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Muni Metro Train Control System

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(30 Slides)

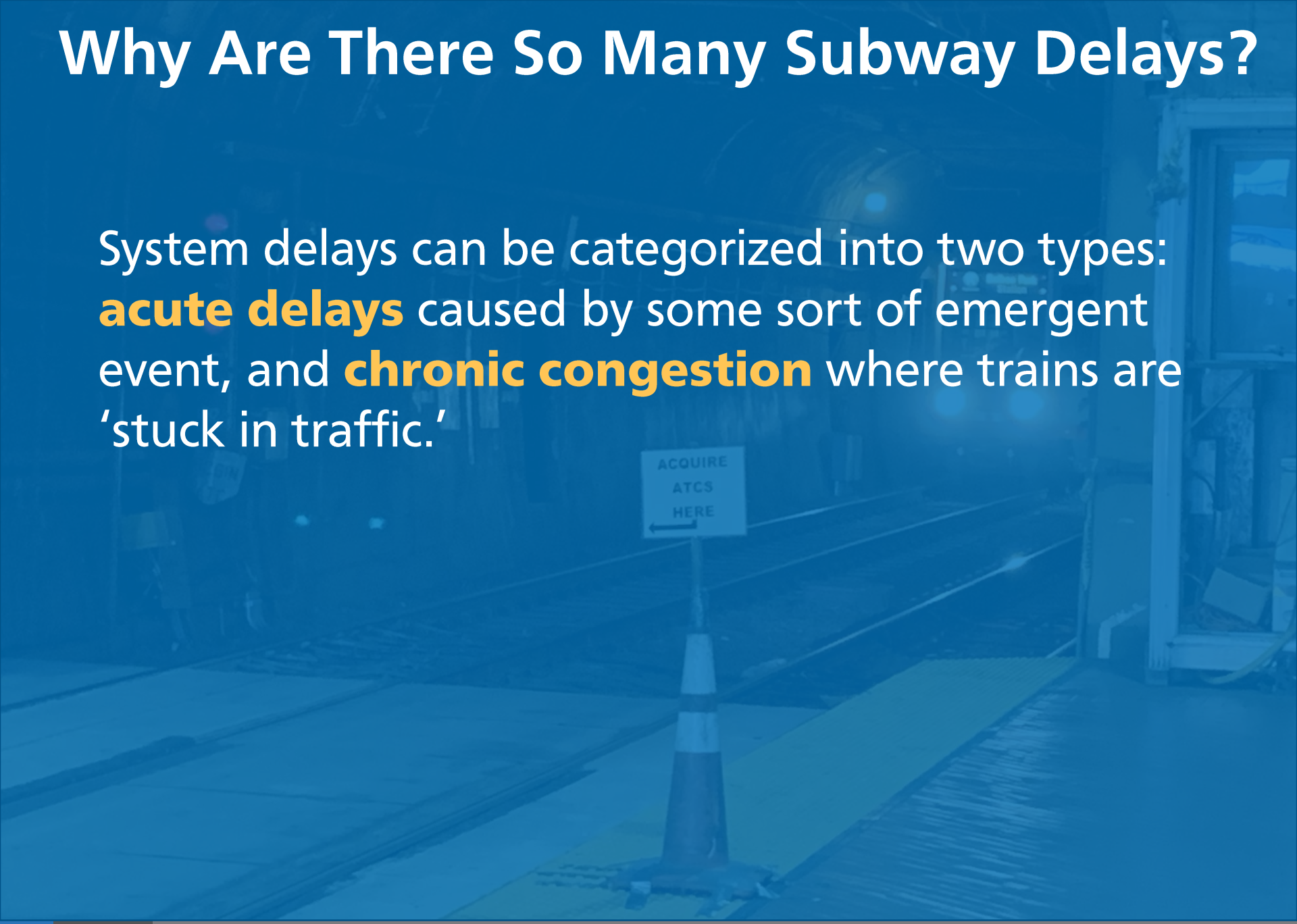
What makes great subway service?

Mass transit works best when it takes you from where you are to where you want to go more easily, reliably, and cheaply than other modes.

Dedicated right of way	High frequencies	Reliable	Accessible
Gets everything and everyone out of the way, permits high speeds and low incidence of disruption	You can just wander into the system with confidence your wait will be short and your connections will be plentiful	Passengers are confident they know the length of time their trip will take	The system is easily navigable—people of all abilities and backgrounds understand how to use the system

Why Are There So Many Subway Delays?

System delays can be categorized into two types: **acute delays** caused by some sort of emergent event, and **chronic congestion** where trains are 'stuck in traffic.'



Types of Subway Delays

Acute Delays

Vehicle Breakdowns

Infrastructure Failures

Intruders/Falls/Dogs

Medical/Police Emergencies

Communication Failures

Failed Entries

ATCS Computer Failures

ATCS Infrastructure Failures

Chronic Congestion

Subway congestion

Bunching

Non-Communicating Trains

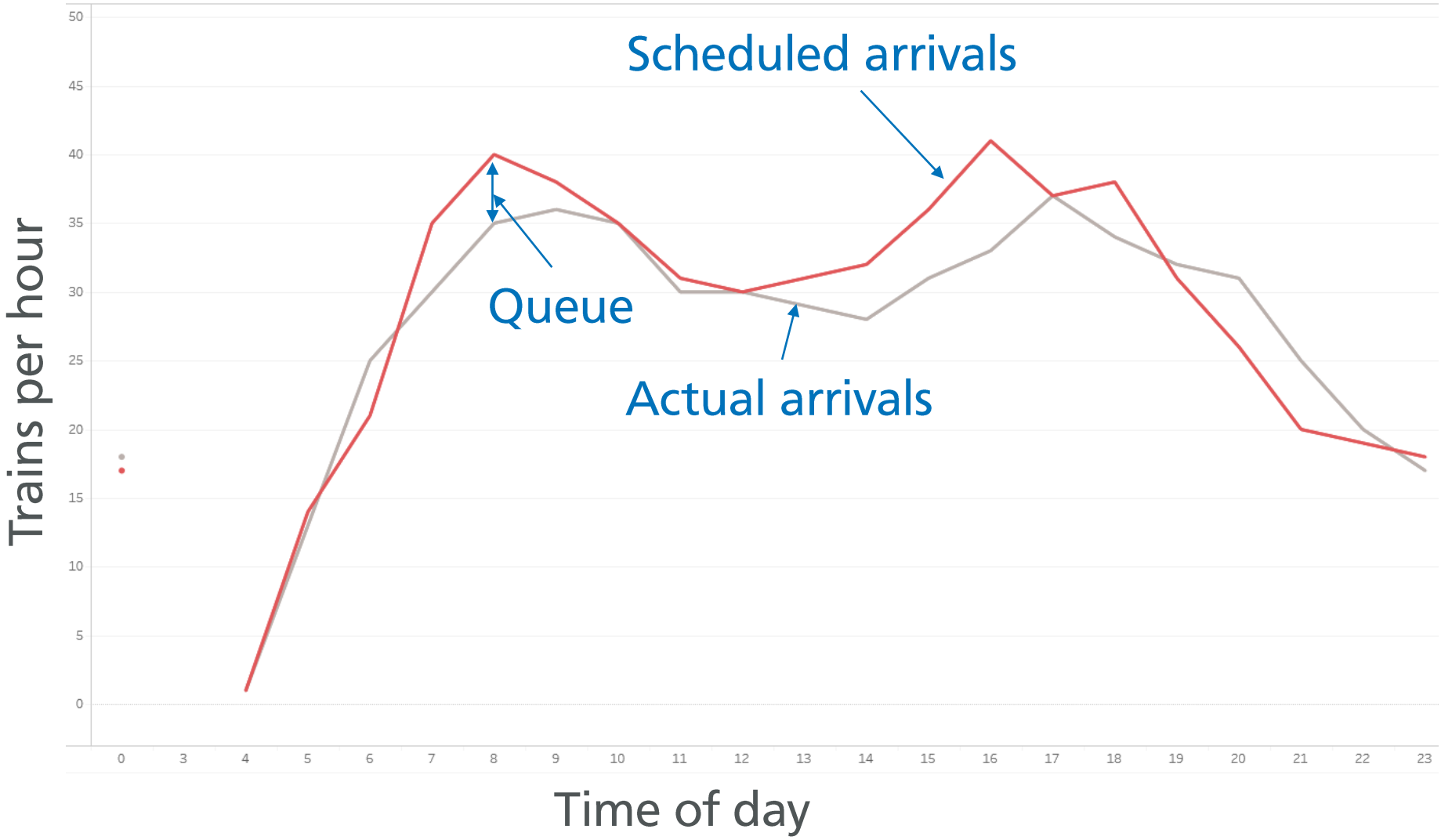
Street congestion

Green: Train control related

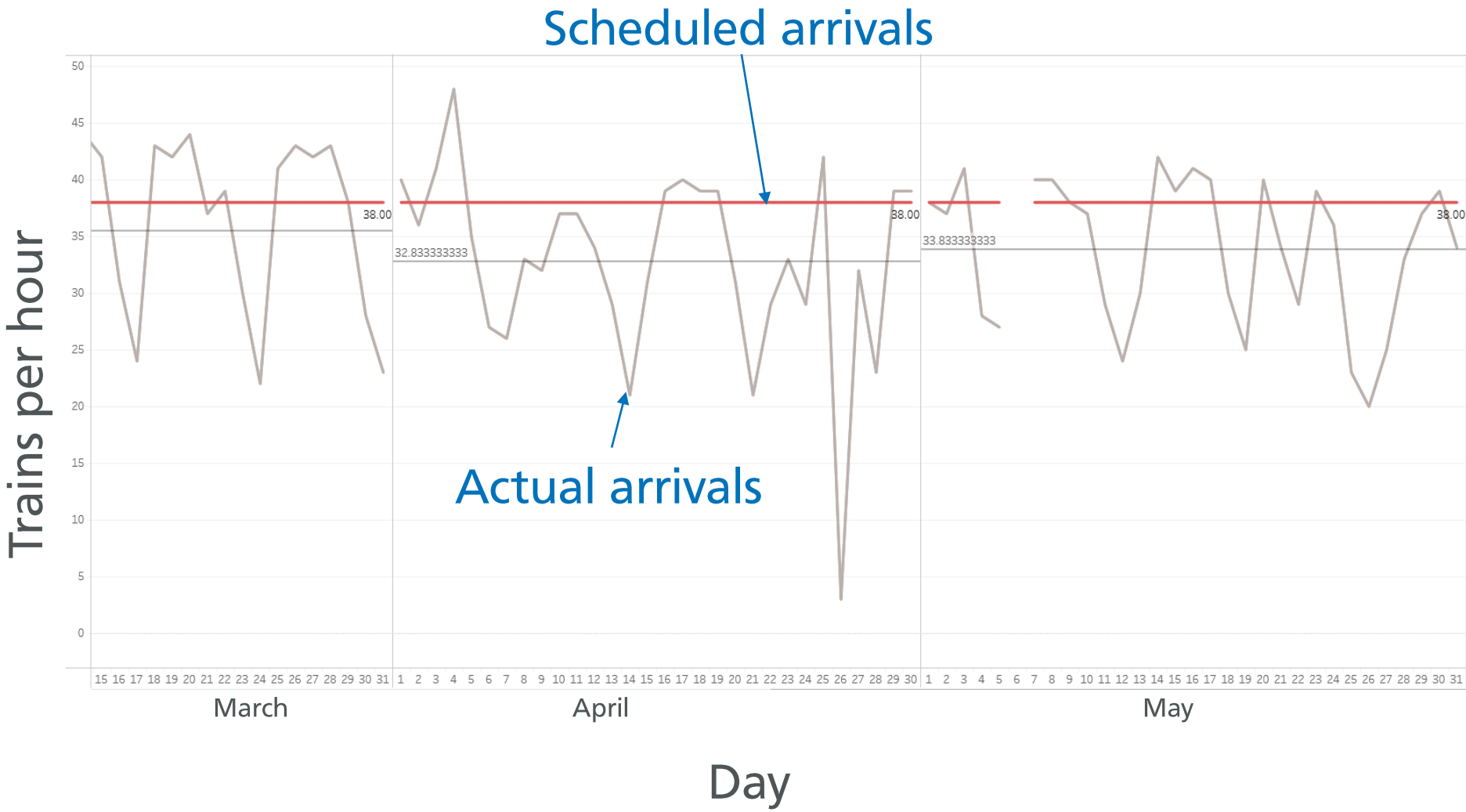
Gold: Maintenance related

Gray: Outside of Muni control

Chronic Congestion: Throughput

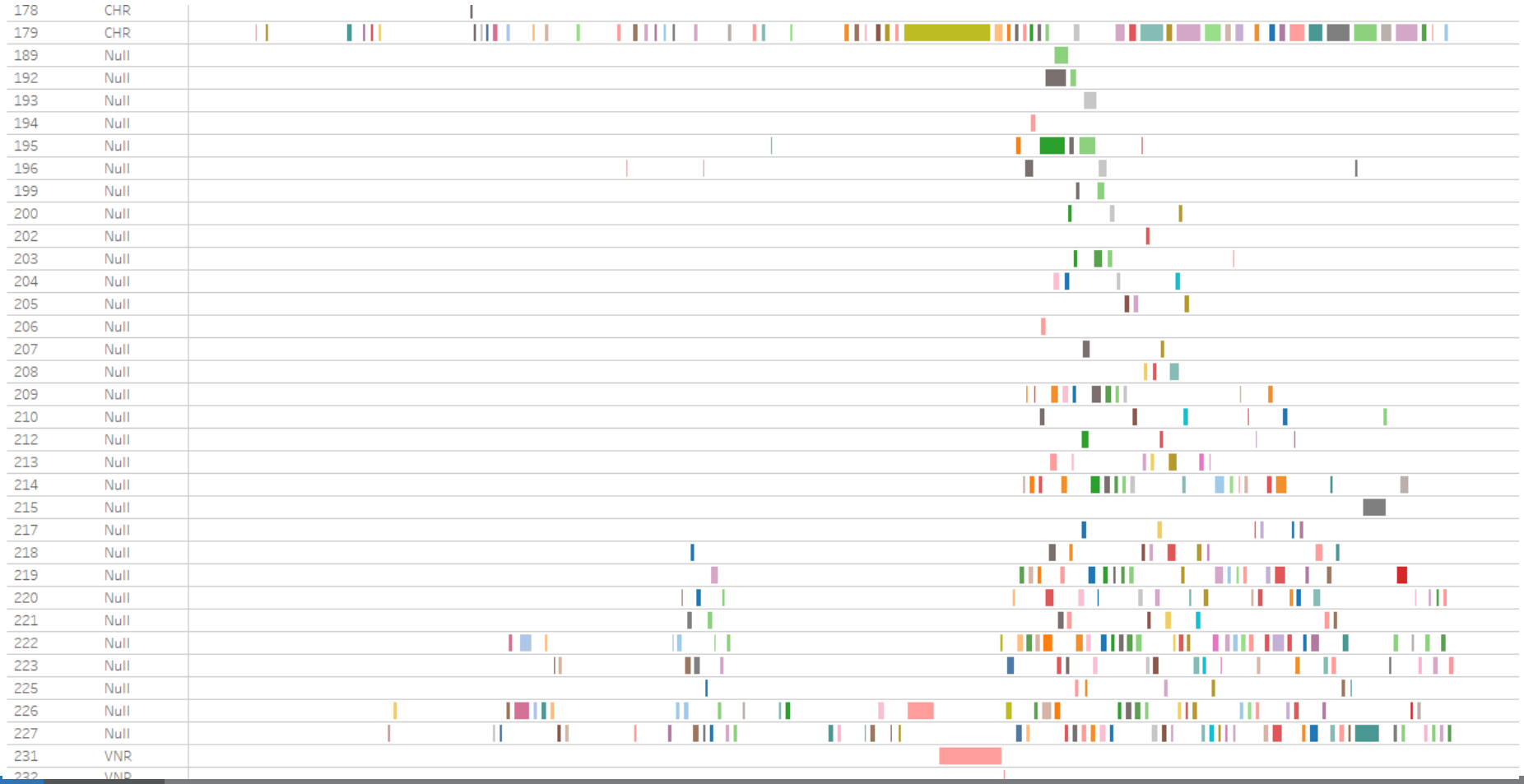


Subway Throughput (PM Peak)

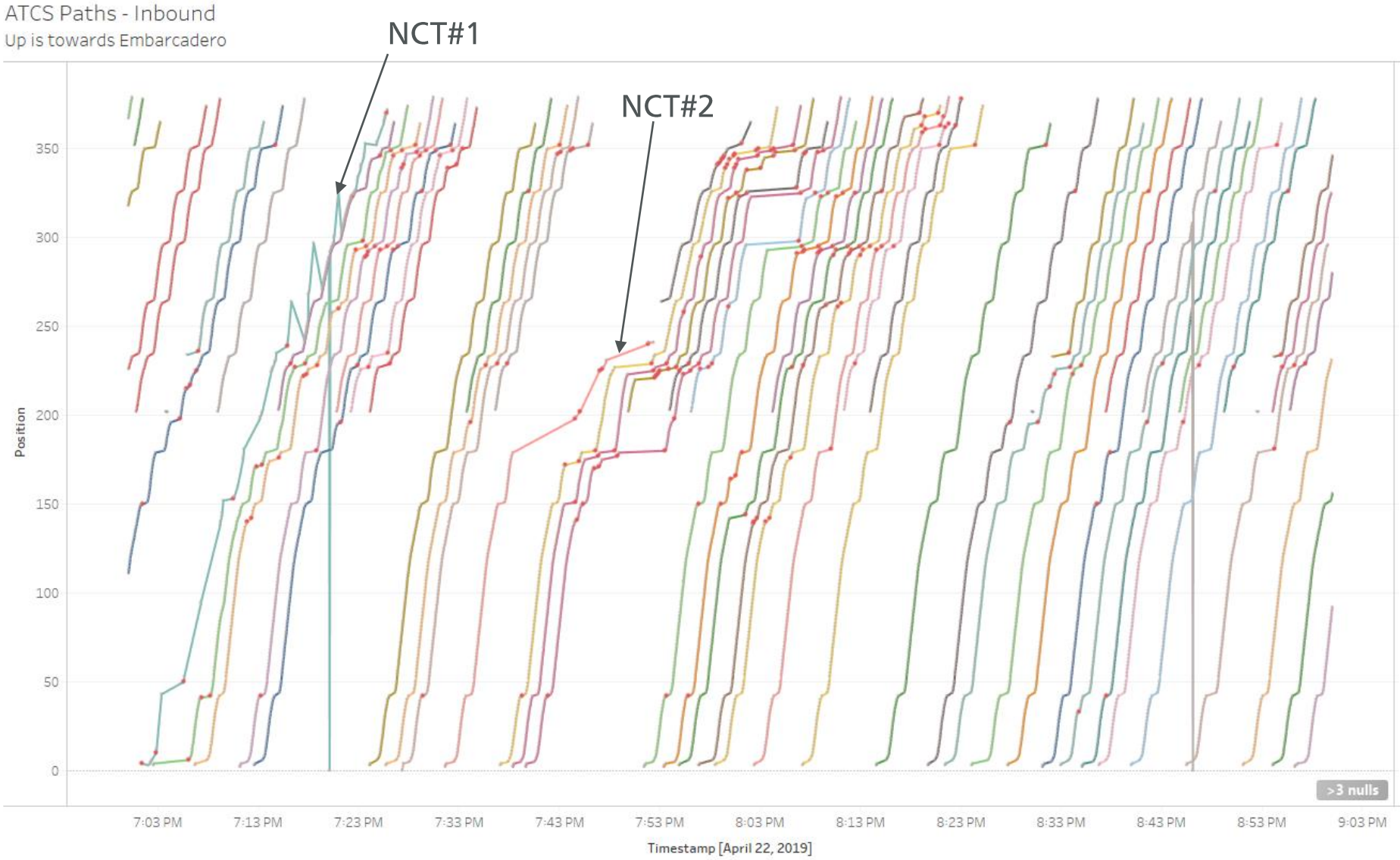


Case Study: Communication Failure

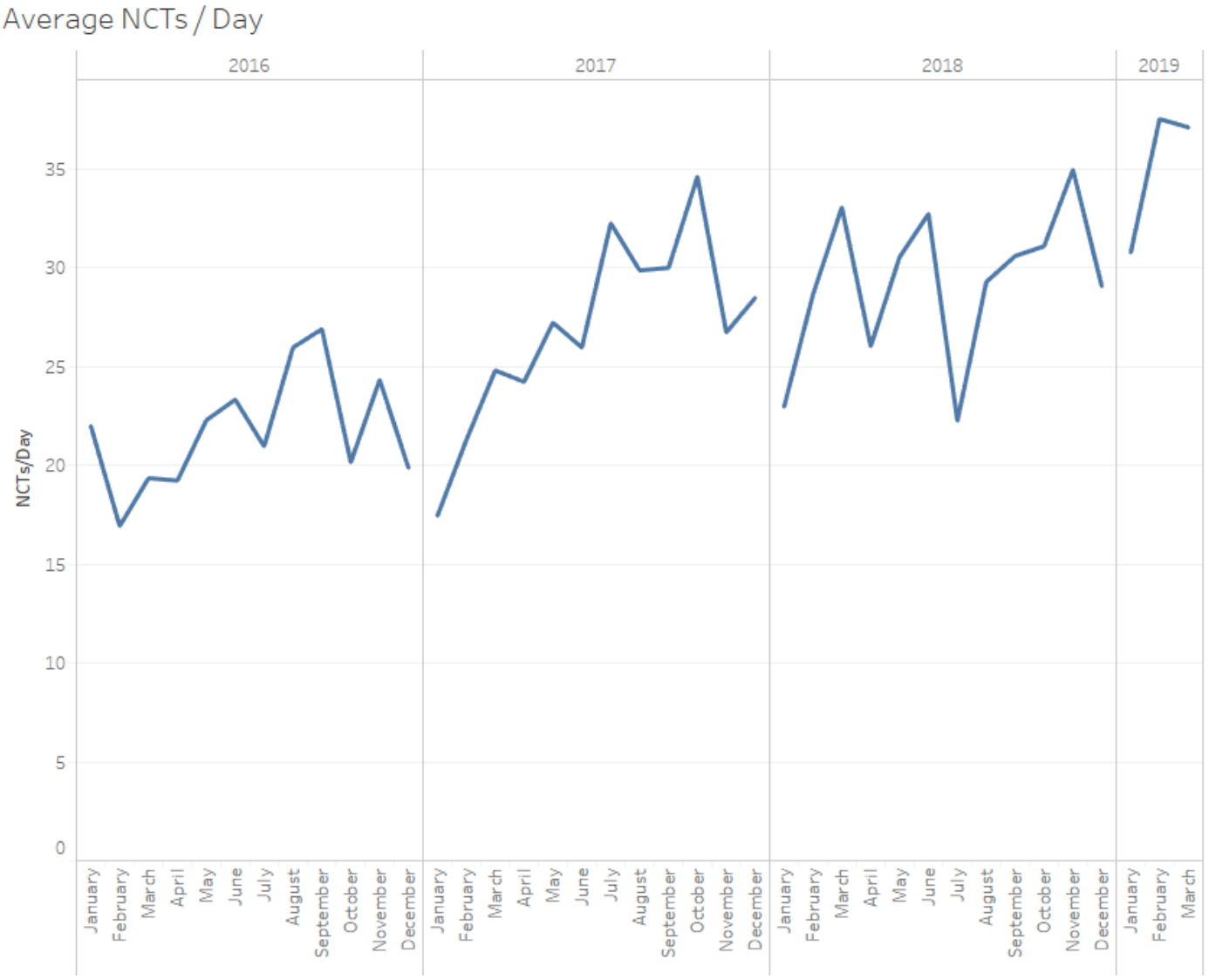
A 15-minute timeout causes about 2 ½ hours of residual congestion: this results in about 10 train-hours of delay



Non Communicating Trains

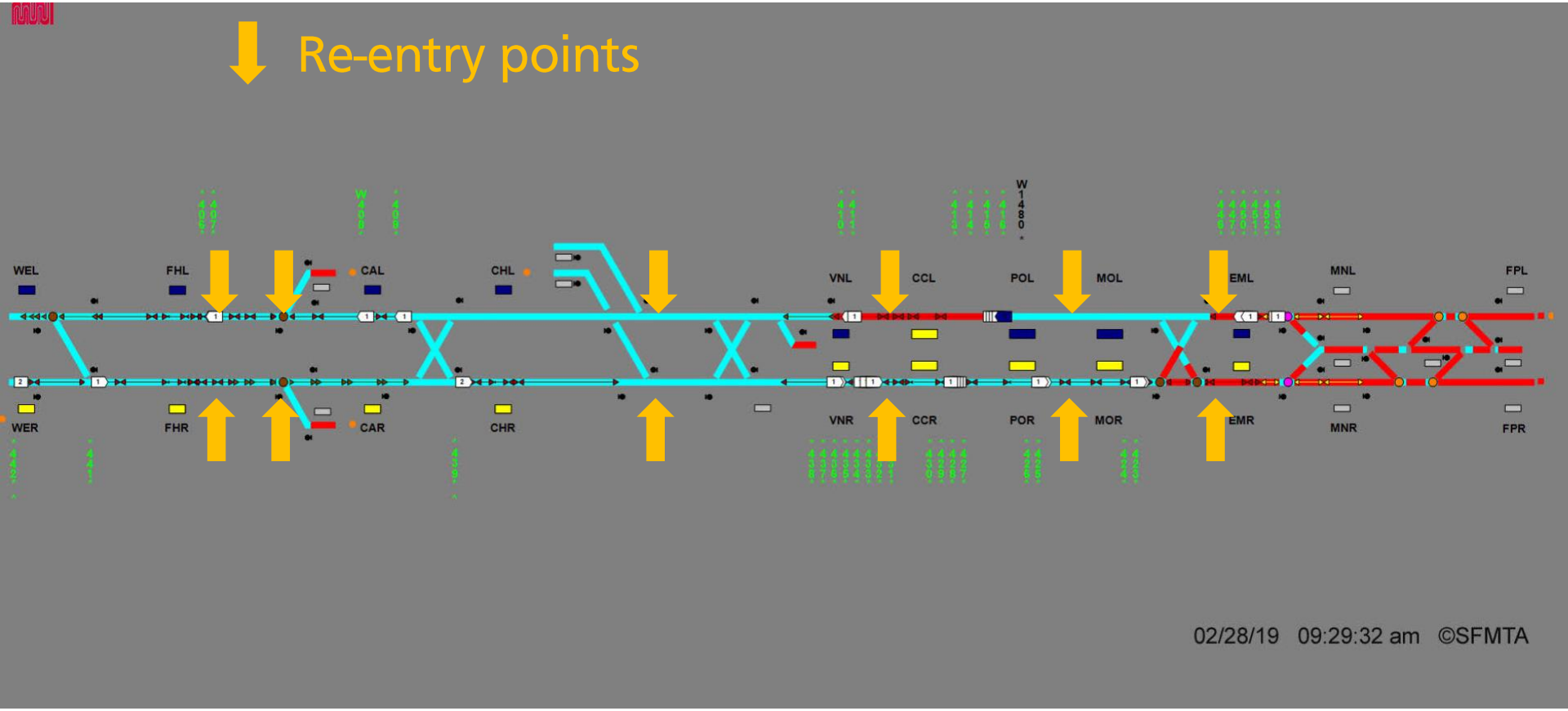


Frequency of Timeouts/NCTs



Case Study: Central Computer Failure

Loss of communication for about 1 hour causes another 2 hours of residual congestion: this results in about 30 ¼ train-hours of delay



What are the key reasons for poor train control system performance?

The present system was rolled out in the 1990s—it experienced significant issues then, and continues to cause headaches today

Three entry portals	Twenty-year-old system	Rigid infrastructure	Congestion
Multiplies the opportunity for system failures, makes systemic management of entire rail system complex	Components fail regularly, technology has significant capacity issues, fewer and fewer people have expertise to understand system	Extremely unforgiving system design, system is slow to come back up and results in delays that are disproportionate to significance of initial failure	We are operating at (or even above) capacity of the train control system, leaves zero room for error

OCC Control Center - Then

TMC Control Center - Now

If it's so bad, why use it?

- The ATCS provides safer, more efficient train movements in the subway than if we were to operate without it.
- It provides significant safety features that prevent collisions
  - Fallback mode is "stop everything"—good for safety, but false-positives are bad for operations
- It provides substantial efficiencies for vehicle throughput, even if it could be better
  - 45 trains/hour is maximum today (ideally)
  - 25 trains/hour was maximum throughput before ATCS

Modernizing the train control system will provide tangible benefits to riders by reducing delays.

Towards the future

Modern Equipment	Better Software	Traffic Signal Coordination	Supervision Everywhere
New systems use modern standards like WiFi and cellular, provide redundant communication to keep trains connected. New equipment is less failure-prone than today.	Better software will allow for increases in capacity through more efficient operations. Software can also predict faults to reduce delay-causing failures in service.	Train control system communicates with traffic signals so trains don't get stopped by red lights.	A system-wide train control allows trains to enter system at yards, cutting out portal entry delays. It also permits better sequencing on the surface to avoid bunches/gaps.

Next Steps

Summer 2019	Train control upgrade strategy; provides a plan for future upgrades and investments in train control
Fall 2019	Possible operational / service plan adjustments targeting Metro congestion
Winter 2020	RFP for new CBTC on surface and subway
Spring 2020	Incremental adjustments to ATCS for improved performance
Summer 2020	Activation of West Portal Crossover
2023	Potential delivery date for new train control system

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Questions?