum to bring CBTC to the rest of the subway.**

While we implement the work funded in the 2025-29 Capital Plan, we are planning the next 20 years of signal modernization—learning from past projects and leveraging new technology to roll out CBTC across the subway system at an accelerated pace.

We've learned a lot about what makes a successful CBTC project. To capture the full potential benefits of CBTC and accelerate the pace at which we roll it out, we will apply these lessons and take advantage of emerging technology. **Several key strategies will double down on our work to streamline CBTC projects and put us on the path to completing the systemwide rollout of CBTC by 2050.**



A legacy/CBTC system switch on the 8 Av A C E project

How we're innovating to deliver CBTC faster:



Fully removing legacy equipment:

We are moving towards a 100% CBTC-equipped fleet of revenue trains, but our work train fleet remains unequipped. To move work trains throughout the system while keeping service running, we must include backup legacy signal equipment on our CBTC lines, adding complication to CBTC projects. Equipping our work train fleet with CBTC can allow us to simplify the scope of future projects by removing the legacy signaling equipment included.



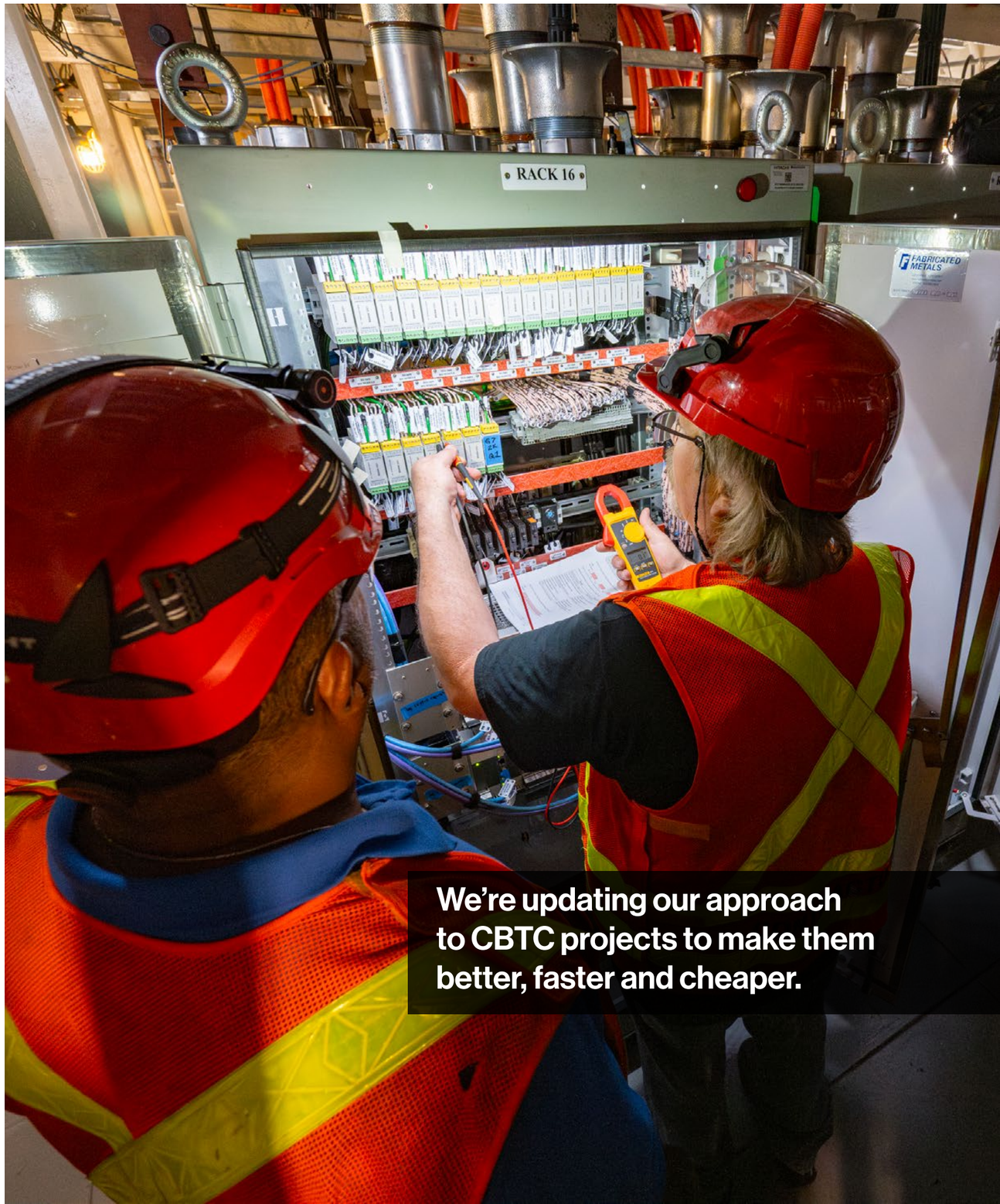
Leveraging the latest technology:

As technology evolves, we want to keep our system on the cutting edge. Currently, trains operating under CBTC scan a series of transponders placed between the rails to pinpoint their location along the line. We are piloting a new system for monitoring train locations that would employ sensors mounted on the cars, without the need for track-level transponders. This could allow for a further reduction in the amount of trackside equipment we must install and maintain as we transition to CBTC.



Rethinking project structure and scope:

We weigh dozens of factors in the way we shape these projects—including opportunities to bundle other improvement work with CBTC projects, and the contractual structure that defines how various vendors and project elements work together. We will continue to learn from our existing CBTC projects about what will allow us to deliver these projects better, faster, and cheaper.



We’re updating our approach to CBTC projects to make them better, faster and cheaper.

OUR PLAN TO COMPLETE SIGNAL MODERNIZATION

We have developed a strategy to bring us to systemwide CBTC by 2050.

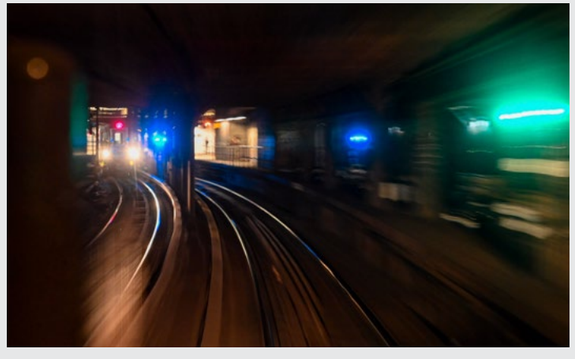
Roll out CBTC concurrently with hundreds of new railcars on the numbered lines— taking advantage of an opportunity to deliver modernization at scale to 2 million riders on some of the subway's busiest lines.



Unlock the benefits of end-to-end CBTC coverage on the lettered lines where modernization has begun— applying the lessons of streamlined project delivery to complete signal modernization on 15 remaining subway lines.



Accelerate the pace of signal modernization to finish this campaign by 2050. This requires streamlining the scope of these projects, advancing enabling projects, and exploring novel contract approaches to deliver these projects better, faster, and cheaper, without sacrificing on safety.





Testing CBTC equipment on the 8 Av A C E project

We are planning this rollout with subway performance data at the center of our strategy.

A robust, data-driven analysis process guides our investment strategy. We are balancing signal age along with the day-to-day performance of this equipment in our daily service. Using data, we know on which lines the signals require the most maintenance work, where signal issues frequently cause delays, and where signal capacity snarls the subway the most. These are crucial inputs into our planning process.

Finishing signal modernization will build on the benefits we've already seen from our completed projects.

- As more aging signal equipment is decommissioned, reliability will continue to improve.
- CBTC enables centralized control of train movements from our Operations Control Center. As more subway lines can complete their full journeys under CBTC, our operations teams will have more robust tools to keep service moving and recover quickly from disruptions.
- End-to-end CBTC coverage is part of what powers the high reliability on the L and 7 lines. There is a lot more benefit to come for riders as we reach this milestone for every one of our service lines.
- CBTC gives us additional capacity and the option to run more frequent service. Across the subway system, this capacity is important to keep up with the growth in ridership we anticipate over the next few decades: our region is projected to grow by over 1 million residents and nearly 1 million jobs by 2050.



Legacy signals on the Fulton A C line

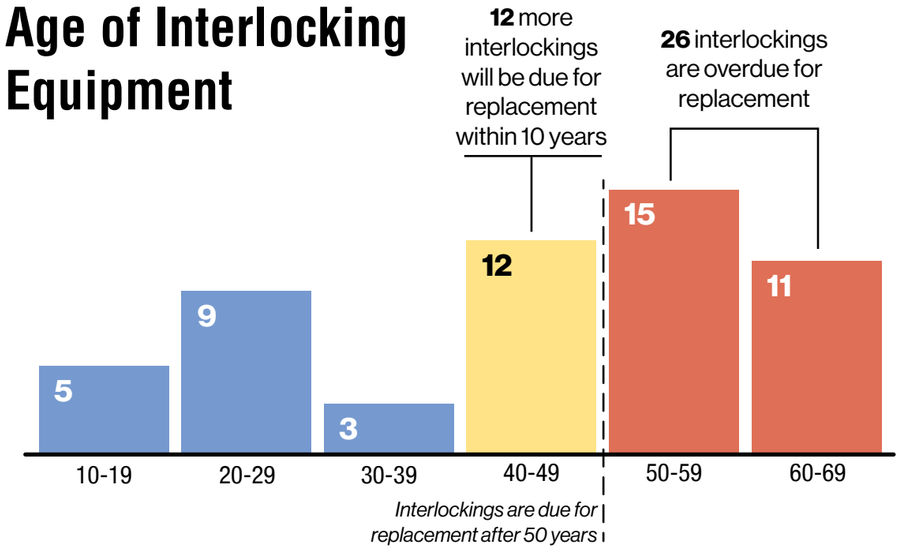


Modernize the Numbered Lines

An R142 5 train at 14 St-Union Square

The New York City Subway was not built as one system, but by three separate, competing operators. The oldest system—built by the Interborough Rapid Transit Company (IRT)—makes up today's 1 2 3 4 5 6 7 trains and remains separate from the lettered lines due to its narrower tunnels and railcars. These numbered lines are referred to as the A Divison, while the lettered lines are referred to as the B Division. To date, we have not rolled out CBTC on the A Division lines, except for the self-contained 7. But with some of our busiest stretches of track and oldest signal equipment, the need to modernize the 1 2 3 4 5 6 lines is clear. **We have a plan to begin the rollout of CBTC to these lines now, aligning the rollout of CBTC to the rollout of hundreds of new subway cars.**

Most interlockings on the A Division are approaching or beyond their useful life



Our aging signals are a sign we must begin installing this new signal system.

Our fixed-block signaling equipment has a useful life of 50 years, and over 50% of the approximately 210 miles of the A Division have equipment that is already older than that. This includes parts of the 7 Av 1 2 3 and Lexington Av 4 5 6 lines, some of the busiest parts of the entire subway system. The most complex signaling is found at interlockings, which manage the safe merging of trains. A Division riders lose over 1.2 million hours a year to signal issues; the average incident delays over 1,400 riders by over 11 minutes.

The major projects in the 2025-29 Capital Plan present a unique opportunity.

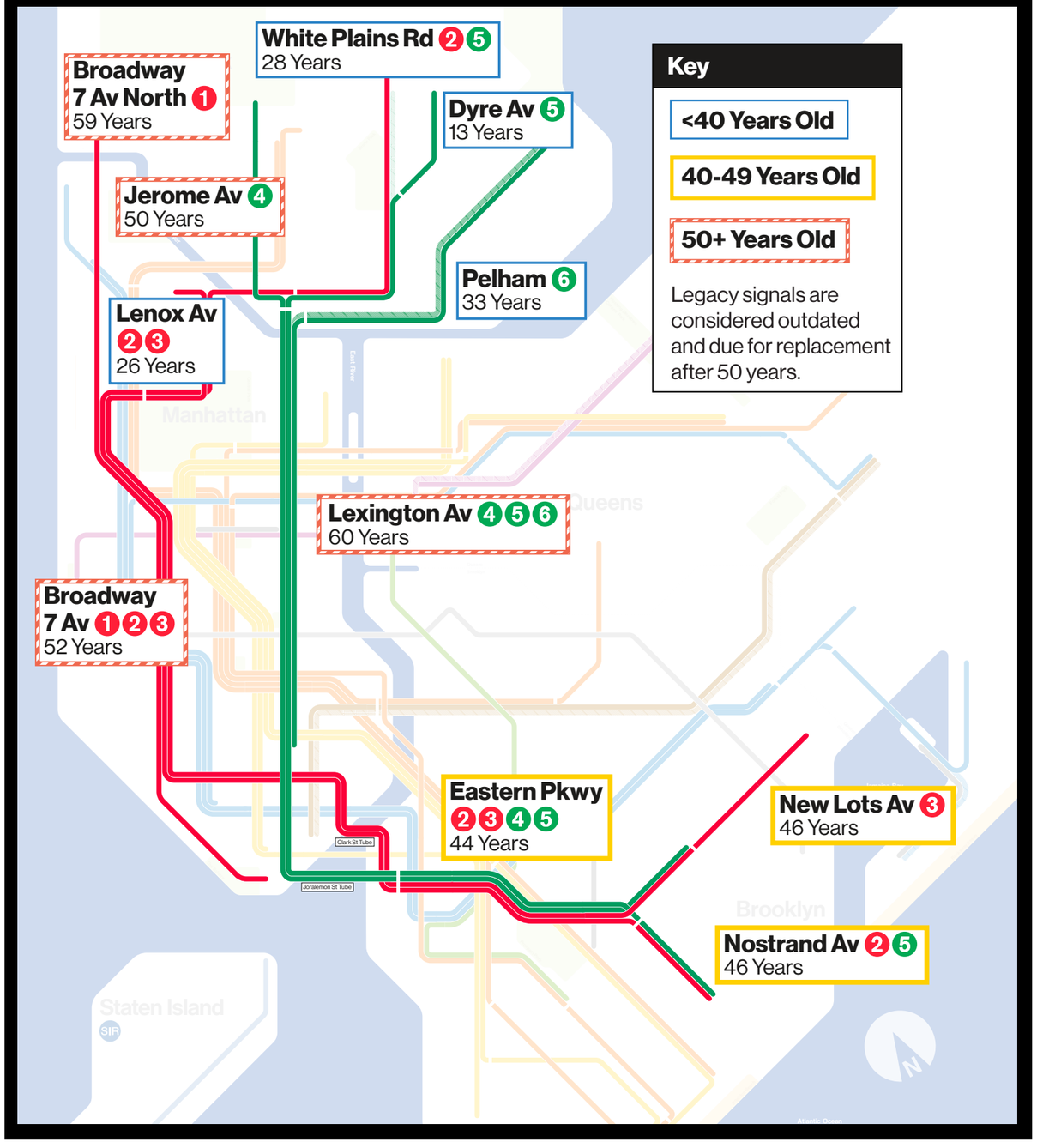
The first step to modernizing these lines is replacing their aging fleet—and in the 2025-29 Capital Plan, we have begun the replacement of up to 2,400 new railcars. Because CBTC requires new equipment on both trains and along the tracks, **purchasing a replacement for our fleet and equipping them with carborne CBTC equipment removes one of the biggest current barriers to rolling out CBTC across the A-Division**.

We are also renewing the A Division's original Automatic Train Supervision in this Capital Plan, which will benefit CBTC when it is put into service. This replacement will streamline the scope of CBTC projects and allow us to get more performance benefits out of CBTC when it is put into service.



An R211 train on the Brighton B line

A Division Signal Corridors with Median Signal Age (2026)



The order in which the rollout will progress will be shaped by several factors:

- **Signal age, condition, and performance:** we are drawing on extensive data on our existing assets to target our oldest signal assets and largest potential performance benefits first.
- **Pace of railcar delivery:** we will have to align the deployment of trackside CBTC equipment with the delivery of CBTC-equipped railcars. This is why we are beginning the rollout on sections that require fewer cars, so we can put CBTC into service sooner.
- **Cost to do this work:** even as we drive down per-mile costs, we must plan how to fund this work in a way that creates sustainable investment cycles for decades to come.
- **Managing disruptive construction:** it's no secret that CBTC projects require significant outages and temporary changes to our subway service to do the critical installation work that happens along the tracks. Taking advantage of technological innovations can help us reduce the number of outages required, but we will still need to ensure that alternate routes are kept open during construction.

The combination of State of Good Repair needs and major capital projects being initiated on the A Division makes now the right time to begin signal modernization. Our first steps include:

Equipping the new R262 fleet with carborne CBTC equipment before they arrive so they can be put into service. This is the most effective way to equip our rolling stock but only makes sense if we plan to install a new trackside signaling system at the same time so it can be put to use.



Initiating the CBTC rollout at the north ends of the 1 and 4 lines in the Bronx. These are two lines with legacy signal equipment at or well beyond its useful life and due for investment. By beginning this work now, we can have trackside equipment ready to go when new railcars arrive, allowing us to start testing and refining the system immediately and match the pace of the CBTC rollout to the pace of the new railcar delivery.



Taking a new approach to planning for these projects by tackling more of the design work for the 1 2 3 4 5 6 lines upfront. This will allow us to more quickly scale up the CBTC rollout in upcoming Capital Plans.



This is a transformative rollout that will benefit millions of daily subway riders.

On a regular weekday, there are 2 million trips taken on a 1 2 3 4 5 or 6 train, more than double the combined ridership of the Washington Metro and Chicago "L" last year. The 6 train has the highest line ridership (560,000 average daily riders in 2025), more than the entire Boston subway system. High ridership and short headways between trains mean that signal problems on the A Division can quickly snarl service and disrupt passengers' journeys. CBTC will make these journeys faster and more reliable and ensure the century-old A Division lines are equipped for decades of service ahead.



Passengers board a 6 train



Finish Modernizing the Lettered Lines

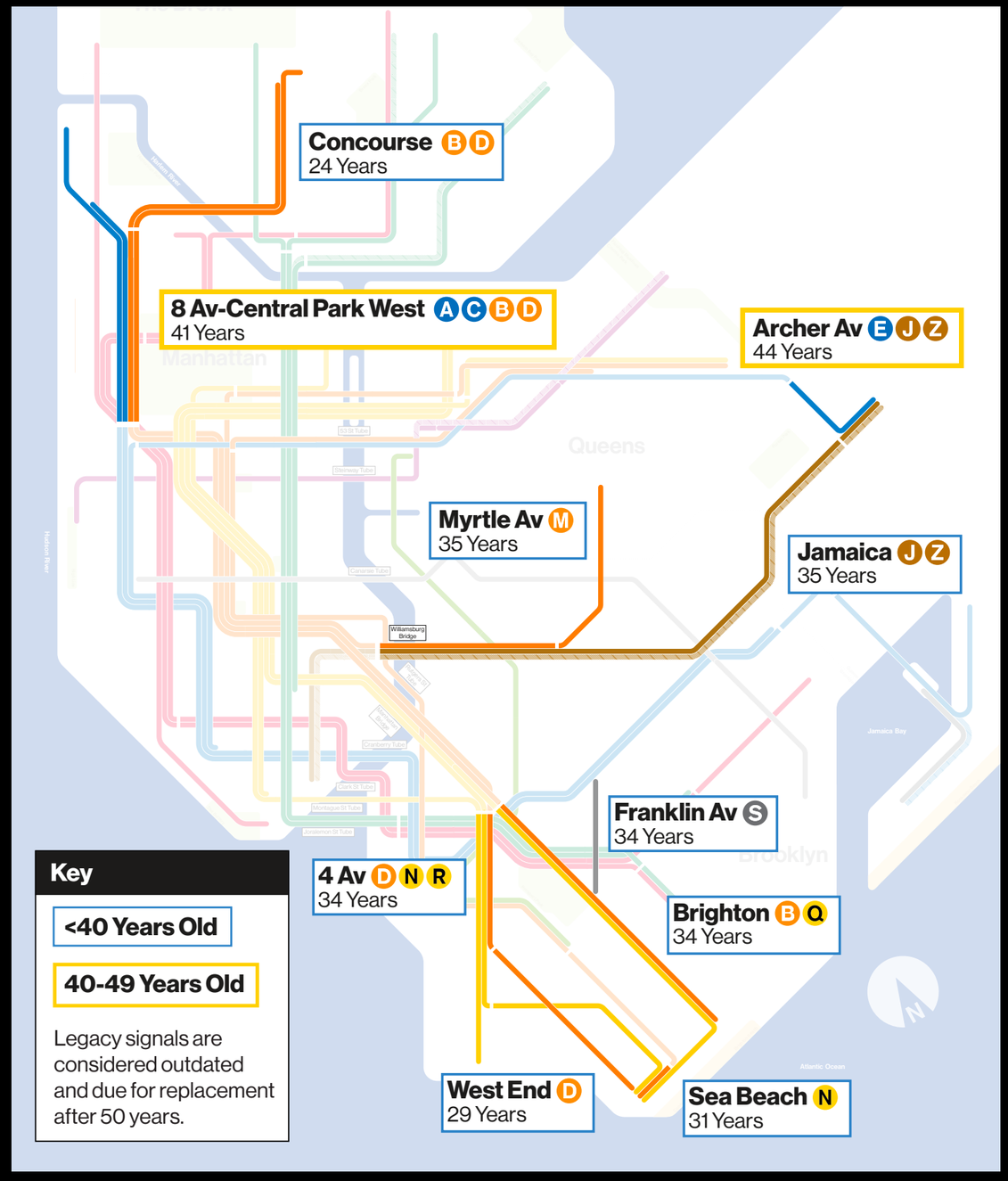
A J train crossing the Williamsburg Bridge

With the projects in the 2025-29 Capital Plan, we will have modernized more than 60% of the signals on the lettered lines, or B Division. Future CBTC projects will build on this work and permit additional subway lines to complete their full trip under CBTC.

On the B Division, the focus of our work to date has been the replacement of some of the subway's oldest signal infrastructure—replacing components that are up to 90 years old on corridors like the Crosstown F G and Fulton-Liberty A C lines. Now, we can focus on unlocking the benefits of end-to-end CBTC coverage on the lettered lines. This allows us to use the tools provided by CBTC to speed up trains and manage service to their full potential, maximizing benefits to riders.

We will continue the rollout of a more streamlined CBTC to the remainder of the B Division. As we do so, we will continue to use asset and performance data to prioritize the corridors with the greatest impact. Our strategy to streamline and accelerate CBTC projects will allow this work to take place alongside the rollout on the numbered lines and bring us to systemwide CBTC coverage by 2050.

Remaining B Division Signal Corridors with Median Signal Age (2026)



While we deliver the signal modernization projects from the 2025-29 Capital Plan, we are also advancing a suite of parallel work that will make our construction more efficient and the signaling system we are installing more reliable in the future.

- **Enabling projects**
  CBTC is a well-tested and proven system that can safely and efficiently move riders through our subway system. We are confident we can simplify the scope of our ongoing and future CBTC projects and are completing the enabling work necessary to do this. This includes equipping our work train fleet with CBTC equipment so every train we use can communicate with this new system.

- **Technological innovations**
  The MTA is actively monitoring the cutting edge of CBTC technology and including the newest innovations in our strategy. Improvements that meet our incredibly strict standards can allow us to build a fantastic signaling system with less equipment, reducing the points of failure and making it easier to maintain. Innovations like this also make these projects cheaper and faster to install.

- **Project Delivery**
  We weigh dozens of factors in the way we structure these projects, including the contractual structure, the way that our vendors are required to work together, and the scope of work included alongside the critical signal improvements. We will continue to learn from our existing CBTC projects about what will allow us to deliver these projects better, faster, and cheaper.



Workers install an axle counter in the Church Av Yard

Looking Ahead to 2050



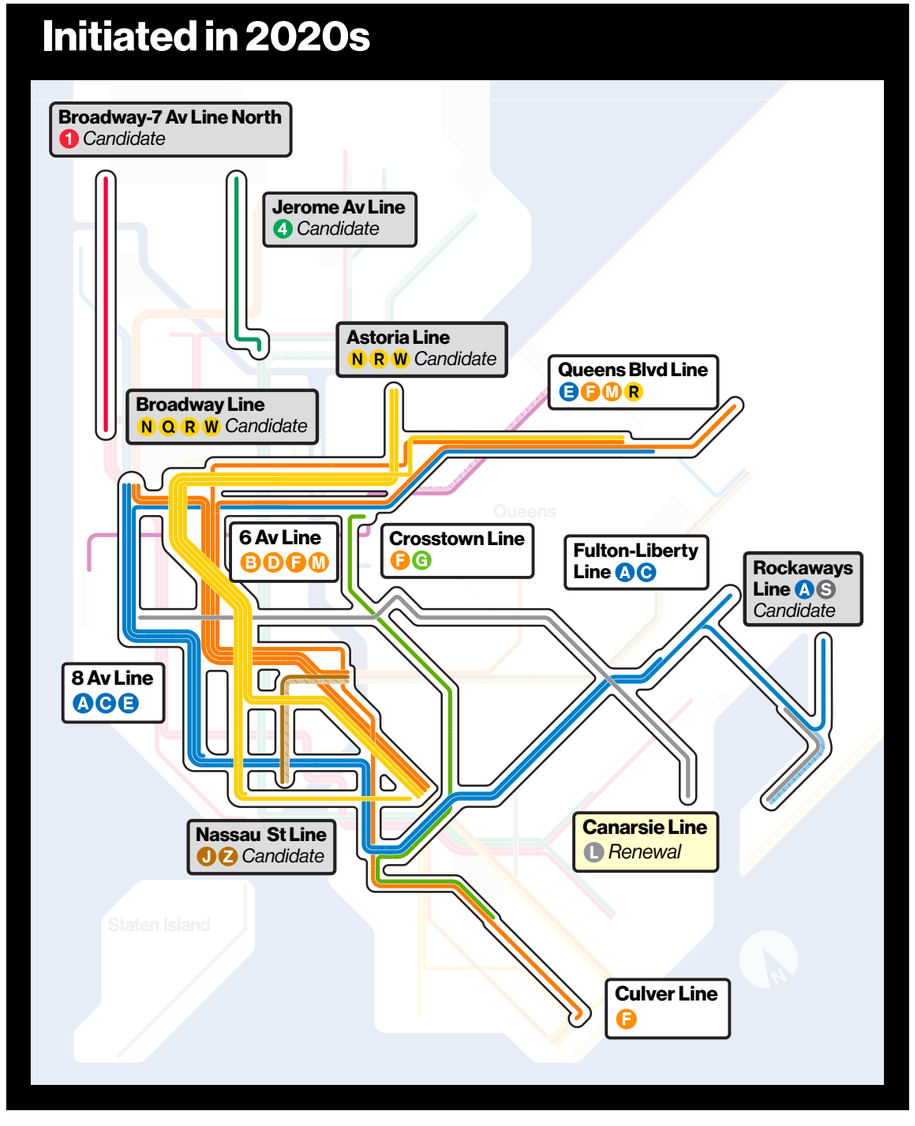
Switch replacement work on the Fulton-Liberty A C CBTC project

We have a strategy to modernize signals across the rest of the subway system by 2050. We know this work cannot wait any longer—to address the backlog of investment in our signal system, and to deliver service that is faster, more reliable, and more predictable for riders. When we complete this work, the MTA will be the largest subway system in the world to have fully replaced its signaling system.

Here is our strategy for making that vision a reality.

In the 2020s, we will deliver our funded CBTC projects and take the necessary steps to be well positioned to tackle the next wave of CBTC projects. This includes:

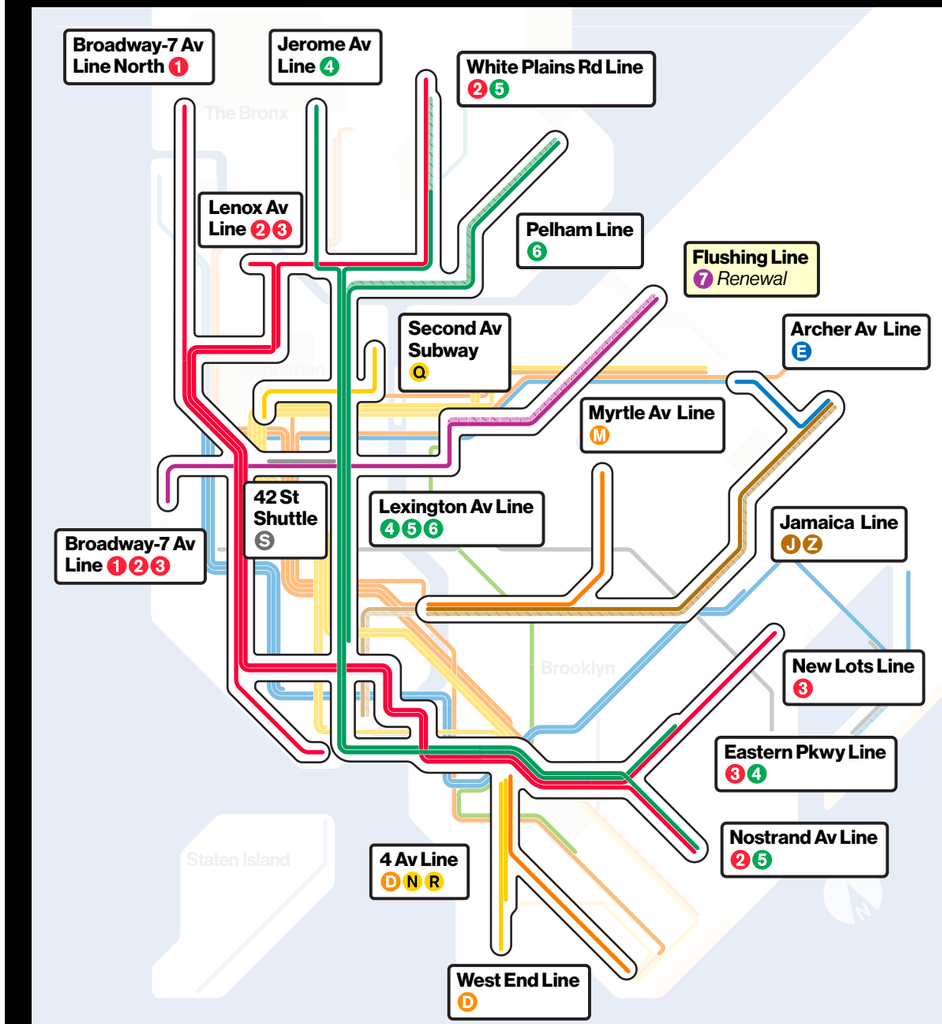
- **Expanding on the innovation** in how we build these projects that began with the Crosstown F G project. Delivering CBTC-centric projects that include less legacy signal equipment makes these projects faster and cheaper without compromising on safety or performance. We will also integrate our work train fleet into the CBTC signal system, a critical enabling step to our migration.
- **Completing our first CBTC renewal project** on the Canarsie L line, replacing the oldest CBTC system in New York City. This is an opportunity to improve the performance of this line and to demonstrate the ways in which CBTC renewals are less onerous than legacy signal modernization projects.
- **Bringing end-to-end CBTC to additional services: the F G W and Rockaways S.**



In the 2030s, we plan to aggressively modernize the A Division while continuing to address some of the oldest and highest priority corridors on the B Division. This includes:

- **Matching the R262 railcar delivery schedule with the pace of our A Division CBTC rollout.** Beginning with the early deployment lines, we will modernize signals using the cutting-edge CBTC design across some of the oldest remaining signal corridors. This will allow us to transform the experience for riders that have been riding 40-year-old railcars navigating 50-year-old signals.
- **Modernizing priority B Division corridors** that can deliver benefits to riders and be installed in parallel to priority A Division corridors.
- **Bringing end-to-end CBTC to eleven additional services: the 1 2 3 4 6 E J Z M R and 42 St S.**

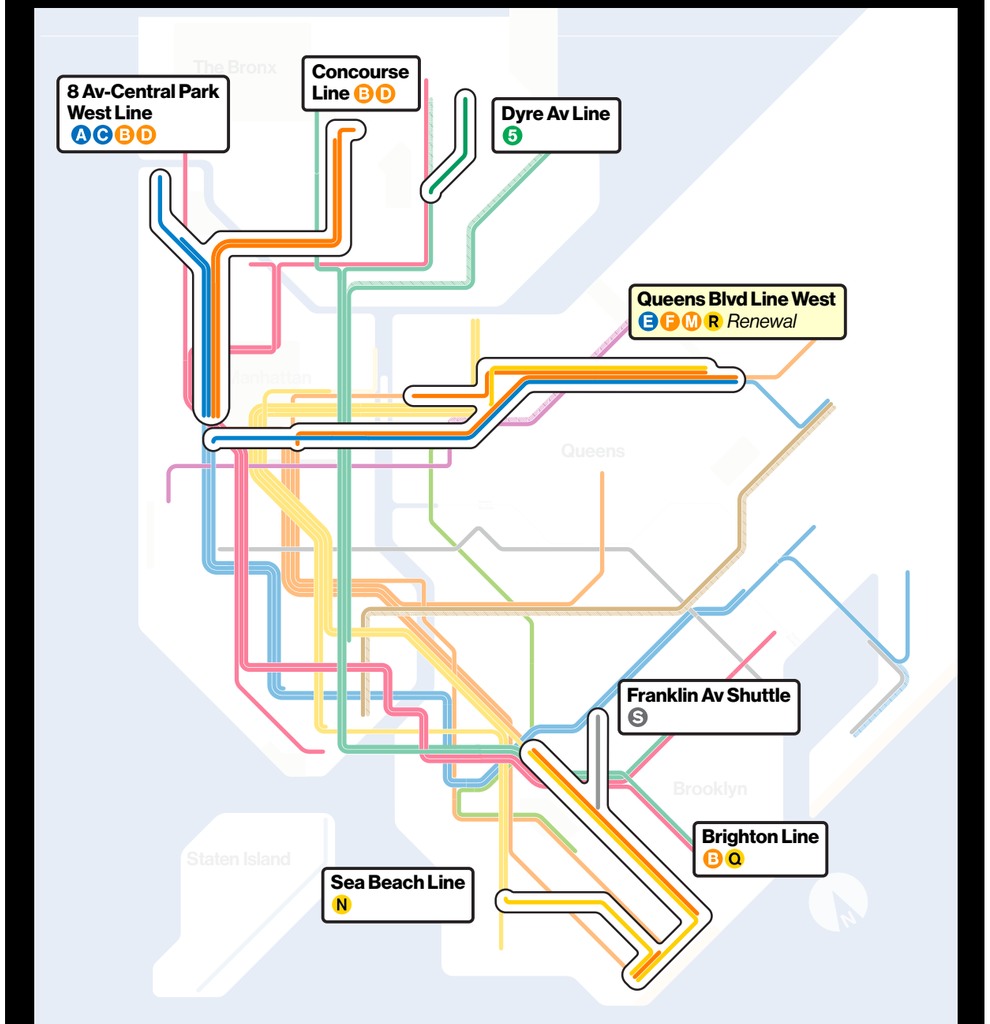
Initiated in 2030s



In the 2040s, we will wrap up our signal modernization campaign, bringing our signal system into a state of good repair, and beginning our regular CBTC renewal cycle with Queens Boulevard West and Culver. This includes:

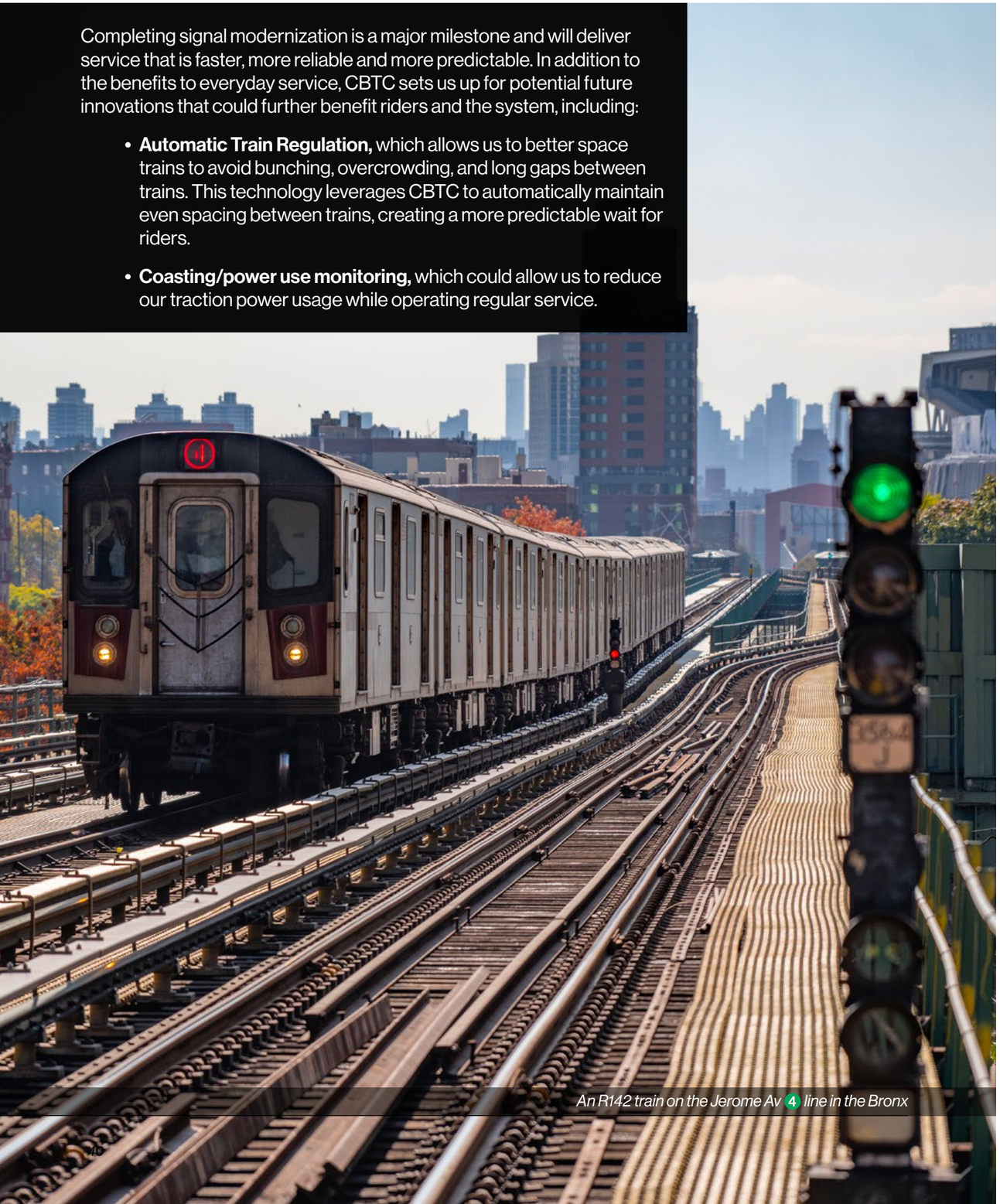
- **Completing the remaining A and B Division corridors,** catching up with the backlog of signal capital investment and bringing the service improvements of CBTC to every single subway rider.
- **Entering a steady state of CBTC renewal,** with renewal projects coming to Queens Boulevard by 2050. We will use this opportunity to implement lessons learned from Canarsie and Flushing renewal projects to apply to future CBTC renewal projects, which will require more investment in the decades to follow.
- **Bringing end-to-end CBTC to eight additional services: 5 A C B D N Q and Franklin Av S.**

Initiated in 2040s



Completing signal modernization is a major milestone and will deliver service that is faster, more reliable and more predictable. In addition to the benefits to everyday service, CBTC sets us up for potential future innovations that could further benefit riders and the system, including:

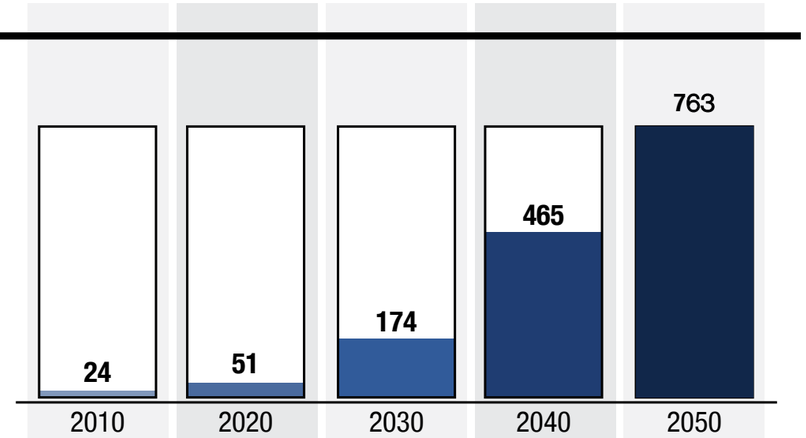
- **Automatic Train Regulation,** which allows us to better space trains to avoid bunching, overcrowding, and long gaps between trains. This technology leverages CBTC to automatically maintain even spacing between trains, creating a more predictable wait for riders.
- **Coasting/power use monitoring,** which could allow us to reduce our traction power usage while operating regular service.



An R142 train on the Jerome Av 4 line in the Bronx

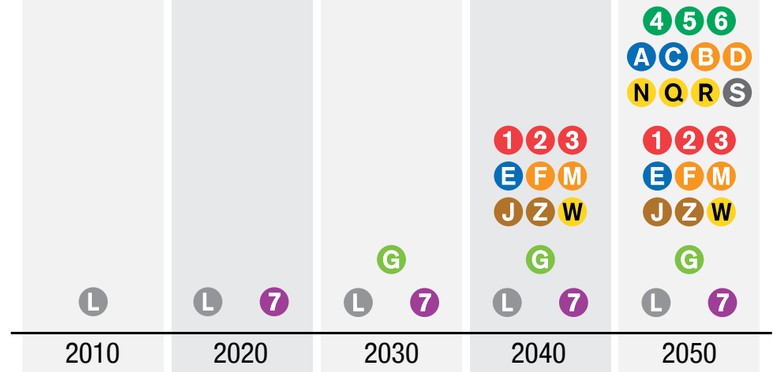
Signal miles completed by decade (cumulative)

We will pick up the pace of signal miles modernized by decade to finish by 2050.



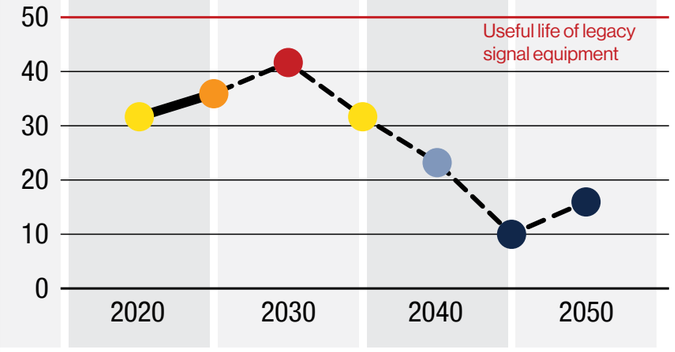
Service lines with end-to-end CBTC coverage

Through centralized control, CBTC along an entire route will bring the full reliability and performance benefits to riders.



Median signal interlocking age, current and projected

Our signal modernization pace hasn't kept up with the age of our signaling equipment; this plan will change that.





Installing wayside equipment near the Broadway G station

Conclusion/Next Steps

This report on signal modernization is part of a larger effort to prepare for our next 20-Year Needs Assessment, which identifies key needs in advance of each 5-Year Capital Plan. We released the first report, "Eliminating Bottlenecks: Speeding Up Your Ride," in July. That report summarized a data-driven analysis of capacity constraints throughout the subway system and detailed some of the highest priority bottlenecks to address, including a bottleneck at DeKalb Interlocking that we will mitigate as part of the installation of CBTC on the 6th Avenue line starting next year.

Soon, we will begin modernizing corridors in the 2025-2029 Capital Program, such as the Broadway-Astoria N Q R W line, and pursue enabling projects like equipping our work train fleet for CBTC operation. We will also initiate CBTC rollout on sections of the 1 and 4 lines in the Bronx, for the first time synching the installation of trackside equipment to the arrival of new subway cars, allowing us to test and refine the system immediately. And we are initating our first CBTC renewal project on the Canarsie L line, updating that equipment to the cutting edge of our signaling system as it reaches the end of its useful life.

As we look toward the next 20-Year Needs Assessment and Capital Plan, we will continue to evaluate the best strategies for delivering these major CBTC projects and look for additional opportunities to combine bottleneck mitigation and signal modernization efforts. Our approach will be flexible enough to be nimble; if one project gets delayed or other work makes a corridor impossible to modernize for a while, we will pivot to an alternative to constantly deliver better service for riders.

APPENDIX:
Guide to Subway Corridors



	Service Lines	Corridor	Corridor Limits
	1 2 3	Broadway-7 Av	96 St to South Ferry and Borough Hall
	1	Broadway-7 Av North	Van Cortlandt Park-242 St to 96 St
	5	Dyre Av	Dyre Av to E 180 St
	2 3 4 5	Eastern Parkway	Borough Hall to Crown Heights-Utica Av
✶	7	Flushing	Flushing-Main St to 34 St-Hudson Yards
	4	Jerome Av	Woodlawn to 149 St-Hostos
	2 3	Lenox Av	Harlem-148 St and 149 St-Hostos to 96 St
	4 5 6	Lexington Av	149 St-Hostos to Borough Hall
	3	New Lots	Crown Heights-Utica Av to New Lots Av
	2 5	Nostrand Av	President St-Medgar Evers College to Flatbush Av-Brooklyn College
	6	Pelham	Pelham Bay Park to 3 Av-138 St
	2 5	White Plains Rd	Wakefield-241 St to 149 St-Hostos
	S	42 St Shuttle	Times Square-42 St to Grand Central-42 St
	Q	2 Av	96 St to 57 St-7 Av
	D N R	4 Av	DeKalb Av to Bay Ridge-95 St
✶	B D F M	6 Av	59 St-Columbus Circle to DeKalb Av and Jay St-MetroTech
✶	M	63 St	21 St-Queensbridge to 47-50 St-Rockefeller Center
	A C B D	8 Av North	59 St-Columbus Circle to Inwood-207 Street
✶	A C E	8 Av	59 St-Columbus Circle to High St
	E	Archer Av	Kew Gardens-Union Tpke to Jamaica Center-York College
	N R W	Astoria	Astoria-Ditmars Blvd to 57 St-7 Av
	B Q	Brighton	DeKalb Av to Coney Island-Stillwell Av
	N Q R W	Broadway	57 St-7 Av to DeKalb Av
✶	L	Canarsie	8 Av to Canarsie-Rockaway Parkway
	B D	Concourse	Norwood-205 St to 145 St
✶	F G	Crosstown	Court Sq to Church Av
✶	F	Culver	Church Av to W 8 St-NY Aquarium
	S	Franklin Av Shuttle	Prospect Park to Franklin Av
✶	A C	Fulton St	High St to Euclid Av
	J Z M	Jamaica/Myrtle	Essex St to Jamaica Center-York College and Middle Village-Metropolitan Av
✶	A	Liberty Av	Euclid Av to Ozone Park-Lefferts Blvd
	J Z	Nassau St	Broad St to Essex St
✶	E F	Queens Blvd East	Jamaica-179 St to Kew Gardens-Union Tpke
✶	E F M R	Queens Blvd West	Kew Gardens-Union Tpke to 47-50 Sts-Rockefeller Center and 50 St
	A S	Rockaways	Rockaway Blvd to Far Rockaway and Rockaway Park
	N	Sea Beach	59 St to Coney Island-Stillwell Av
	D	West End	36 St to Coney Island-Stillwell Av

✶ — Corridor has CBTC in service or in progress

MTA 2050

MTA 2050 is a series of focused planning studies that will help shape the next 20-Year Needs Assessment, planned for October 2028, and define a forward-looking vision for the transit system at the middle of the century.

Each study examines how a distinct part of the network functions today, the challenges limiting its performance, and opportunities to preserve and modernize infrastructure or improve operations. Together, the studies will build the knowledge needed to unlock capacity, improve reliability, reduce travel times, strengthen connections, and deliver better service across the region.

Learn more at future.mta.info