Rail Modernization Program Plan

Riders Advisory Council
Washington Metropolitan Area Transit Authority
February 4, 2026

Delivering Your Metro, the Way Forward

Rail Modernization supports Metro's strategic goals

Focus Today

Service Excellence
Deliver safe, reliable, convenient, accessible, and world-class service that customers can trust across all modes.

Talented Teams
Attract, develop, and retain world-class talent where individuals feel valued, supported, and proud of their contribution.

Financial & Organizational Efficiency
Steward public resources and efficiently allocate resources where they drive the most value, to ensure service delivery.

Objectives of Service Excellence Goal

- **Safety and Security**
- **Reliability**
- **Convenience**

Objectives of Talented Teams Goal

- **Recruitment and Retention**
- **Learning and Development**
- **Customer Service Mindset**

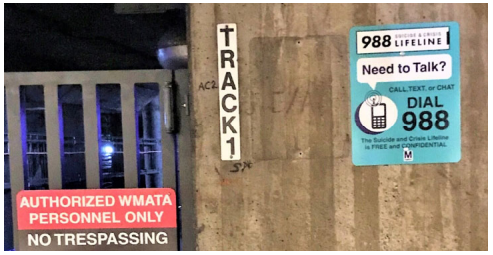
Objectives of Financial & Organizational Efficiency Goal

- **Financial Responsibility**
- **Organizational Efficiency**
- **Energy Management**

1. Vision for Rail Modernization and Automation

Metrorail is facing multiple challenges, with a system that is aging and increasingly outdated

Safety



Ongoing trespassing incidents

- Trespassers, trash, slips/trips/falls
- Human error in operation
- Challenging to mitigate with current system design

Reliability

Aging and unreliable infrastructure

- Inconsistent acceleration and braking by operators and signal system failures causing delays
- Growing maintenance costs; replacement parts are increasingly difficult to source

Capacity

Insufficient room for long-term growth

- Bottlenecks at key locations limit service
- Expensive alternatives to adding capacity

Efficiency

Outdated concept of operations

- Rising operating expenses and inflexible service model

Investing in modernization elements directly addresses Metro's key challenges

Program Elements

Signals

Fleet

Stations/Platforms

Operations

Safety

- **Safer operations**: keep trespassers off tracks, reduce track fires.

Reliability

- **Increase service reliability** up to 99%.
- **Less physical infrastructure to maintain.**

Capacity

- **Increased capacity with more trains per hour.**

Efficiency

- More productive service with **lower operating costs.**
- **Grow ridership & revenue.**

Grades of Automation

Grades of Automation (GoA) are the international standard describing roles and responsibilities for train control systems and on-board staff

Increasing Automation

Grade of Automation	Type of Train Operation	Setting Train in Motion	Stopping Train	Door Closure	Operation in Event of Disruption
GoA 1 	**Manual Operation** with Automatic Train Protection (ATP)	Operator	Operator	Operator	Operator
GoA 2 	**Semi-automatic Operation** with ATP & Automatic Train Operation (ATO)	Automatic	Automatic	Operator	Operator
GoA 3 	Driverless Train Operation (DTO)	Automatic	Automatic	Train Attendant	Train Attendant
GoA 4	**Full Automation**, capable of Unattended Train Operation (UTO)	Automatic	Automatic	Automatic	Automatic

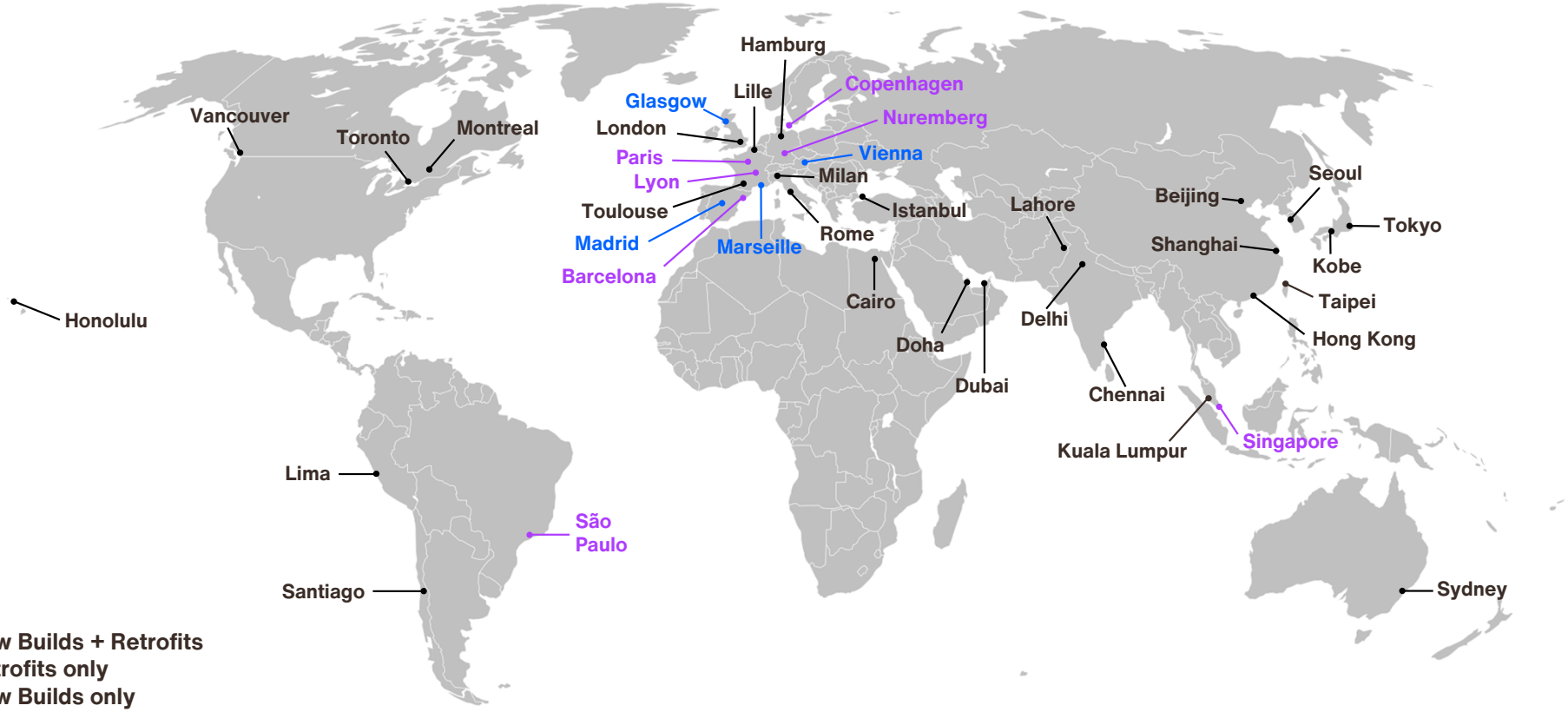
International Standard IEC-62290-1

Metro operated in manual mode as a **GoA 1** system from 2009 to 2025

Metro's Automatic Train Operation (ATO) is a **GoA 2** system

Metros are automating across the world

Selection of Grade of Automation 3/4 (GoA 3/4) lines, current and in development



GoA: Grade of Automation

Replacing Metro's signal system is a systemwide need

Planning to start with incremental investment in the Red Line; it has the oldest and most self-contained infrastructure footprint

R Red Line

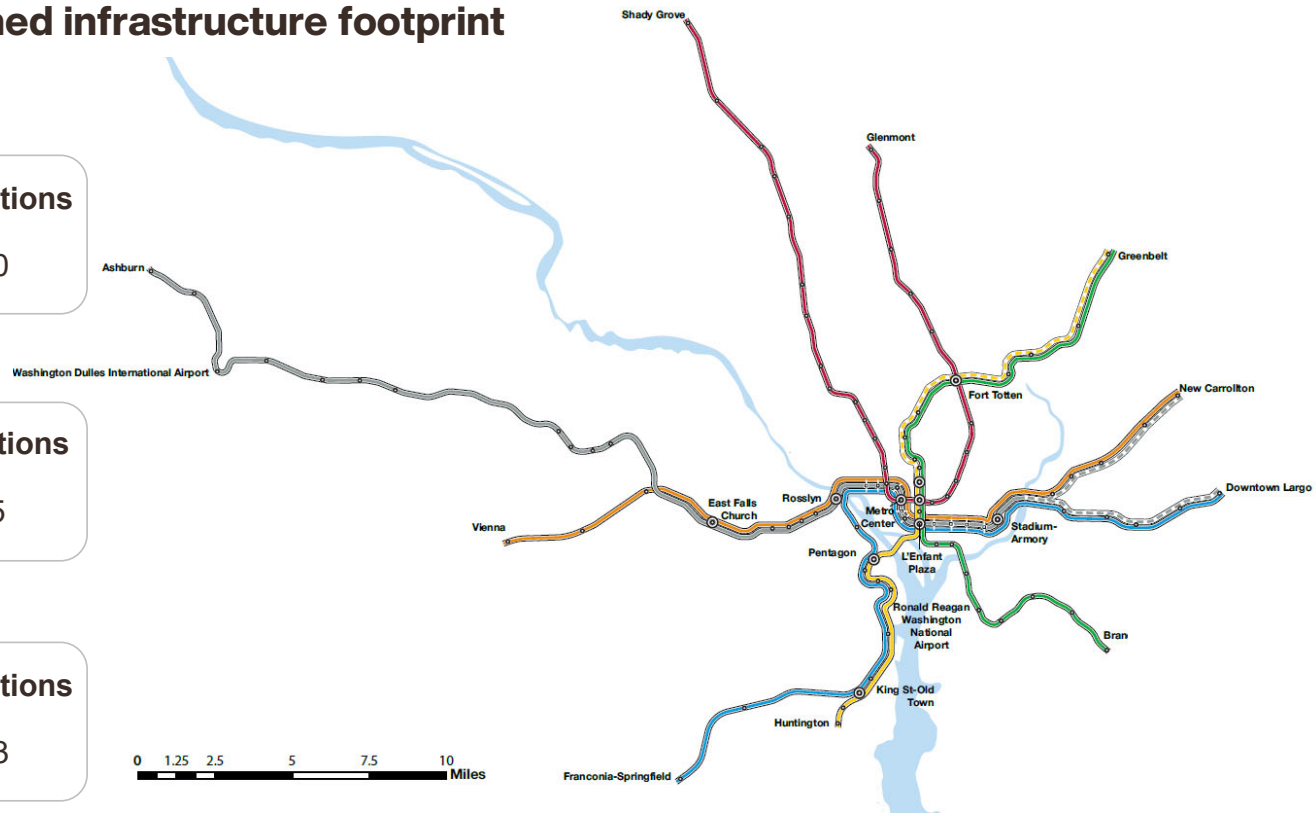
Route Miles	Stations	Avg. Age	Yards	Junctions
32	27	43	3	0

O S B Orange, Silver and Blue Lines

Route Miles	Stations	Avg. Age	Yards	Junctions
58	43	35	3.5	5

Y G Yellow and Green Lines

Route Miles	Stations	Avg. Age	Yards	Junctions
38	32	34	2.5	3



2. Rail Modernization Program Elements

Components of fully automated rail transit

Fully automated rail systems rely on communications-based train control, platform screen doors, and an updated service model

Signals

Metro Integrated Command & Communications Center (MICC)

Modern communications-based train control (CBTC) with capability to control all aspects of train operations, including detection of obstacles on the track

Fleet

Paris Metro: MP05 rolling stock

Railcars must be equipped with CBTC technology – systems use more onboard equipment with less wayside infrastructure

Stations/Platforms

Honolulu Skyline: Hālawa station

Protect customers on the platform with physical barriers, such as platform screen doors

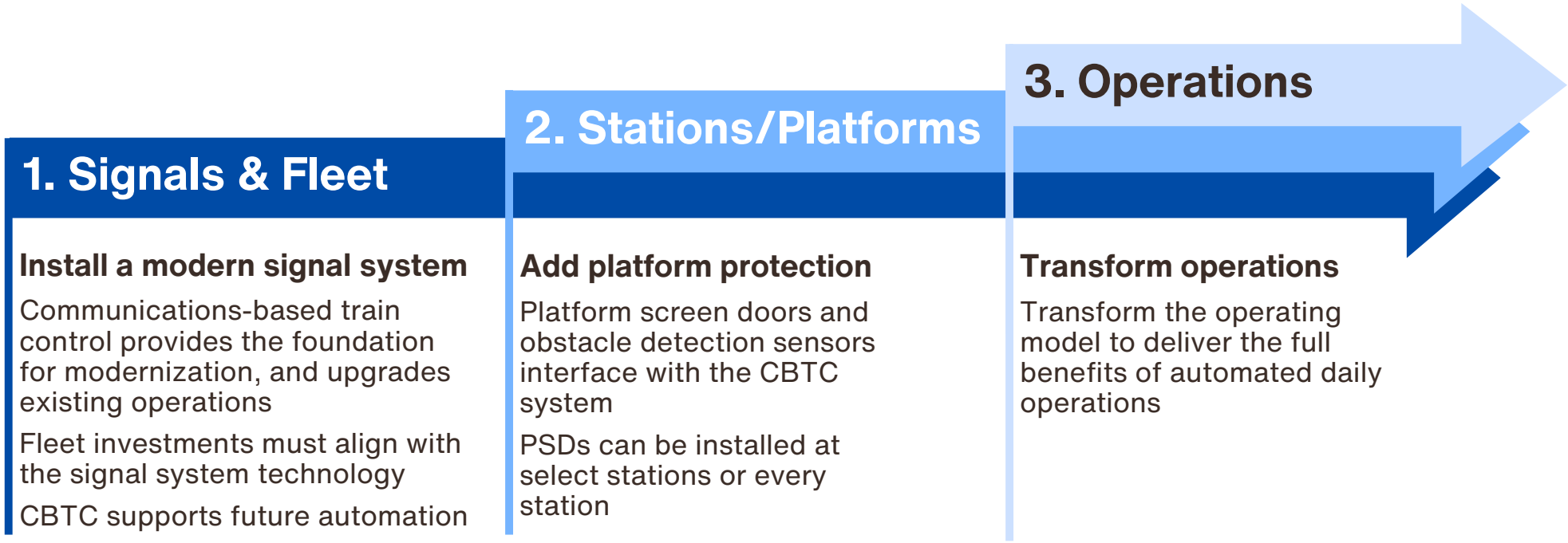
Operations

Greenbelt interlocking

Service shifts to centralized control, with train frequency adjusted dynamically based on demand rather than fixed schedules

Building blocks of modernization and automation

A new, modern signal system is the foundation for additional investments in platform screen doors and automating operations



Install a modern signal system

Communications-based train control provides the foundation for modernization, and upgrades existing operations

Fleet investments must align with the signal system technology

CBTC supports future automation

Add platform protection

Platform screen doors and obstacle detection sensors interface with the CBTC system

PSDs can be installed at select stations or every station

Transform operations

Transform the operating model to deliver the full benefits of automated daily operations

Each investment builds upon the foundation of CBTC, with independent value at each step in the sequence

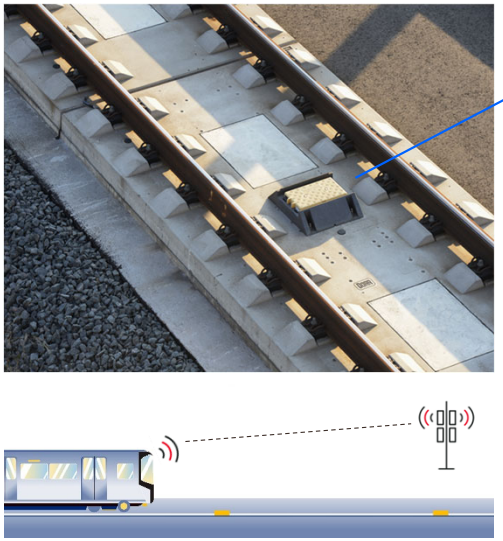
Current track side vs. CBTC

New technology streamlines infrastructure and safety performance

WMATA Legacy 70's & 80's Train Detection

- **3500+** Track circuits with **14,000+** Bonds.
- **700+** Miles of copper cables on the track.
- **100+** Signals on the track.

CBTC use advance communications technology



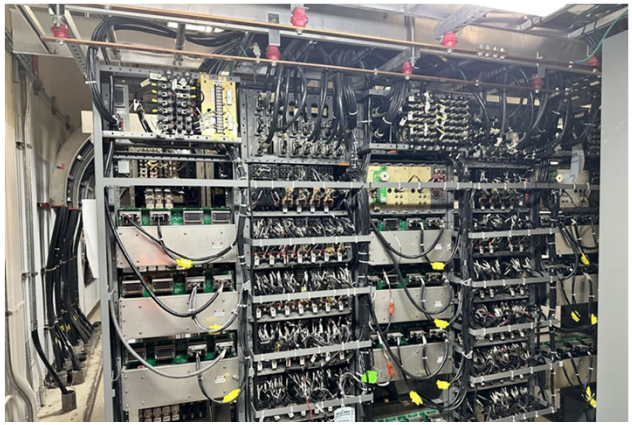
Benefits:

- Minimal access for maintenance and repair, **improving Safety for WMATA Staff**.
- **Reduce** number and duration of revenue **service disruptions**.

Current control rooms vs. CBTC

New technology streamlines operations and maintenance

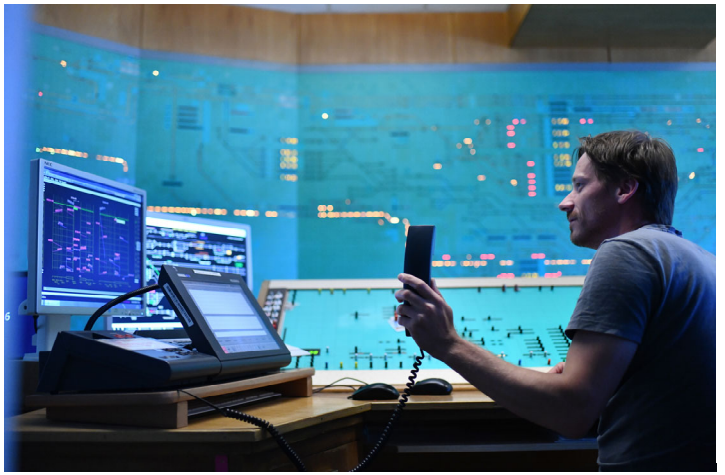
WMATA Legacy 70's & 80's Electromechanical Rooms



WMATA Red Line Train Control Room

- **165** Train Control Rooms.
- **28,000**+ relays with over **300,000** connections.

CBTC uses powerful computers at the MICC running advanced software



Benefits

- **Fewer** control rooms and failure points.
- Built-in redundancy **improves reliability**.
- **Automated diagnostics** speed up maintenance.

3. Business Case

Rail Modernization Strategy

Metro can improve safety, reliability, capacity, and efficiency with incremental investments

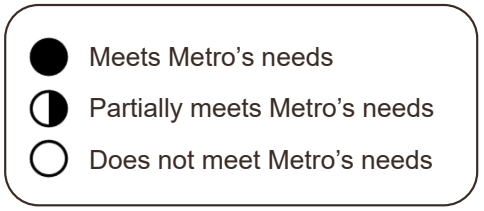
Service Improvements → **Rail Modernization and Automation** → **Expansion**

Maximize Use of Existing Assets		Modernize the System		Expand the System
Use Metro's design capabilities and maximize use of existing assets		Add new capabilities and capacity to Metro's existing 128-mile system		Expand Metro's network
▪ Automatic Train Operation ▪ Return to design speeds up to 75 mph	▪ Service increases ▪ More eight-car trains	▪ Modern signaling (CBTC) ▪ 8000-series railcars	▪ Platform screen doors ▪ Full automation	▪ Serve new markets in a growing region

Why Modernization?

Only Modernization addresses each of Metro's needs

Metro considered three major investment options to address Metro's multiple challenges, including aging infrastructure and capacity constraints.



Alternatives	Safety	Reliability	Capacity	Efficiency
1. **Maintain the Existing Signal System:** Attempt to sustain operation of existing system.	○	●	○	○
2. **Expand the Metrorail System:** Build a new Metro line to add capacity and coverage.	○	◑	●	○
3. **Modernize the System:** Upgrade to Communications-Based Train Control (CBTC), integrate with new railcars, and install platform screen doors.	●	●	●	●

How Modernization improves safety

Preventing access to the track and reducing human error in operation improves safety across the system

- **Platform screen doors:** Provide a physical barrier between customers and moving trains, preventing intrusions, falls, and suicides
- **Modern signal systems:** Reduce human error in operation, increasing worker safety, reduced need to access to the right-of-way
- **Consistent speed and acceleration:** smoother rides result in fewer on-board injuries

Post-event platform crowding at Gallery Place

Platform screen doors provide stand-alone benefits and enable automated operations

PSDs enhance safety, reliability, and quality of experience and are a new global standard for rail transit platform amenities

Safety

- A physical barrier between customers and moving trains reduces risk of injury or death

System Reliability

- This barrier prevents intrusions onto the track and limits trash and debris, preventing delays
- Trains can enter stations at full speed, even with crowded platforms

Quality of Experience

- Customers feel safer on crowded platforms
- Peer agencies show PSD-enabled lines rate highest for customer satisfaction
- Additional improvements to platform air quality, energy efficiency for climate control, etc.

Paris Metro: Line 4 Platform Screen Door Testing

How Modernization can address Metrorail system capacity

	Constraint	Solution
	Fleet size	Better utilization of existing railcars
	Yard storage and maintenance capacity	More efficient fleet and yard utilization
	Traction power	Reduced traction power demand
	Core throughput	Shorter headways and automated turnbacks
	Terminal capacity & turnbacks	Turnback flexibility, expanding terminal capacity
	Platform length and dwell time at stations	Optimizes dwell times and passenger flow

Benefits of Modernization address Metro's needs

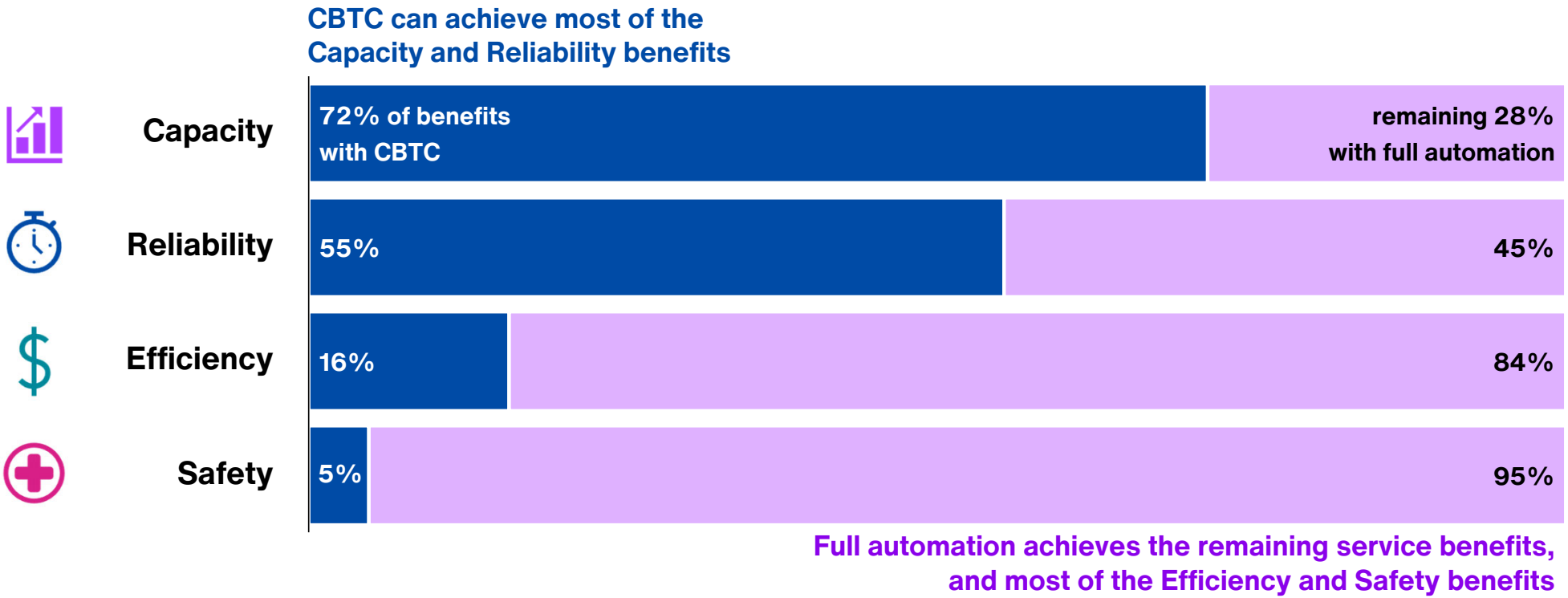
Signal system upgrades, platform screen doors, and automation provide benefits across four key areas of Metrorail service

	Benefits
Capacity	▪ Increase train throughput from 24 trains per hour to 30+ trains per hour
Reliability	▪ Increased on-time performance up to 98% with automated operations ▪ Reduced signal incidents, delays
Efficiency	▪ Faster cycle times ▪ Lower marginal costs / revenue hour
Safety	▪ Reduce fatalities and trespass incidents by 80% to 100% with platform screen doors

Benefit estimates based on international benchmarking of capabilities of similar systems, rail operations simulations of Metro's system, and analysis of Metro internal data

The region can realize more benefits with automation

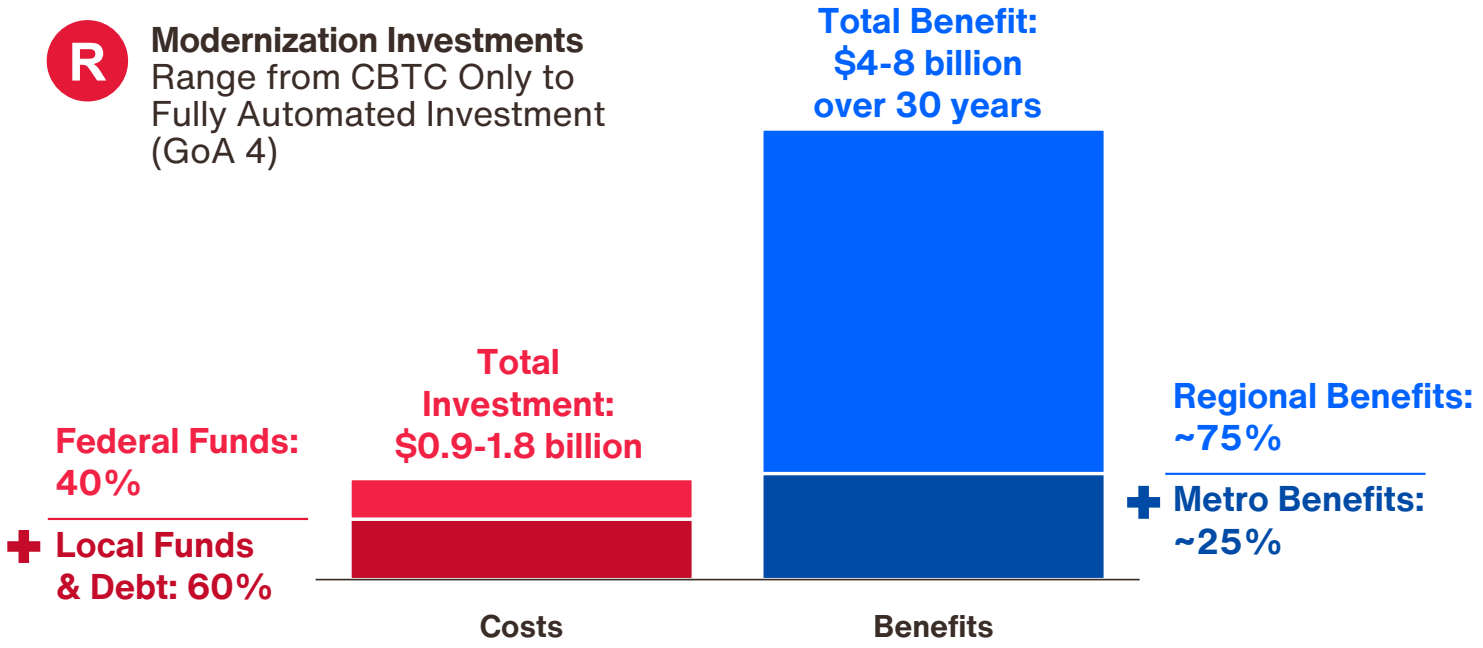
Modernizing Metro's signal system can incrementally improve Metro's capacity and reliability; automation enables transformation for safety and efficiency



Red Line Modernization investment will deliver significant benefits

Leveraging local funds to secure competitive federal grants (60% / 40% local/federal split) improves the return on investment considering local funds only

Modernization Investments
Range from CBTC Only to Fully Automated Investment (GoA 4)



- Harnessing federal funds reduces the local expenditures required to deliver the program, **increasing the cost/benefit ratio** of the local funding.
- This also allows the program to achieve a positive net benefit to the region earlier after completion.

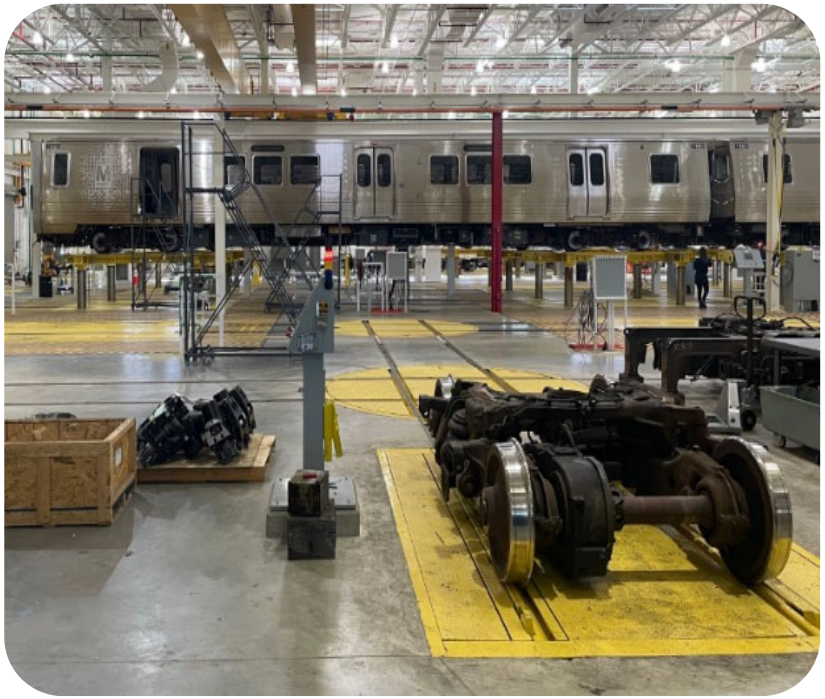
Expenditures and benefit figures shown here in year-of-expenditure and year-of-benefit dollars. Costs reflect rough order of magnitude (ROM) estimates for considered program scope and timeline and are likely to change as project development advances.

Rail Modernization enables capital cost savings

Efficiently using existing assets can both add capacity and reduce the amount of investment needed in the future

Compared to Metro's current signal system, Modernization can achieve higher capacity without the need to incur as many large capital expenses:

- **Railcar purchases:** can achieve better service and higher capacity with fewer railcars than would otherwise be required
- **Lifecycle maintenance costs:** a smaller, more efficient fleet reduces the lifecycle expenses for maintenance
- **Rail yard and shop expansion:** can avoid need for some railcar storage expansion projects by operating more efficiently within the existing footprint of Metro's yards



Dulles Yard Service & Inspection Building

Efficiencies reduce capital needs for yards and facilities

Modernization can deliver increased Red Line service more efficiently than the current signal system, reducing the need for fleet and facilities expansion

Red Line scenarios	Cycle time (minutes)	4-minute service requirements (15 trains per hour)		3-minute service requirements (20 trains per hour)		Current storage capacity	Storage deficit
		Trains	Railcars	Trains	Railcars	Railcars	Railcars
ATC (Current)	136	36	346	48	**462**	**388**	**-74**
CBTC	126	34	328	44	**424**	**388**	**-36**
Automation	118	32	308	42	**404**	**388**	**-16**

Reduced vehicle requirements with modernization would require a smaller scope of yard improvement projects to maximize efficiency.

58 fewer railcars would realize approximately $320 million in lifetime capital purchase and renewal savings

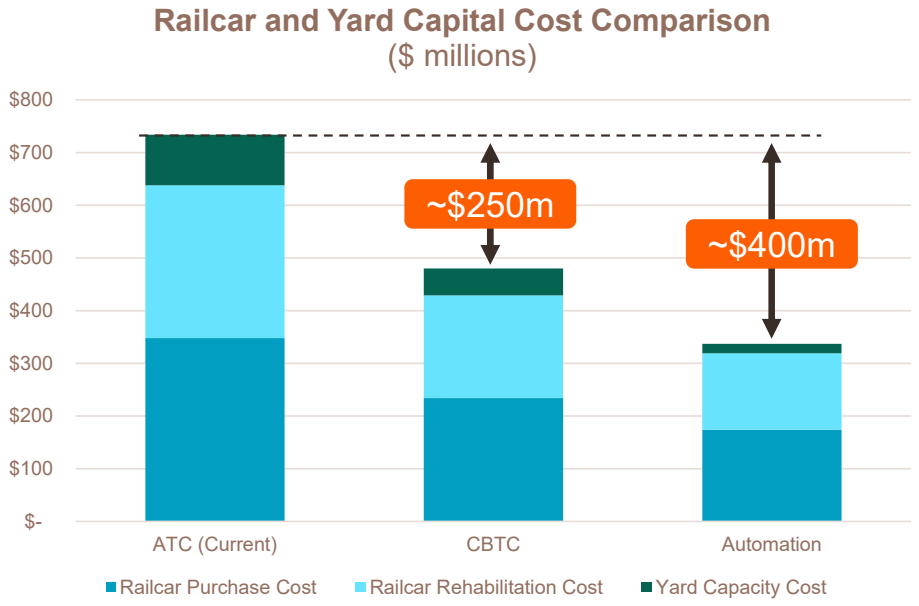
Train requirements include revenue service trains and gap trains.
Railcar requirements assume 100% eight-car trains on the Red Line during peak service and a 20% spare ratio.

Efficiencies reduce capital needs for yards and facilities

Modernization can deliver the same increased Red Line service more efficiently...

Red Line 3-min service scenarios	Increase in railcar requirement	Increase in storage need
	Railcars	Railcars
ATC (Current)	+116	+74
CBTC	+78	+36
Automation	+58	+16

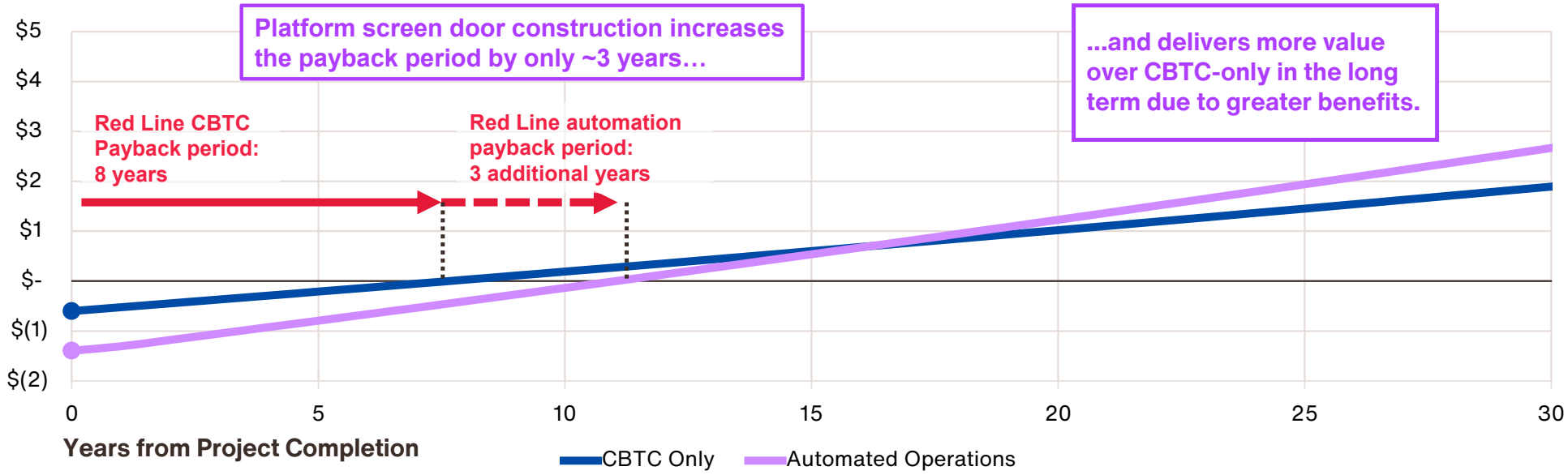
...reducing lifecycle fleet capital costs and the need for additional rail yard capacity



Red Line Modernization delivers billions in net benefits to region

Cost savings, new revenues, and regional benefits fully offset upfront costs of infrastructure investments

Regional Net Benefit from Rail Modernization ($ billions, 2025 $'s)



4. Migration Strategy

Incremental approach minimizes risk and maximizes learning across lines

System Migration Strategy

Phase 1

Red Line

- Most self-contained line in the system
- Lessons learned will improve implementation processes for the subsequent lines
- Opportunity to leverage 8000-series procurement

Phase 2

Blue Line segments, Orange Line, and Silver Line

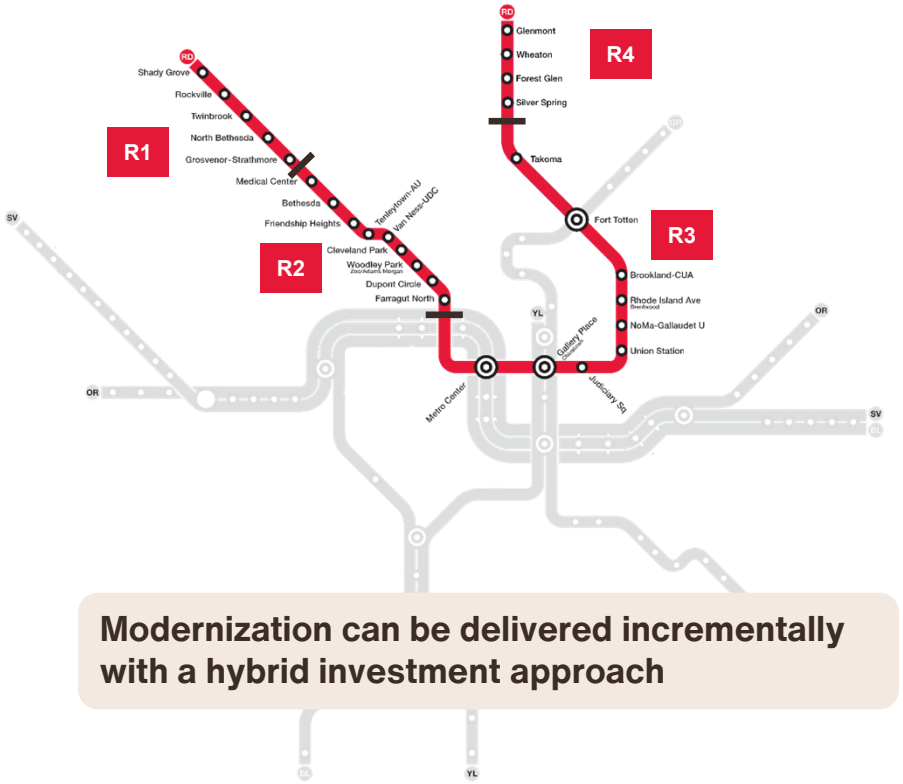
- Increases capacity in the most congested sections
- Complex and high requirement for railcars to be equipped with CBTC

Phase 3

Yellow Line, Green Line, and remaining Blue Line sections

- Final rollout phase to complete systemwide CBTC deployment allowing full operational flexibility

Red Line installation segmentation



Modernization can be delivered incrementally with a hybrid investment approach

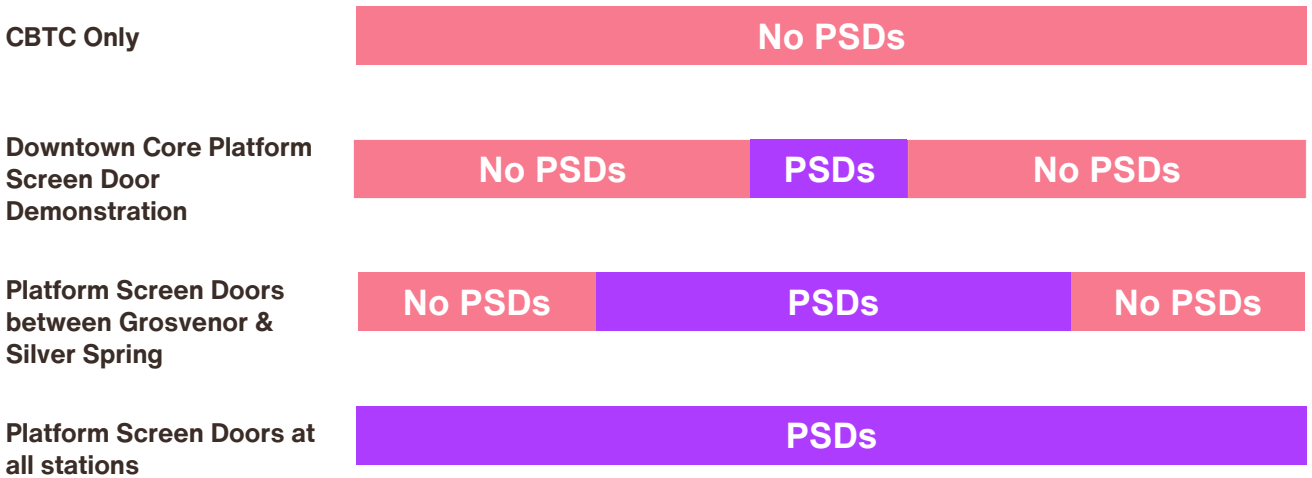
Current segmentation concept: begin CBTC work with the R1 segment to ensure access to largest Red Line rail yard at Shady Grove

Criteria for segmentation

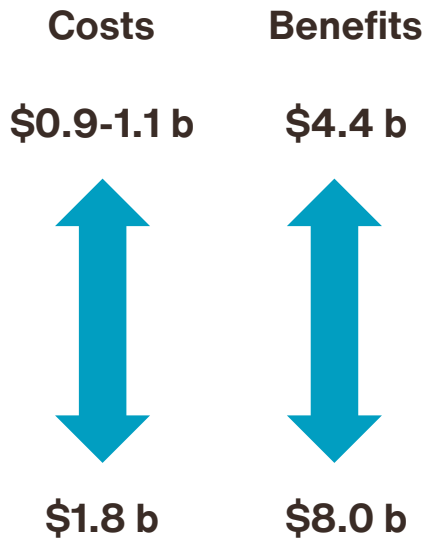
- **Four segments for installation and testing:** Dividing installation and testing in a staggered approach to minimize disruptions in the entire line. Commissioning and start of CBTC operations expected to include two or more segments.
- **Operational flexibility:** Segments are sized for installation and testing, balancing complexity against the cost of many smaller segments. Each segment includes a yard connection, pocket track, or crossover to allow turn-backs during tests
- **Safe transitions:** Segment borders will be placed at stations, so operators can safely switch operating during the dwell time.

Red Line Modernization incremental investment options

Investments can be phased to add new capabilities over time

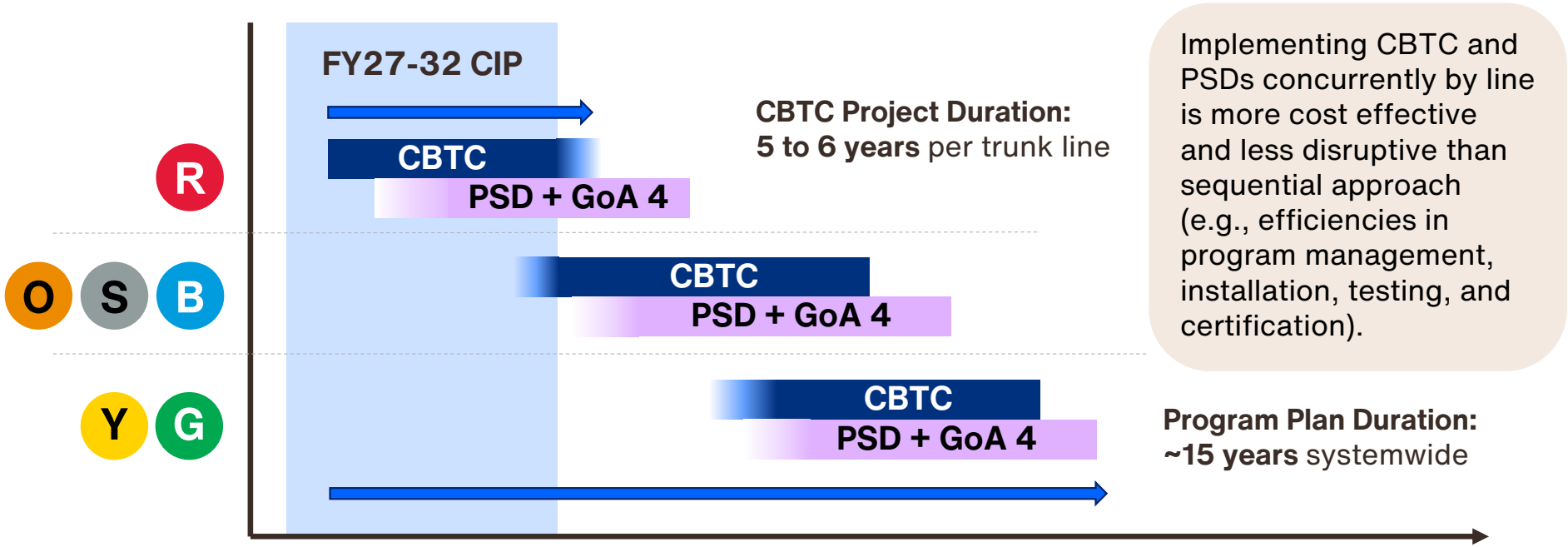


Range of Potential Costs and Benefits
Specific costs and benefits vary based on the scope of Platform Screen Door installation and the ultimate Grade of Automation



Roadmap to modernize Metro

Incremental investment begins with CBTC on the Red Line; Timing and scope for additional projects to modernize each trunk line is dependent on funding availability



Implementing CBTC and PSDs concurrently by line is more cost effective and less disruptive than sequential approach (e.g., efficiencies in program management, installation, testing, and certification).

CBTC: Communications-Based Train Control PSD: Platform Screen Doors GoA4: Grade of Automation Level 4 – Full Automation

5. Next Steps

Rail Modernization Next Steps

Program Summary

- Advance the Rail Modernization and Automation Program with a long-term goal of automating operations across the entire rail system
- Develop modernization projects incrementally on a corridor-by-corridor basis:
  - Red Line
  - Orange/Silver/Blue Lines
  - Yellow/Green Lines
- Build internal capacity to deliver these projects efficiently

Next Steps

- Approval of FY2027-2032 Capital Improvement Program, including Red Line advanced signaling
- Advance technical and functional requirements for Rail Modernization & engage stakeholders on Platform Screen Door design
- Prepare grant applications for federal funding

Interior front view of a driverless train, Copenhagen Metro