

NW Transportation Conference:

Division Corridor - Next Gen Transit Signal Priority and Safety Improvements

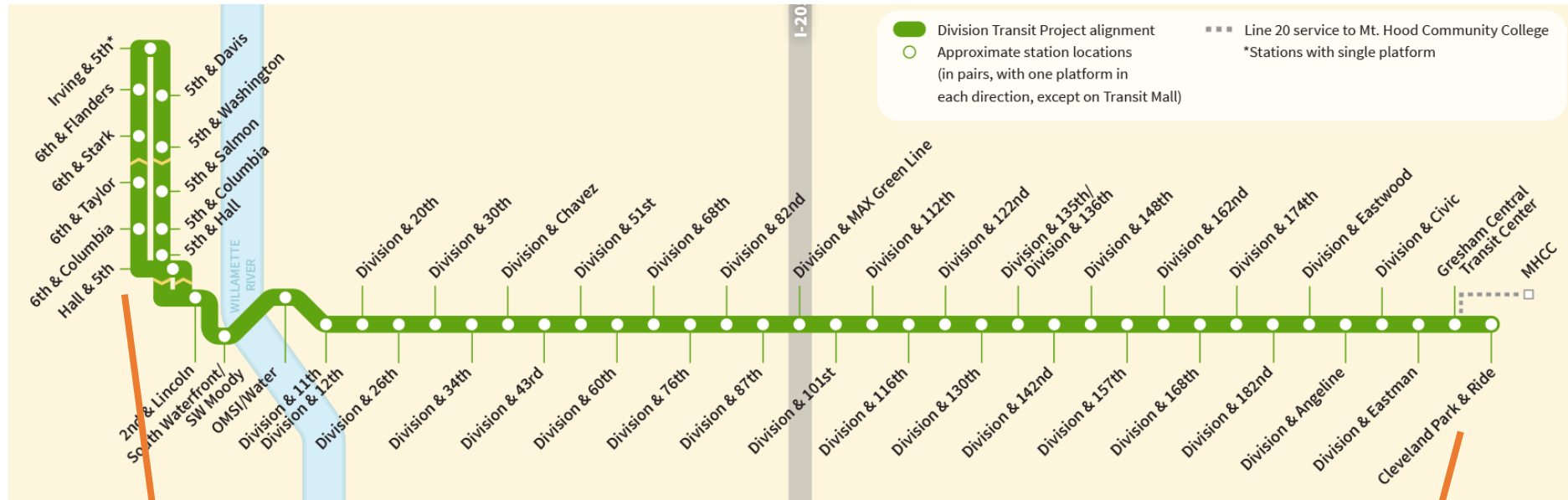
March 5th, 2024

Mark Haines PE, PTOE

Division Transit Project



Division Transit Project

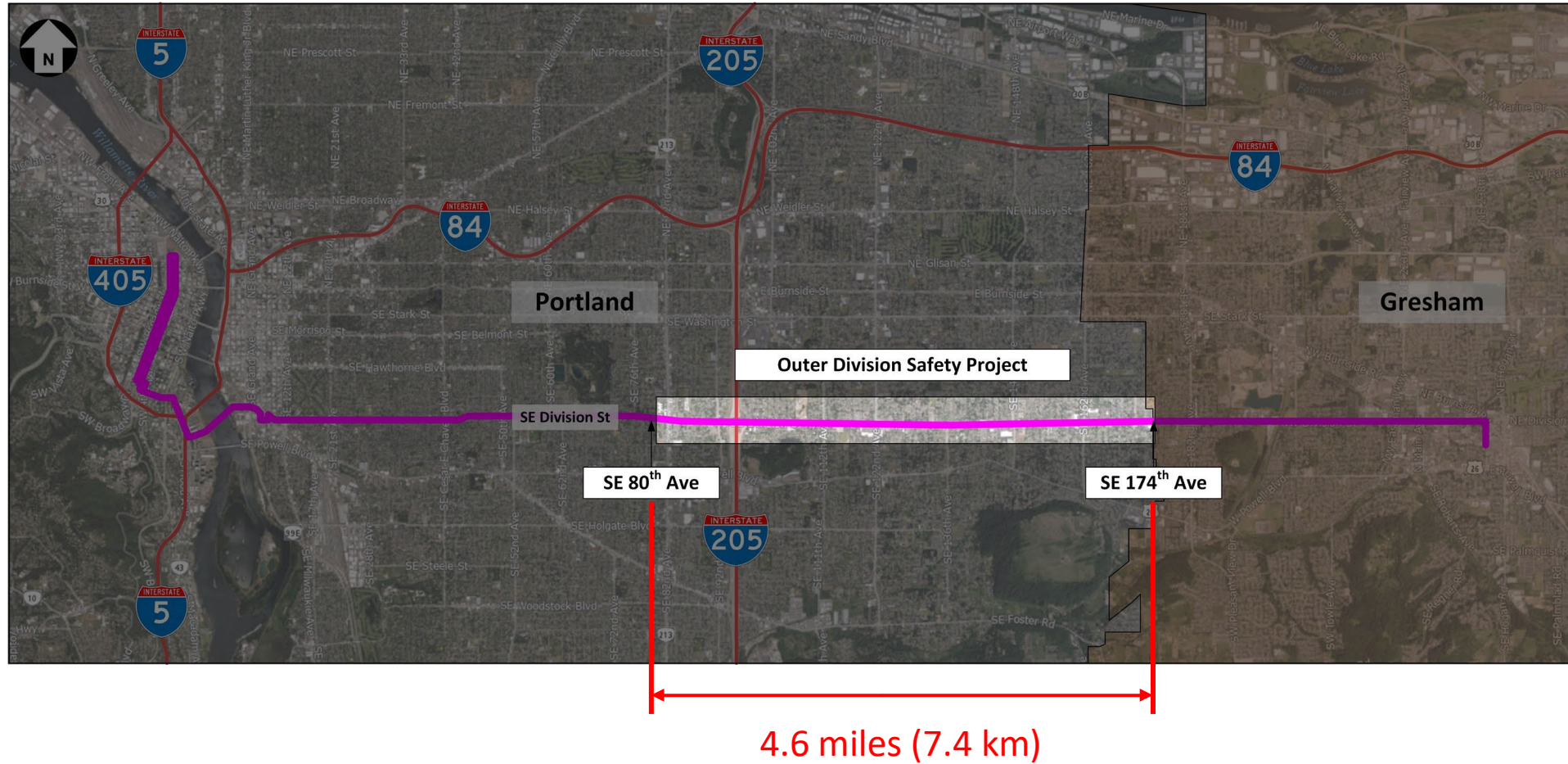


Downtown Portland

26 stations on Division Street in the City of Portland

Gresham

Outer Division Safety Project



Pre-project Conditions:

Outer Division Street SE 80th to 174th

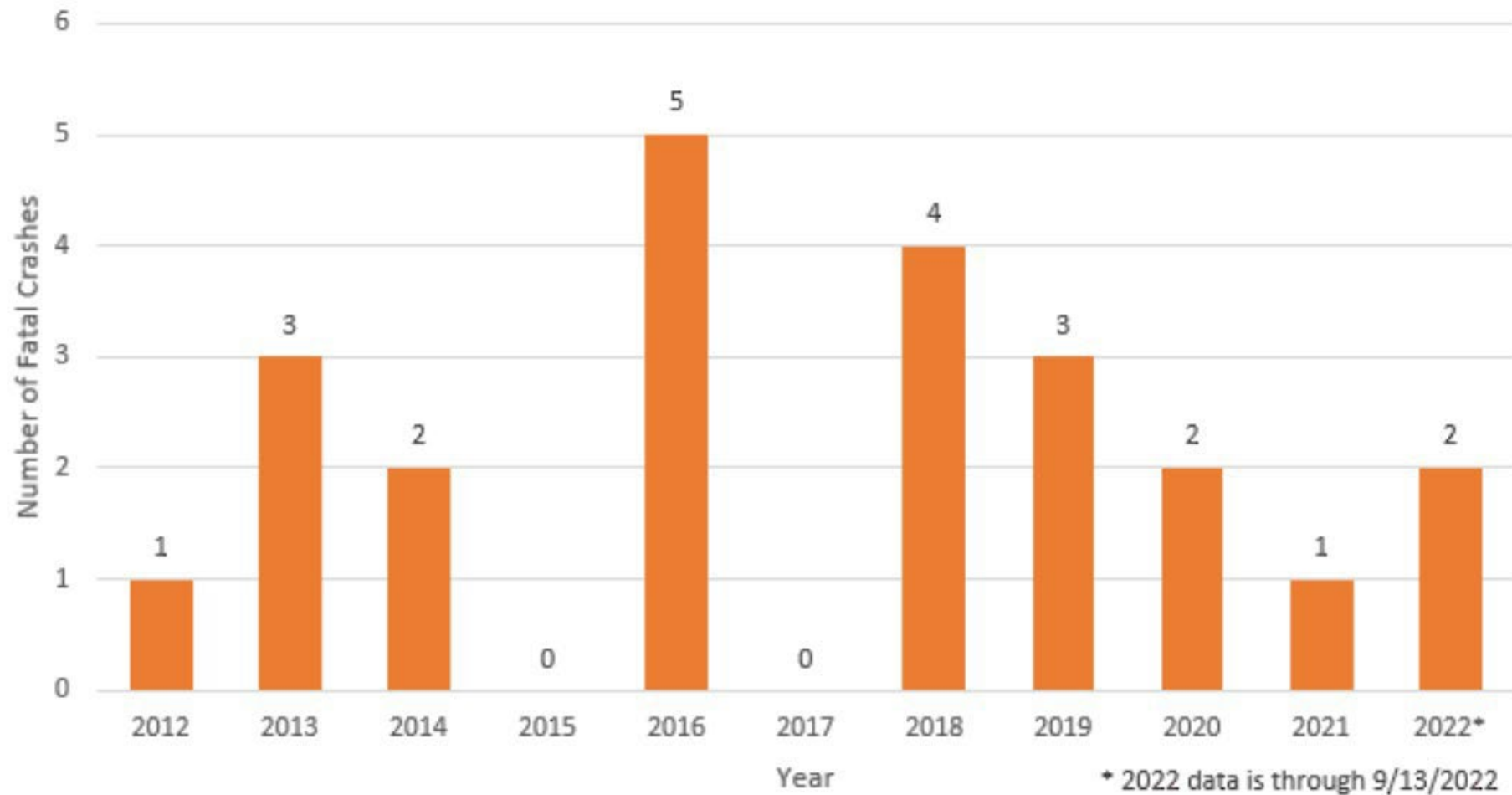


76ft (23.2m) curb-to-curb
90 ft (27.4m) right-of-way

	ADT
Division @ 87th	23,000
Division @ 116th	35,000
Division @ 152nd	30,000



Traffic Deaths on SE Division St: 80th Ave to 174th Ave





SYMBOLS		TYPE OF CRASH		SEVERITY	
	Pedestrian		Head On		Fatal Crash
	Bicycle		Angle		Injury Crash
	Fixed Object		Rear End		
	Parked Vehicle		Sideswipe		

SE Division Safety Project

SE 122nd Ave. to SE 125th Ave.
Collision Crash Diagram
Data Range: Jan 1, 2011 – Dec 31, 2015

Portland Bureau of Transportation
Created: Sept 5th, 2017 – By JMM



Division Safety Improvements

- **Raised Access Management Medians,**
47% crash reduction
- **Signalized Pedestrian Crossings**
56% pedestrian crash reduction
- **Protected bike lanes,**
11% crash reduction

Raised Medians with U-turns every 1/4 mile to 1/3 mile

1.5 min out of direction travel time

Signalized Pedestrian Crossings every 530ft to 800ft

15 new signalized crossings



SE Division St at SE 136th Ave, looking
east

Post Project – U-turn location



Post Project – U-turn location



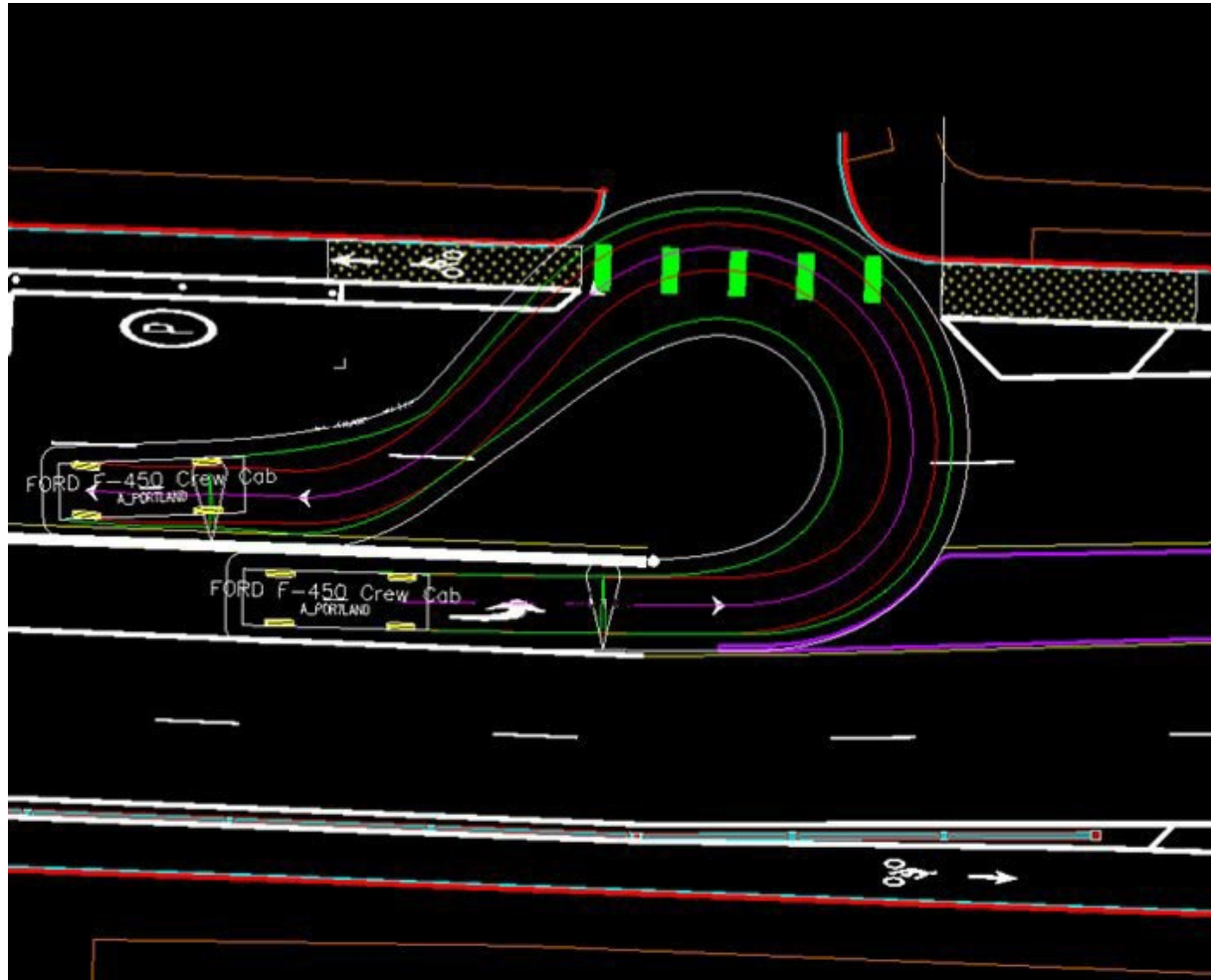
Post Project – Center Median Islands



Post Project – Center Median Islands



U-turn Design Vehicle



Ford F-450



Protected Bike Lanes: Buffer Hardening or Parking Protected



Protected Bike Lanes at Bus Stops: Bikes Behind Step Out



Protected Bike Lanes at Bus Stops: Bikes Behind Step Out



Protected Bike Lanes at Bus Stops: Bikes Behind Step Out



Protected Bike Lanes at Bus Stops: Bikes Behind Step Out



Protected Bike Lanes at Bus Stops: Bikes Behind Step Out





Protected Bike Lanes at Bus Stops:

Bikes Behind
Step Out

Protected Bike Lanes at Bus Stops: Bikes Behind Island Station



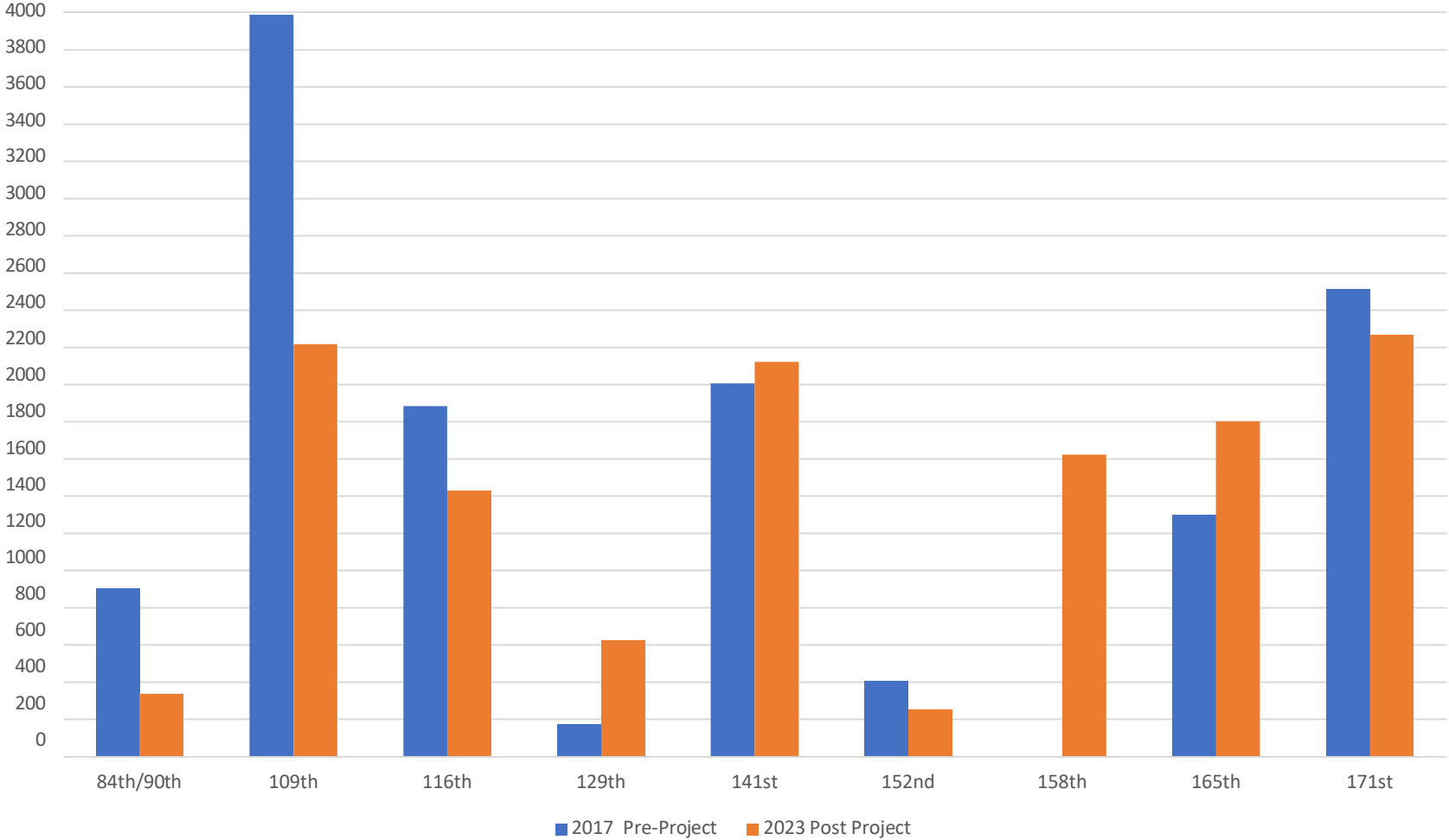
Protected Bike Lanes at Bus Stops: Bikes Behind Island Station



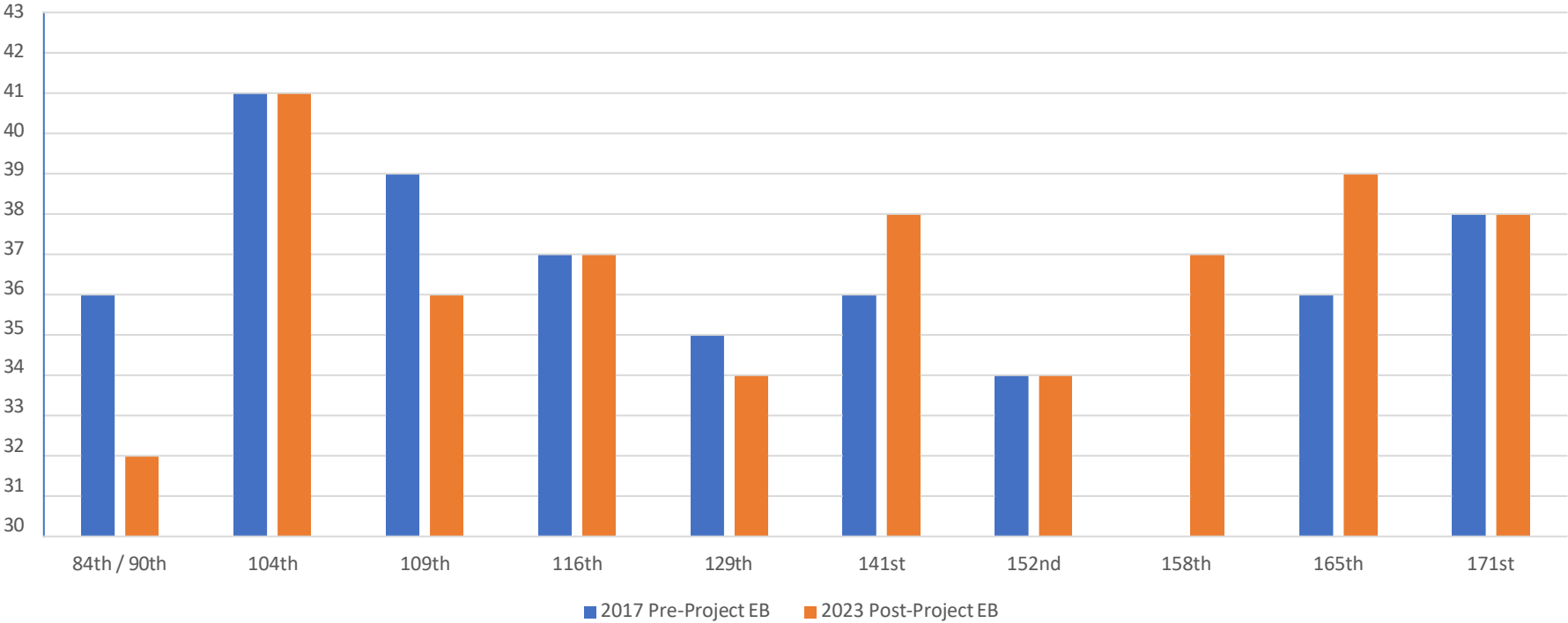
Project Performance Monitoring Plan

- Initial project report 1 year after substantial completion. Division Substantial completion was end of October 2022.
- Report at 3 years to evaluate the first year of available crash data.
- Report at 5 years to evaluate 3 years of available crash data.

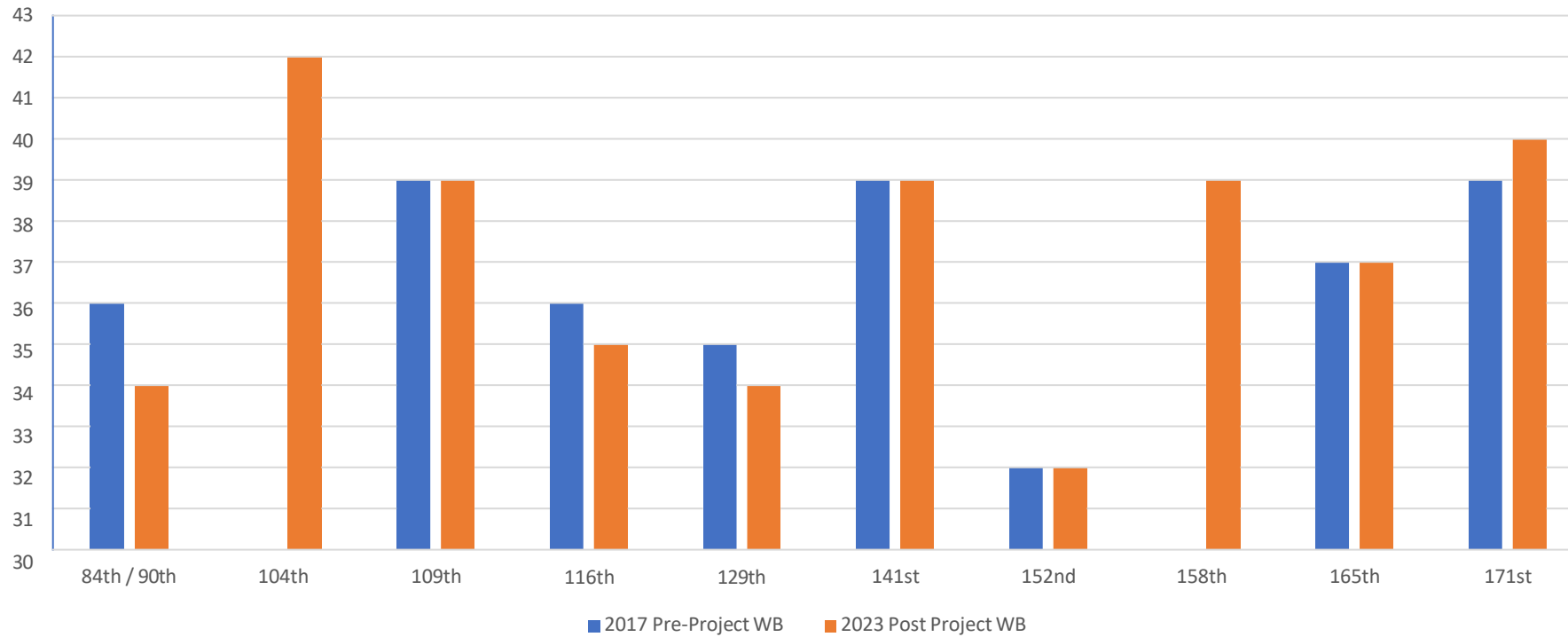
Number of Vehicles Per Day on Division Street (EB and WB Combined) Traveling 10mph or more over the 30mph speed limit



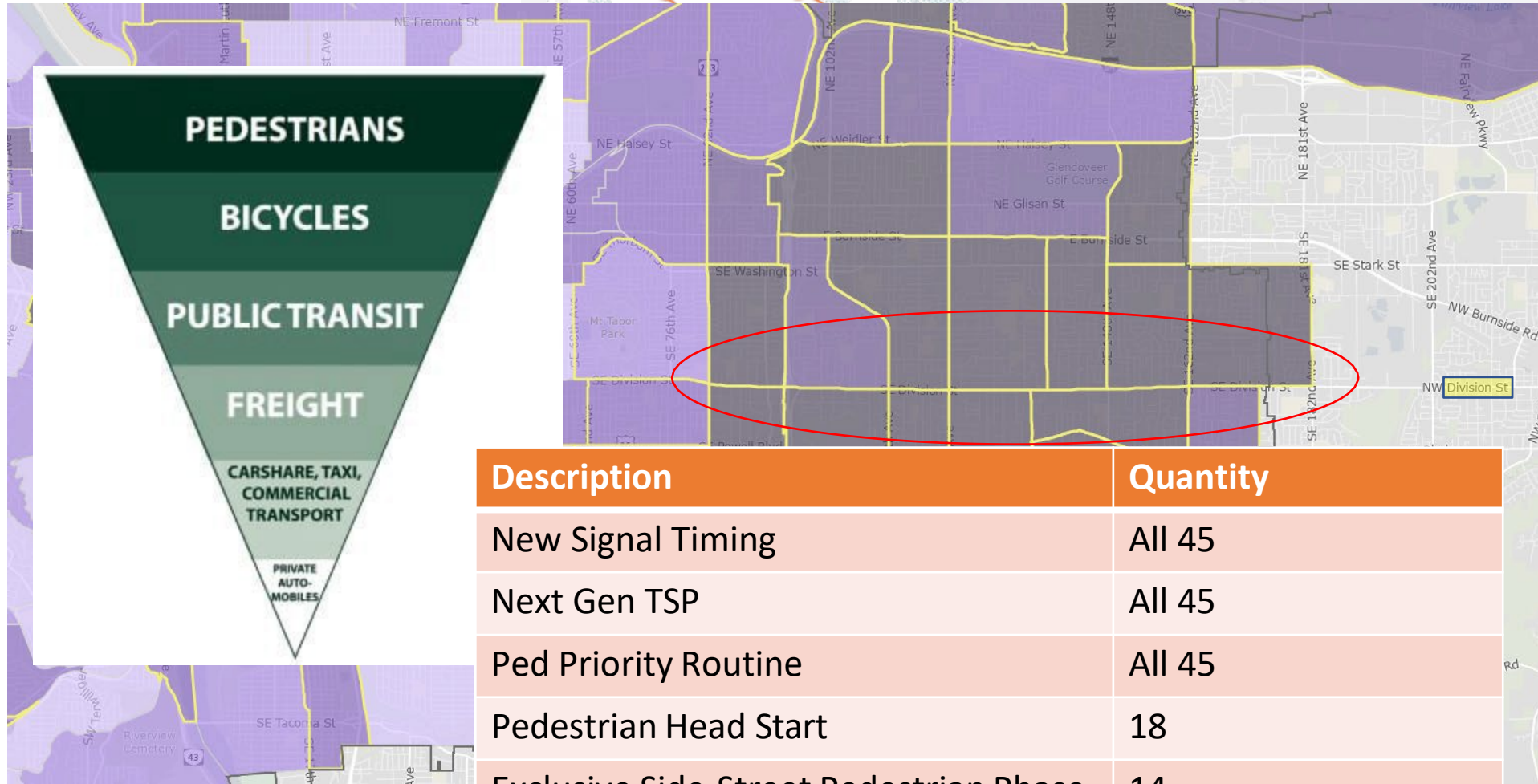
Westbound 85th % speeds (MPH) Pre and Post Project



Eastbound 85th % speeds (MPH) Pre and Post Project



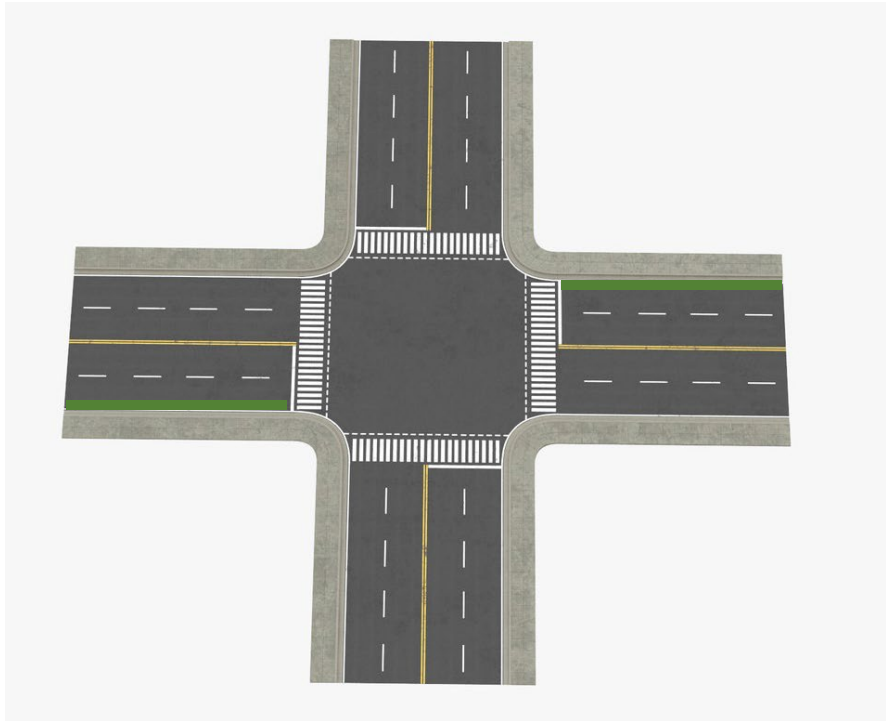
Traffic Signal Operation Goals



Outer Division: New Signal Phases

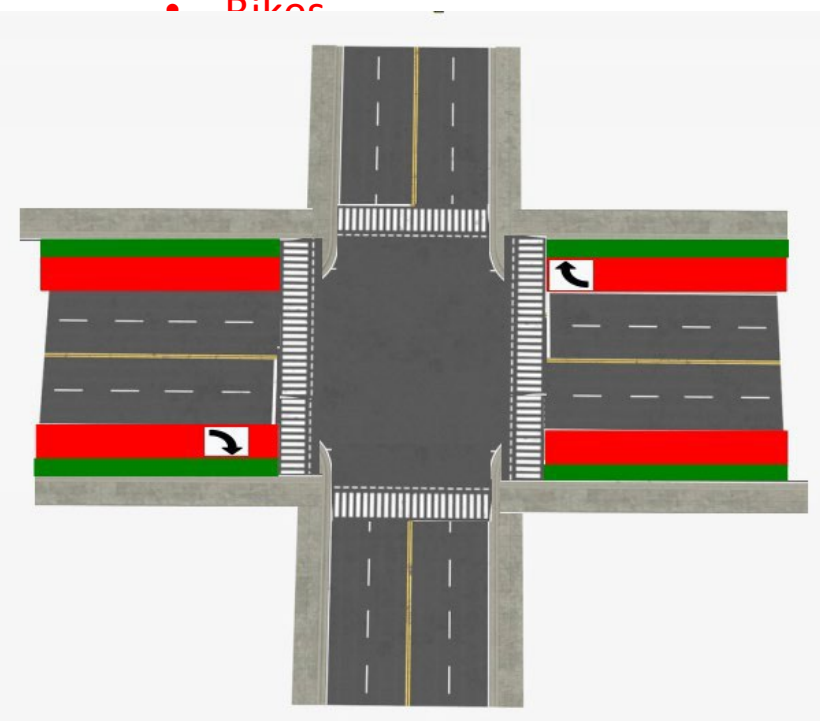
Existing Lane Configuration & Phases

- Vehicles/Bikes/Buses
- Pedestrians

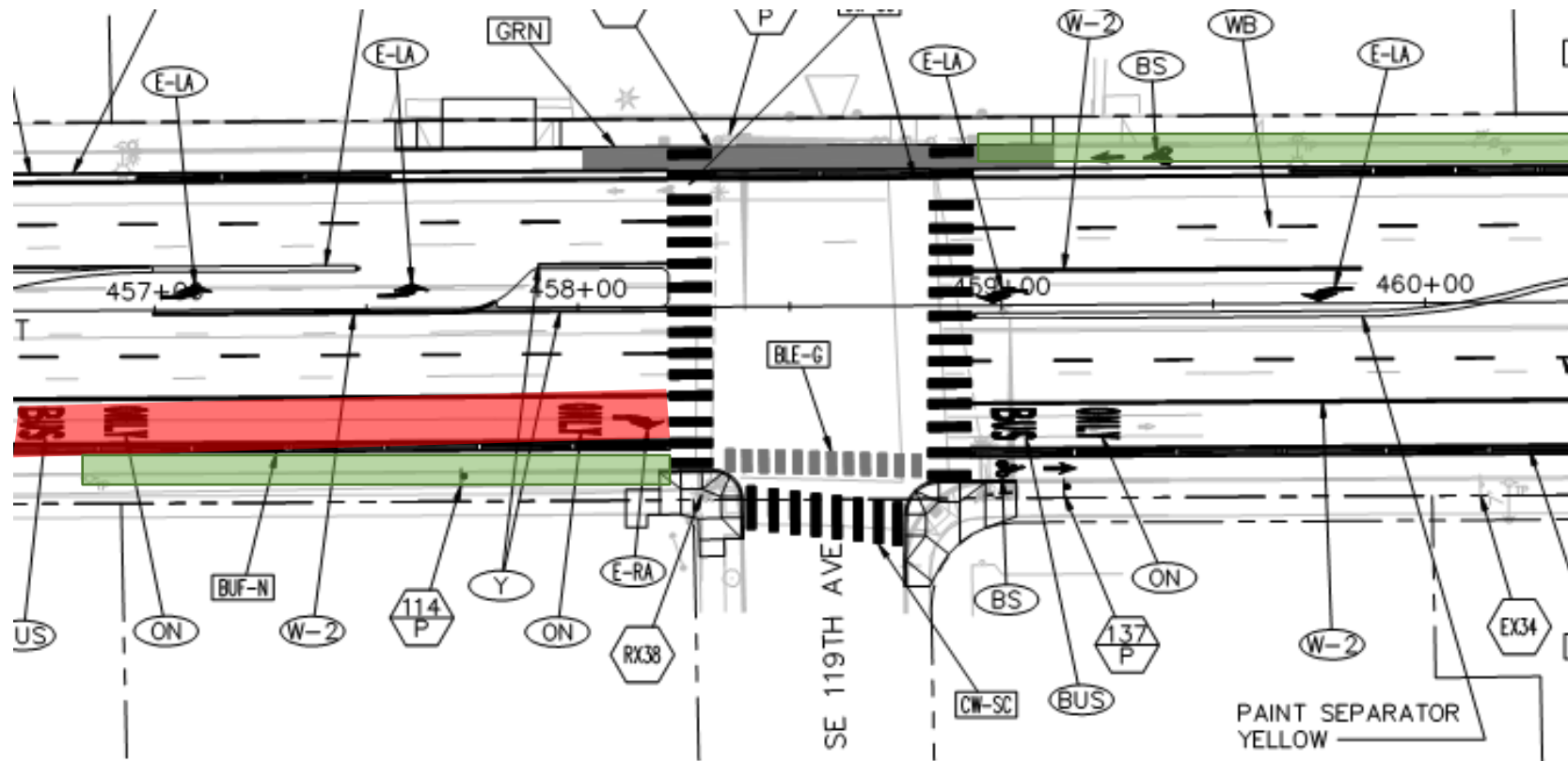


New Lane Configuration & Phases

- Vehicles
- Pedestrians
- Bikes



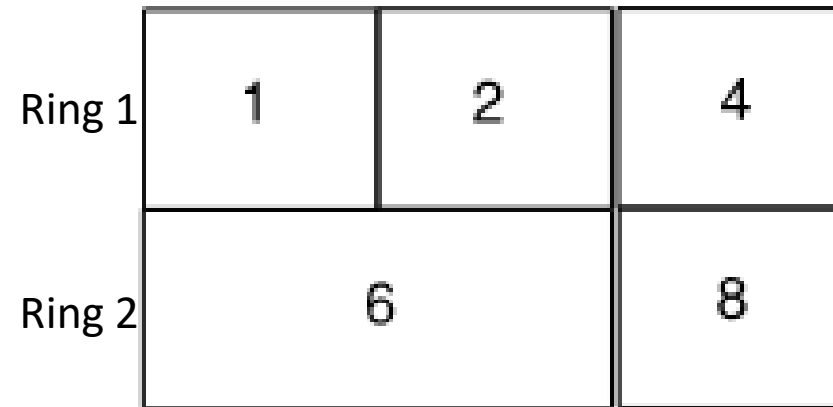
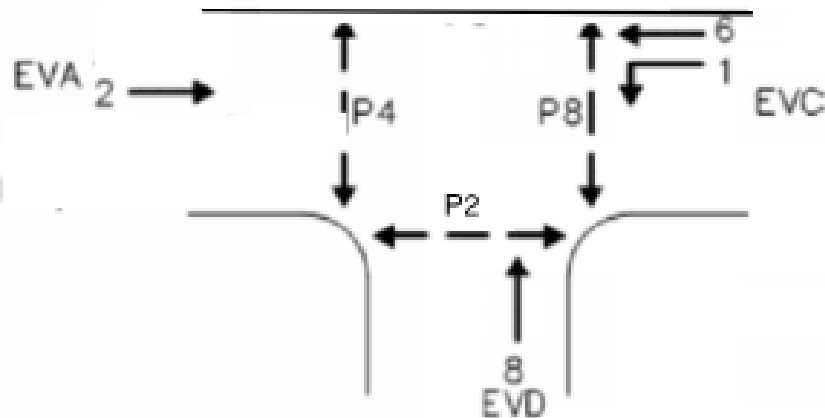
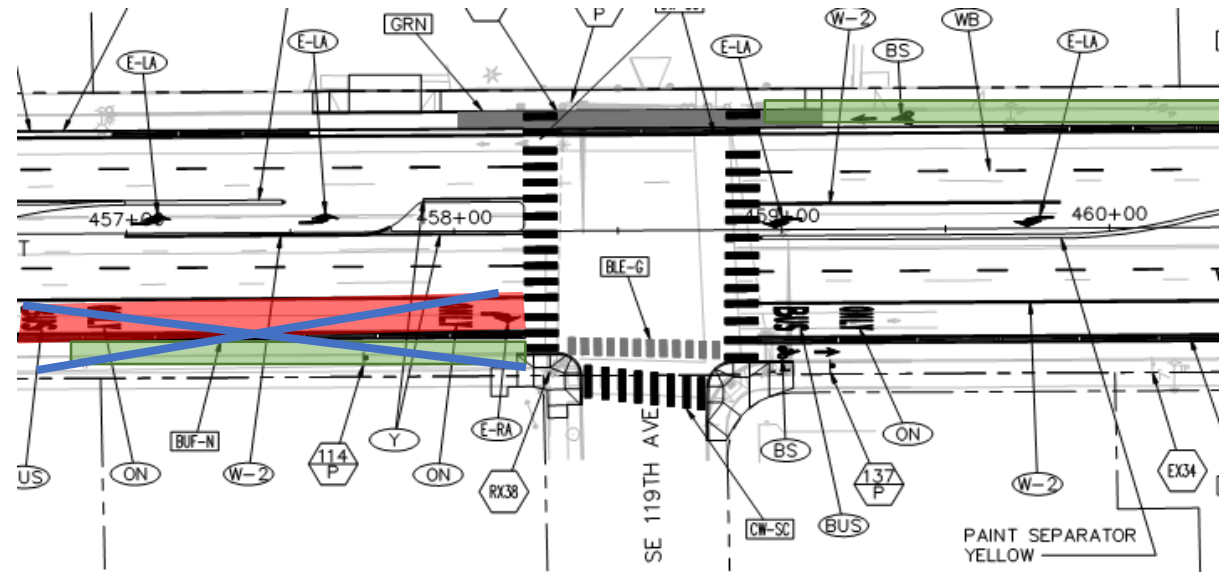
Outer Division: BAT Lanes Approaching Signals



Major Intersections: Signal Display (SE 119th Ave, looking east)

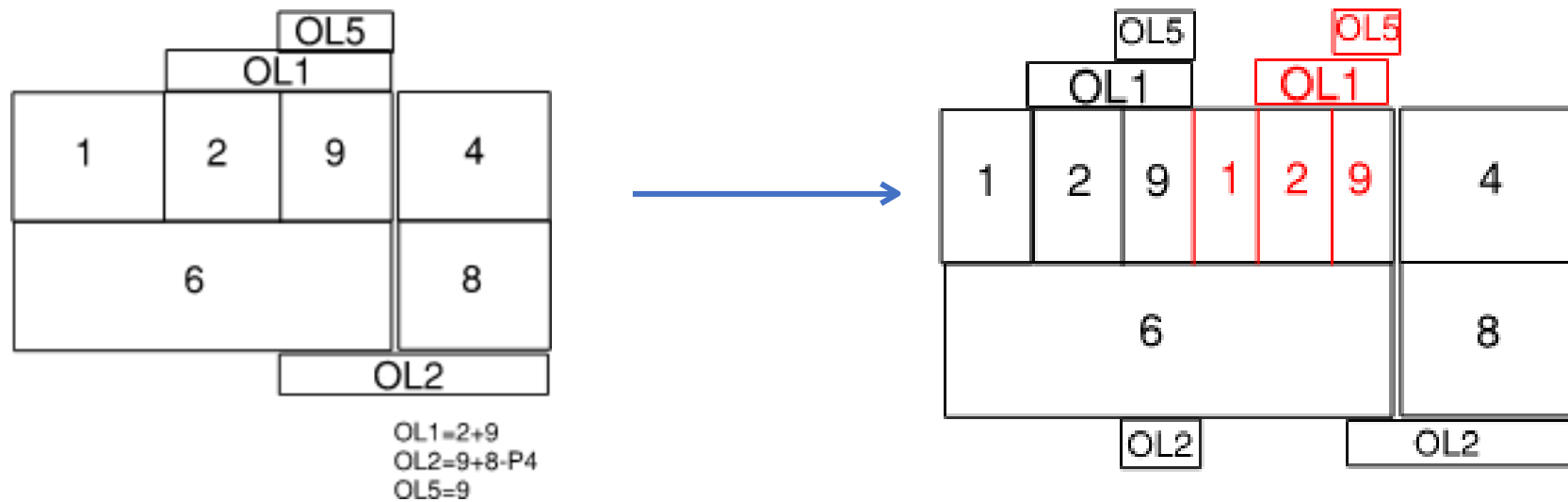
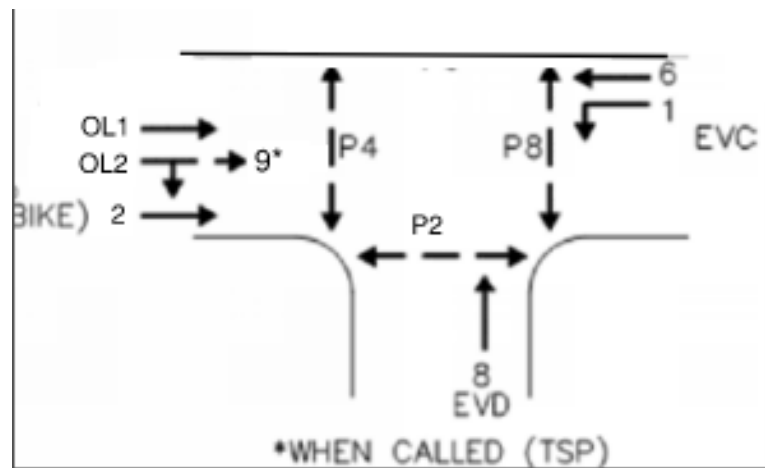


Outer Division: Typical Phasing



Barrier
1

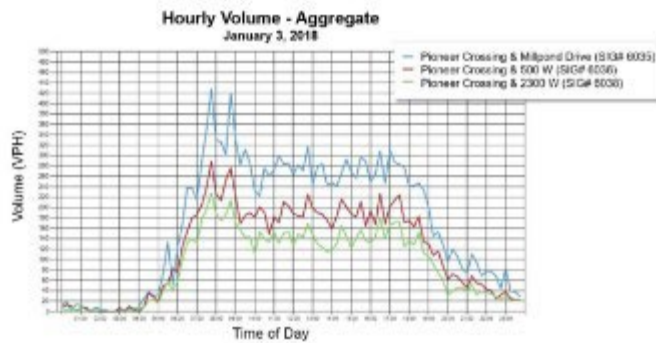
Vehicle Reservice



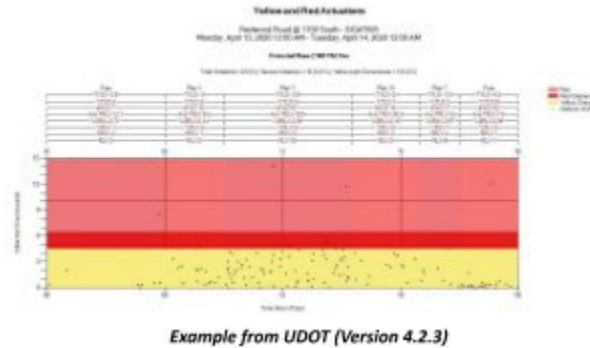
Radar Detection – Operations and Performance Measures



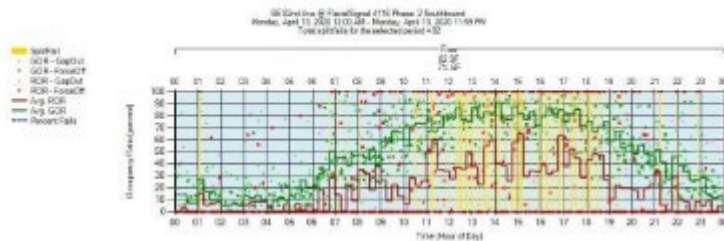
Aggregate Data: Volumes



Yellow and Red Actuations

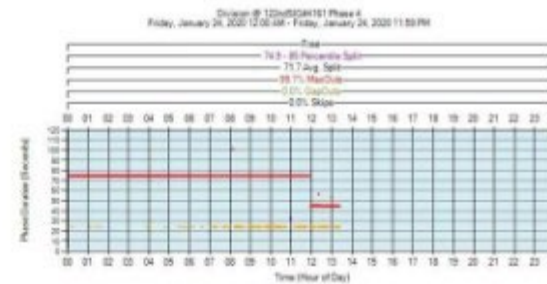


Purdue Split Failure

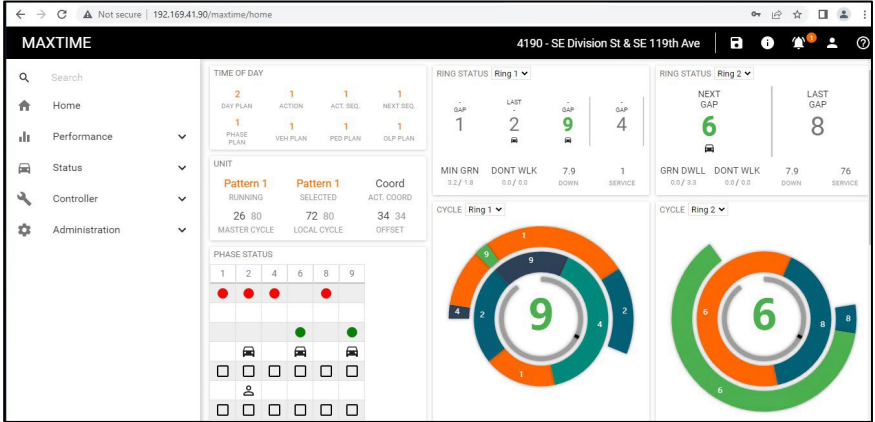


SE 122nd Ave / SE Division St

- Identified a failing detector driving up the dynamic max



Advanced Transportation Controller



Recorded Splits (Past 10 Service/Cycles)

Show All Phases

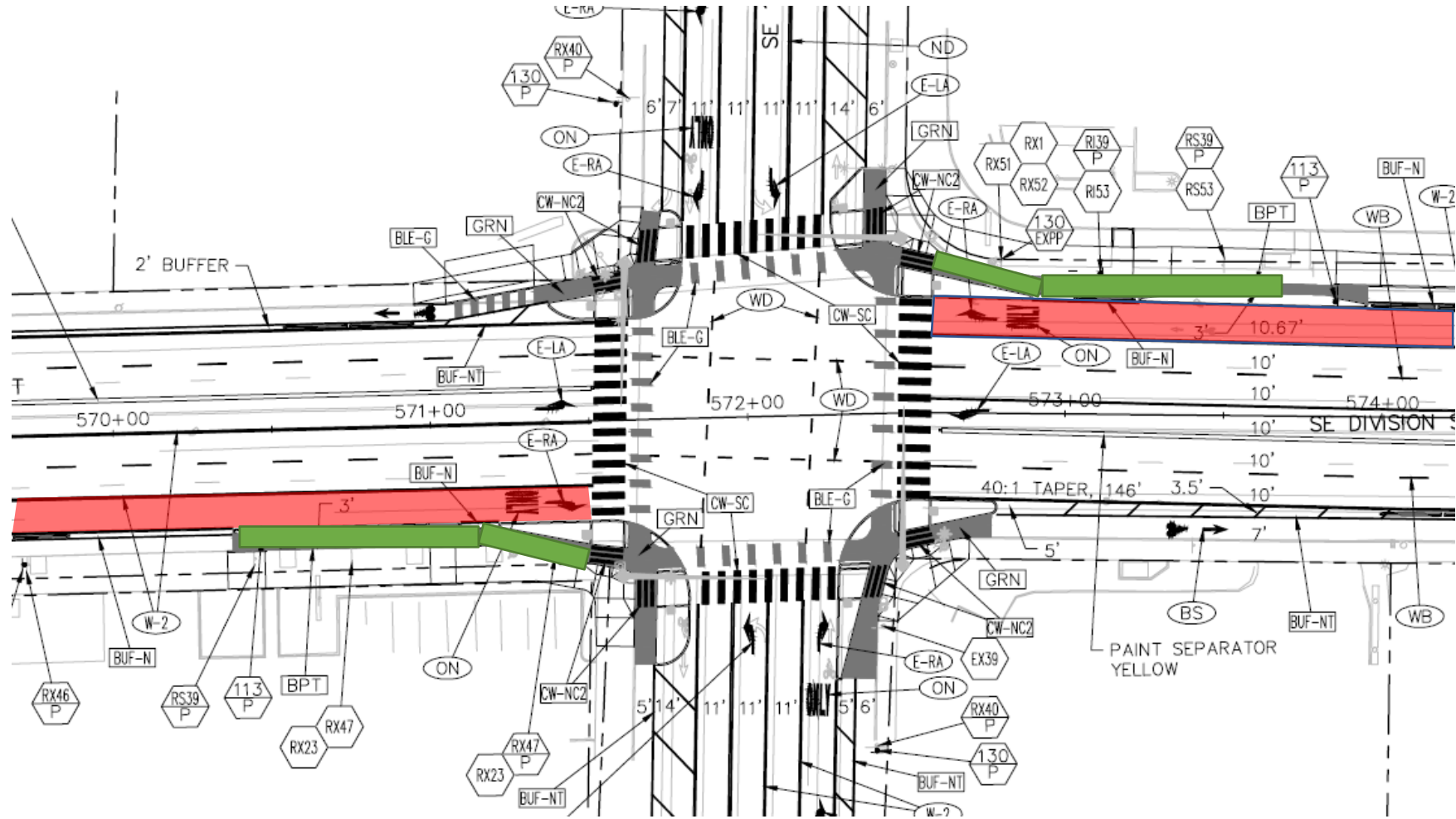
Phase	Description	-1	-2	-3	-4	-5	-6
1	WB LT	11.4	0.0	0.0	10.1	0.0	9.7
2	EB Bike/Ped	19.0	19.5	41.5	34.7	72.3	24.9
4	West Leg Ped	0.0	0.0	0.0	0.0	0.0	0.0
6	WB Thru	118.8	53.8	59.5	58.9	70.5	49.6
8	NB + East Leg Ped	0.0	0.0	9.6	21.1	9.5	0.0
9	EB RT/OL1/OL5	88.4	39.6	0.0	14.1	0.0	13.2

Last Term (Past 10 Service/Cycles)

Show All Phases

Phase	Description	-1	-2	-3
1	WB LT	Force Off		
2	EB Bike/Ped	Force Off		Prioritor
4	West Leg Ped			
6	WB Thru	Force Off	Prioritor	Prioritor
8	NB + East Leg Ped			Force Off

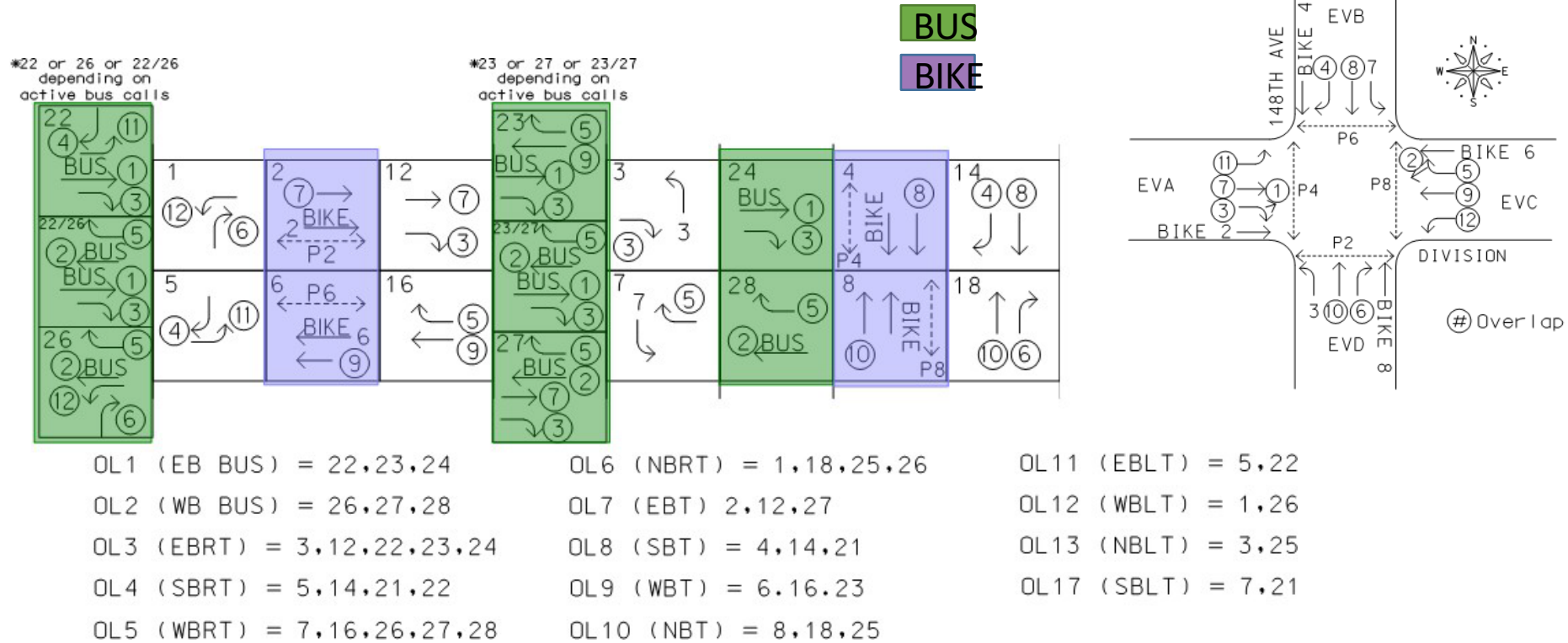
Protected Intersections



Protected Intersections: SE 148th Ave/SE Division St, looking east)

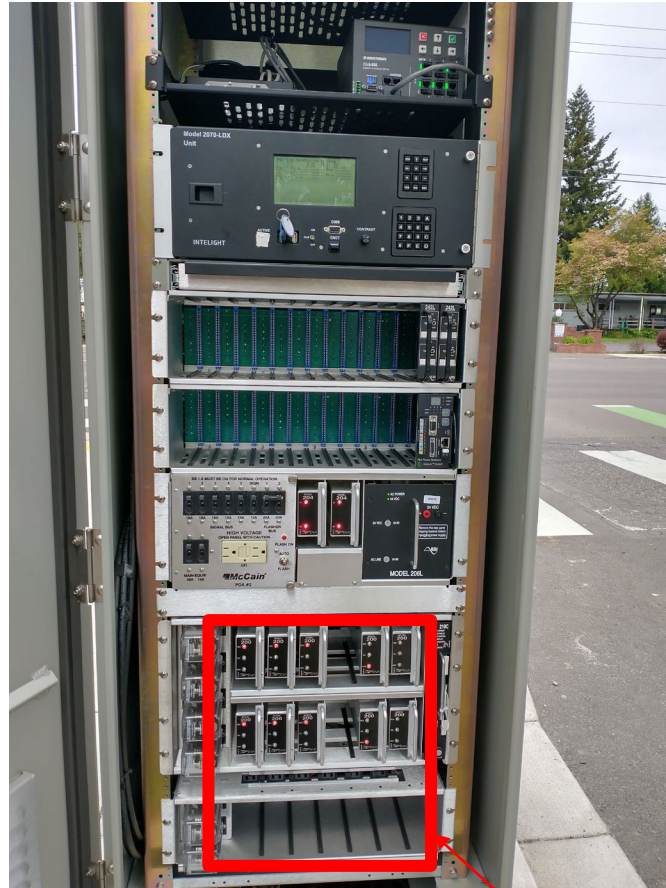


Protected Intersections: Phase Rotation



Protected Intersections: Serial Cabinets

332 Cabinet



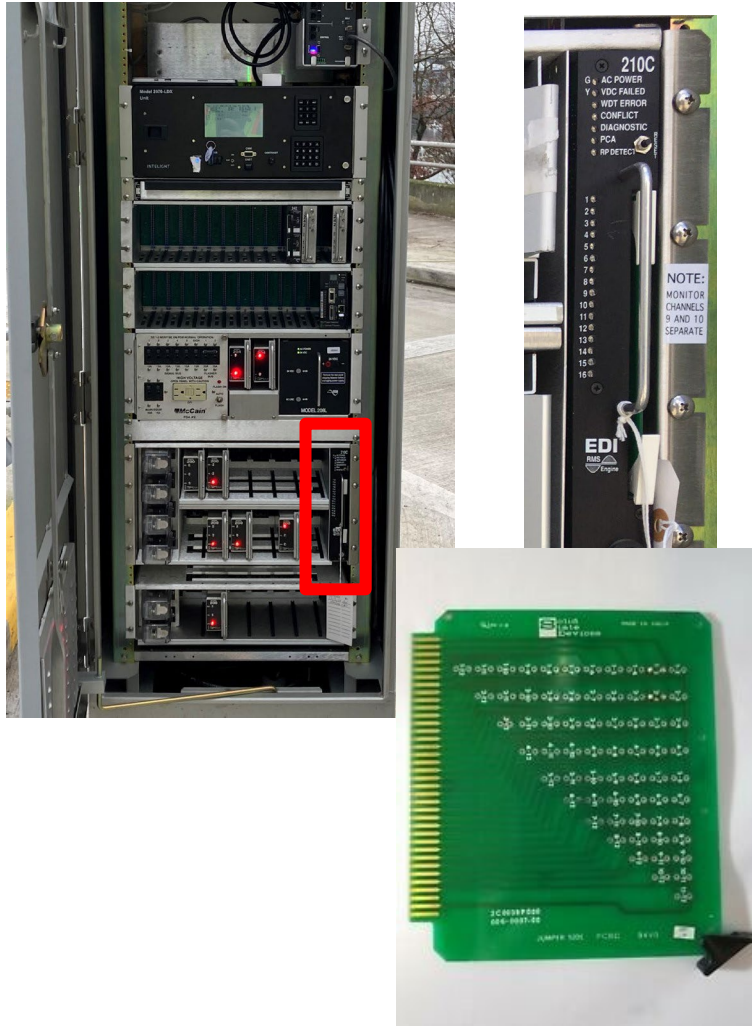
Up to 18 outputs (1 per slot)

Serial Cabinet



Up to 32 outputs (2 per slot)

Protected Intersections: Serial Cabinets

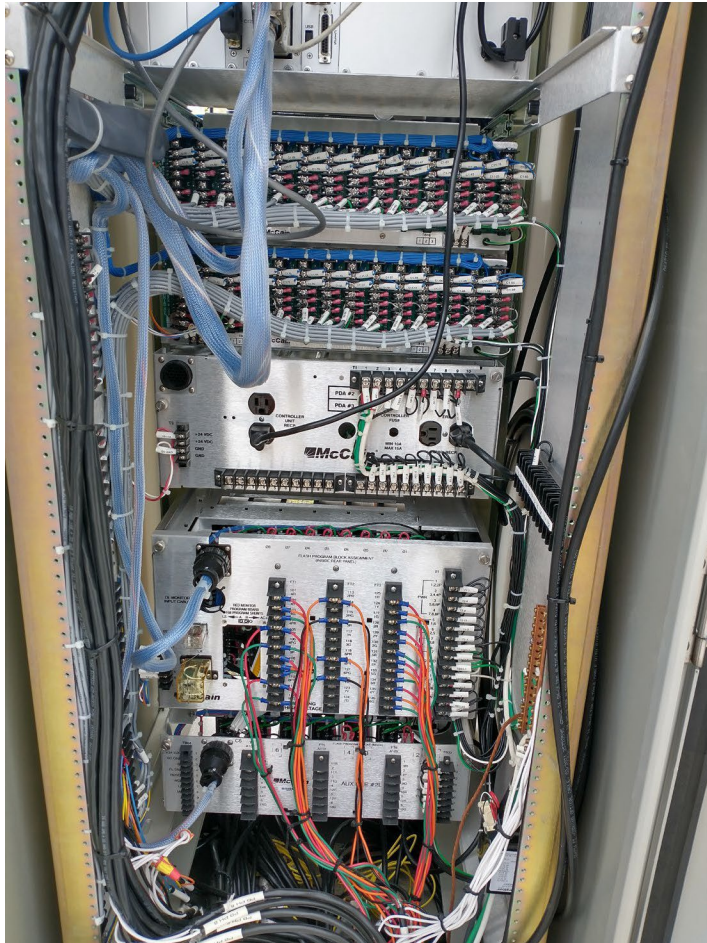


332 Cabinet

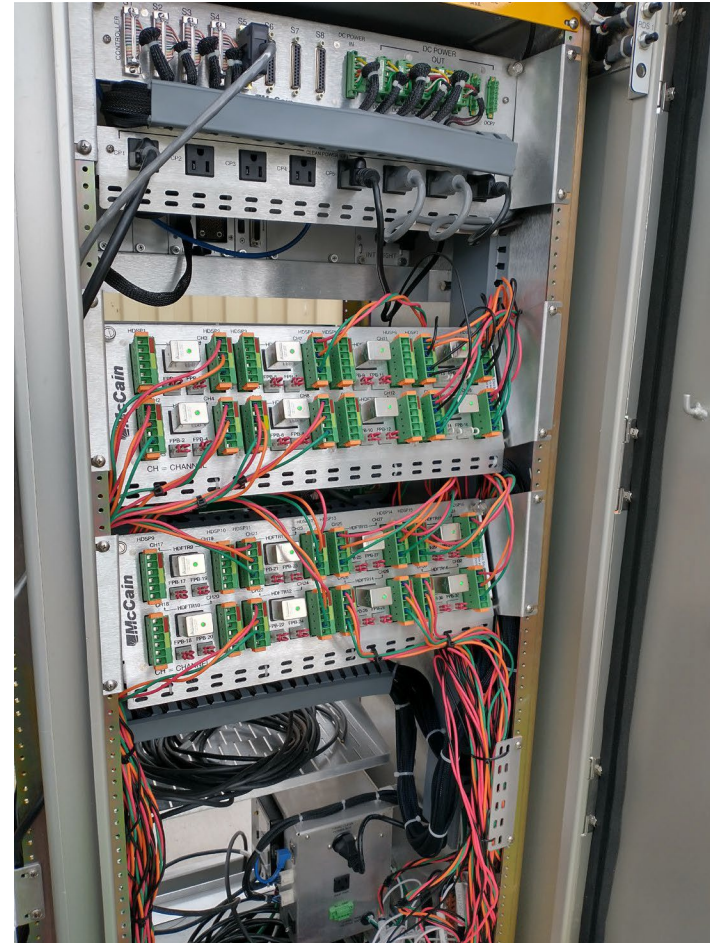


Serial Cabinet

Protected Intersections: Serial Cabinets (Back)



332 Cabinet

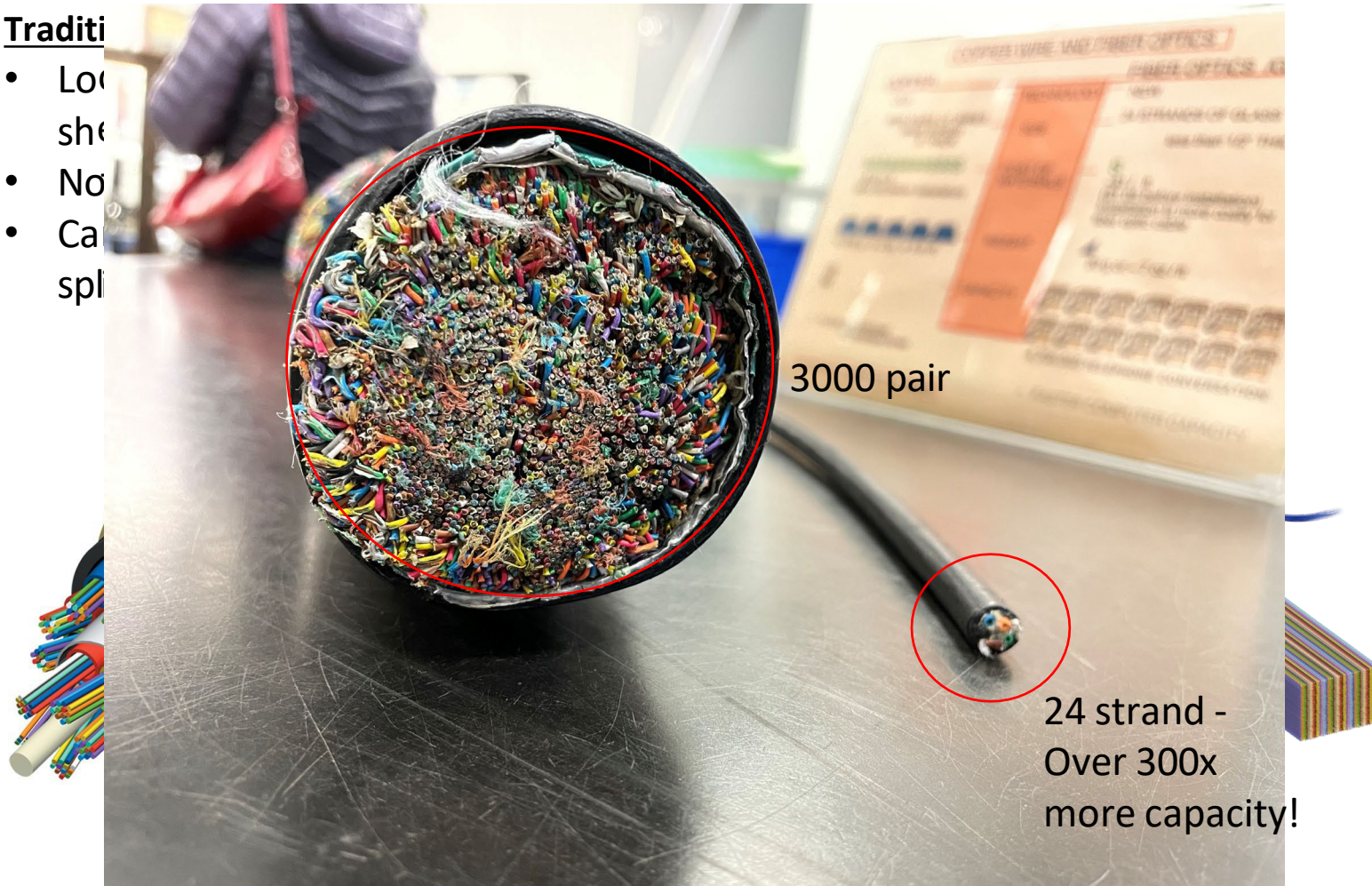


Serial Cabinet

Fiber – The Unsung Hero

Traditi

- Loc
- she
- No
- Ca
- spl



How TriMet Modernized Public Transit

NWTransportation Conference March 2024

Issues That FX Helps to Solve

1. Long-term transit reliability
2. Increase transit speed/capacity
3. Greater accessibility and comfort
4. Improved connectivity
5. Improved safety



Standard Transit Tools

This “Tool Box” typically includes:

- **Adaptive Stop Placement** – minimal infrastructure requirements
- **Shelter Placement** – Applied where demand meets minimum thresholds
- **40’ Buses** – Single-door boarding
- **Service Frequency and Line Variation** – Tool for matching service with demand

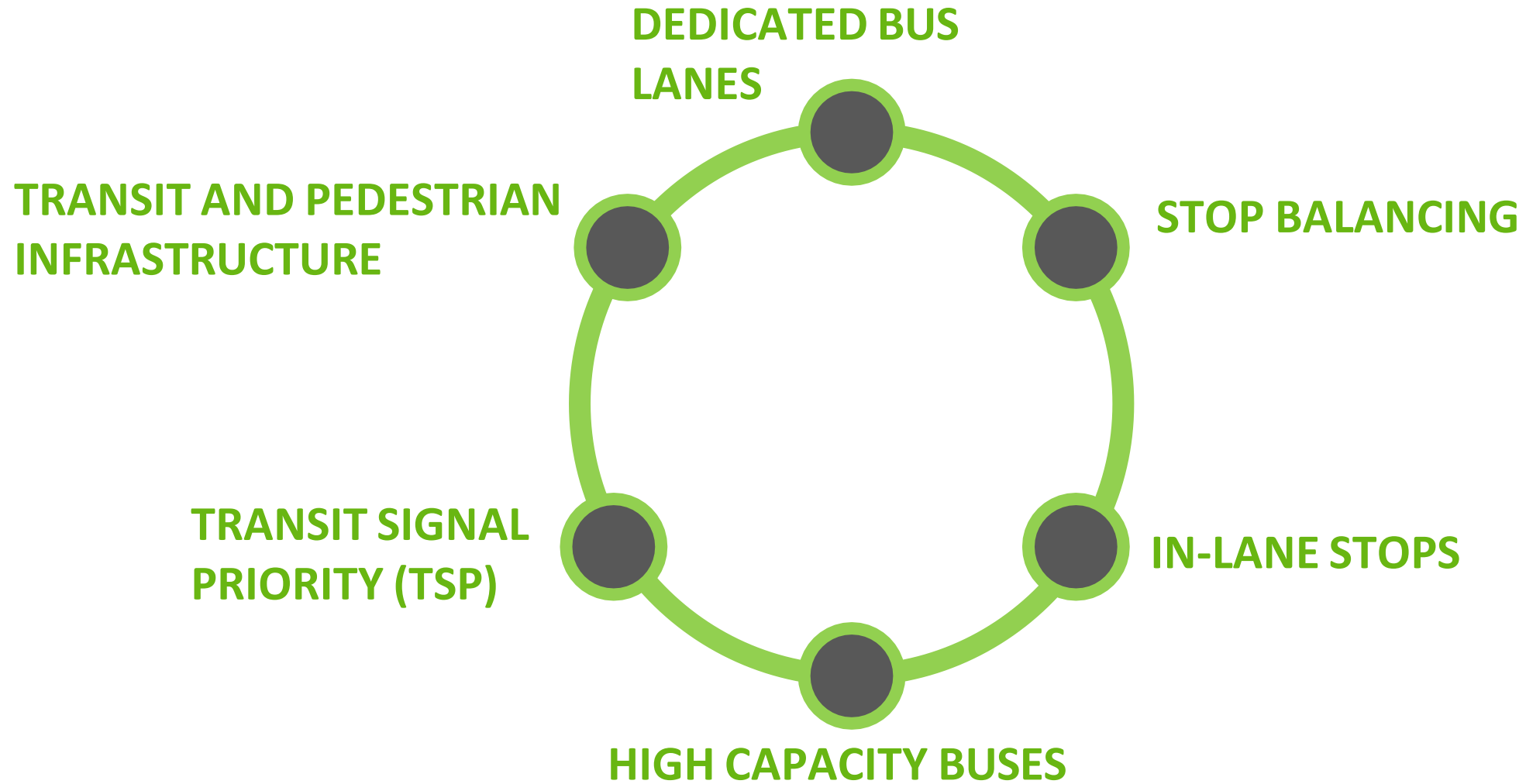


Standard Transit Tools

Limitations of this basic tool box:

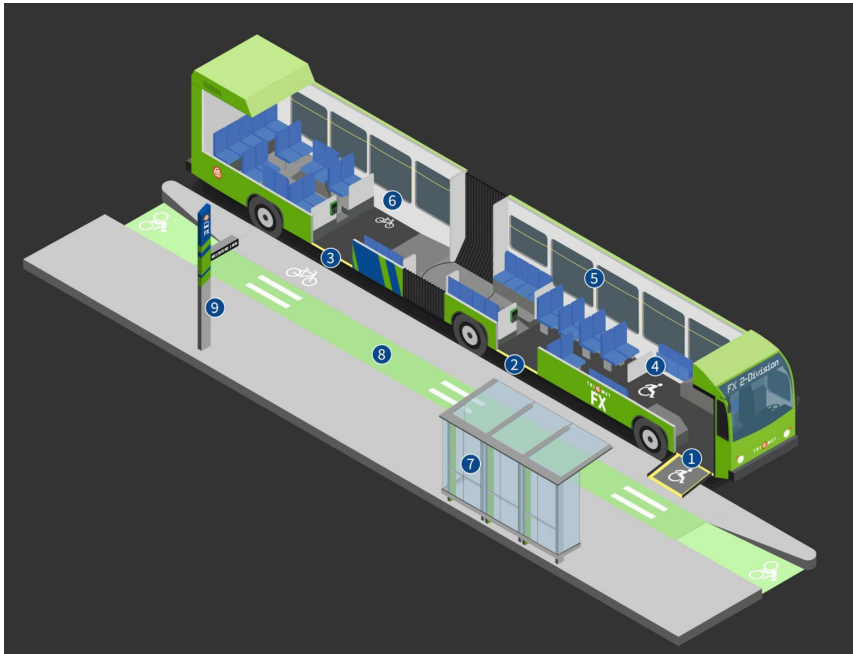
- **Minimal improvement to infrastructure** (stop improvements, sidewalk connections, ADA ramps, lighting, signal and safety improvements).
- **Little improvement to speed / reliability** when route congestion is already an issue
- **Localized vs. corridor-wide safety and accessibility improvements**

FX as a System



High Capacity 60' Buses

- **60% More Capacity Than A 40' Bus** – Eliminates pass-ups, and carries more people with fewer trips
- **3-Door Boarding** - Reduces dwell time by about 1.4 seconds per passenger / 7 seconds per stop (LA Metro, SF Muni studies)

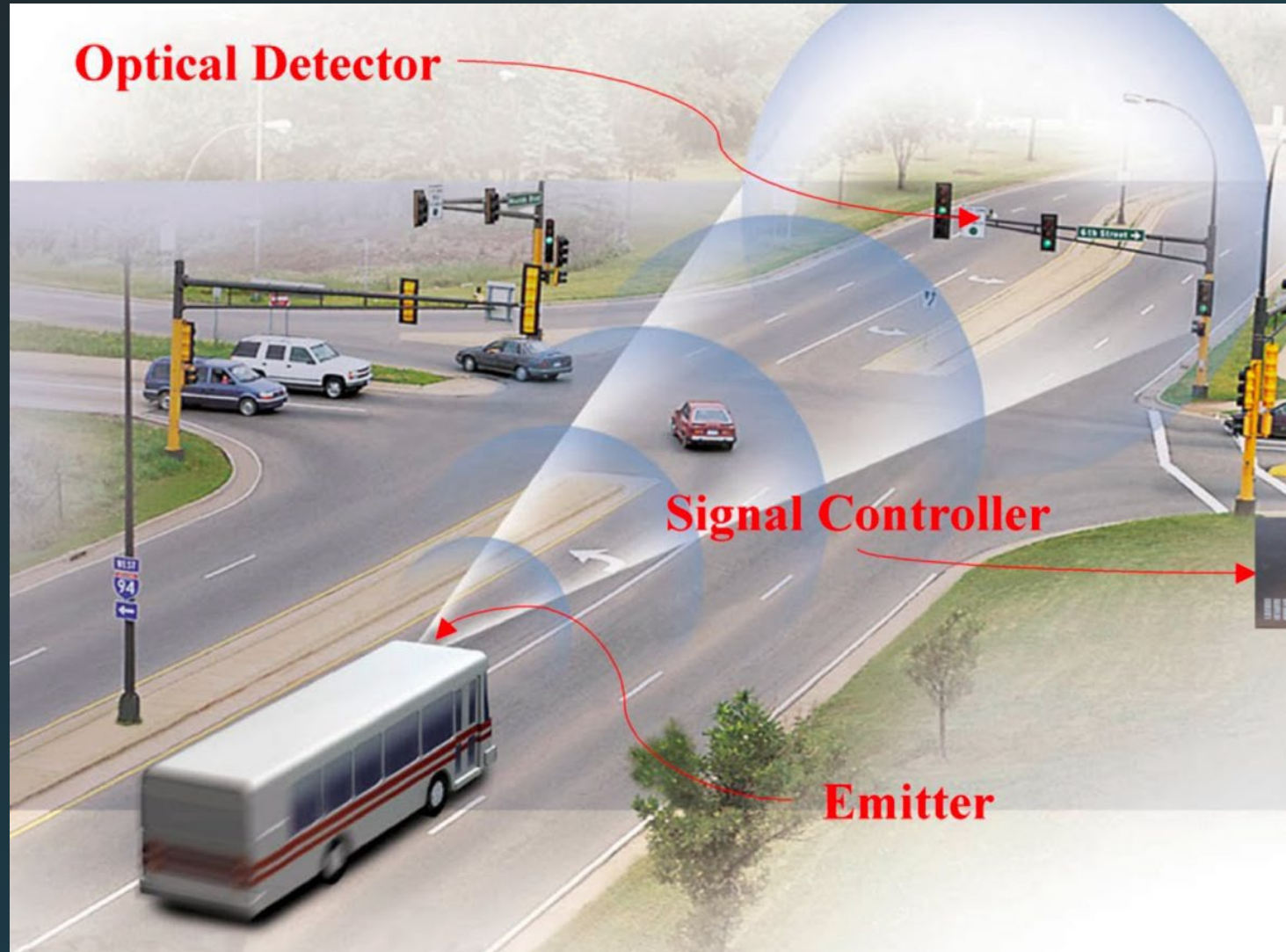




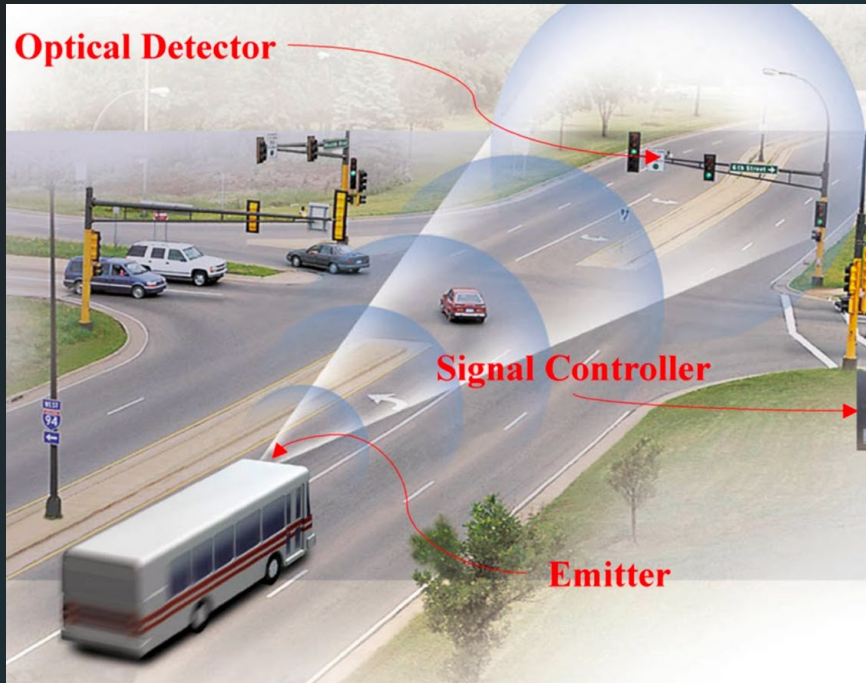
LYT.

MOBILITY SOLUTIONS

Legacy Transit Signal Priority



Legacy Systems



Hardware heavy



Labor heavy

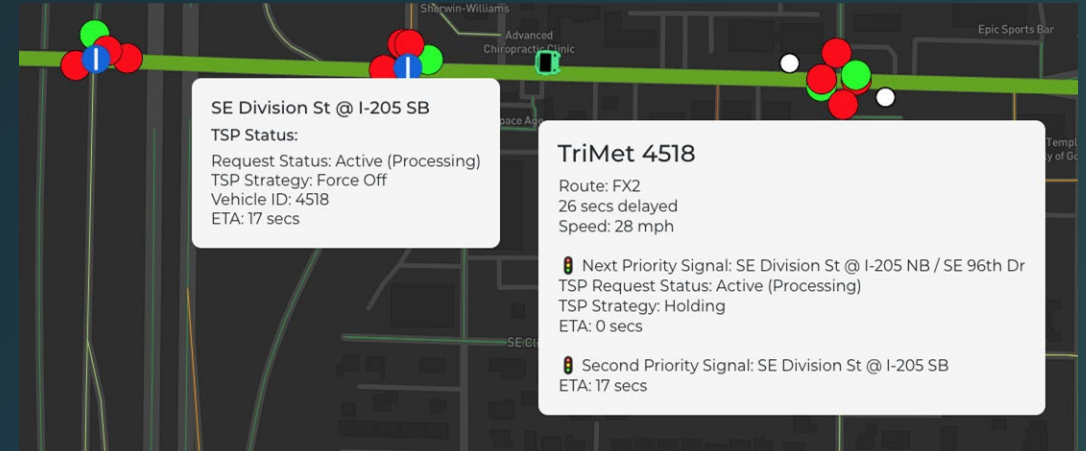


Operational Challenges

Legacy Systems



Poor performance at near-side stops / service disruptions



No observability

The LYT Platform



Emergency Responders
& Public Transporters

LYT Algorithms Learn & Adapt



LYT.speed

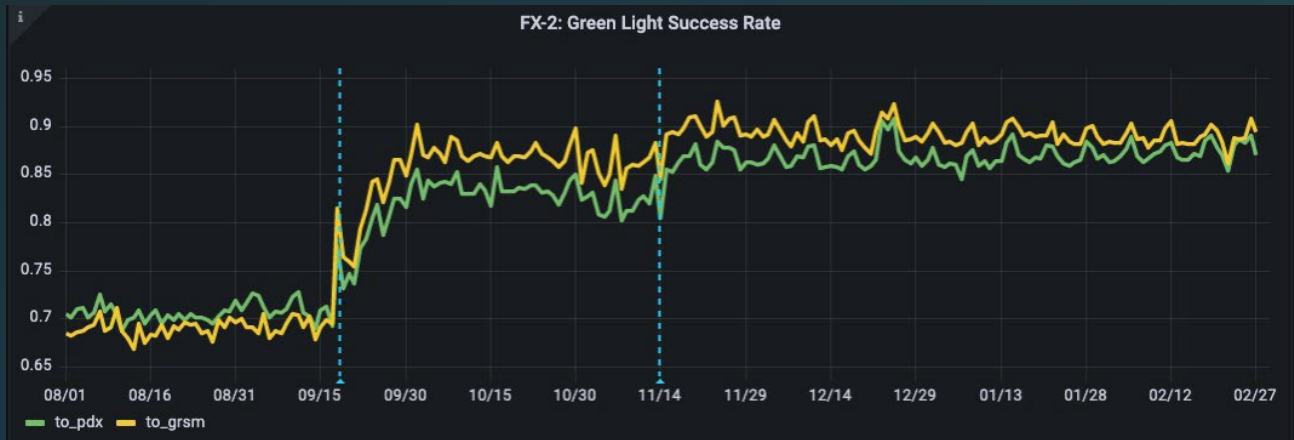
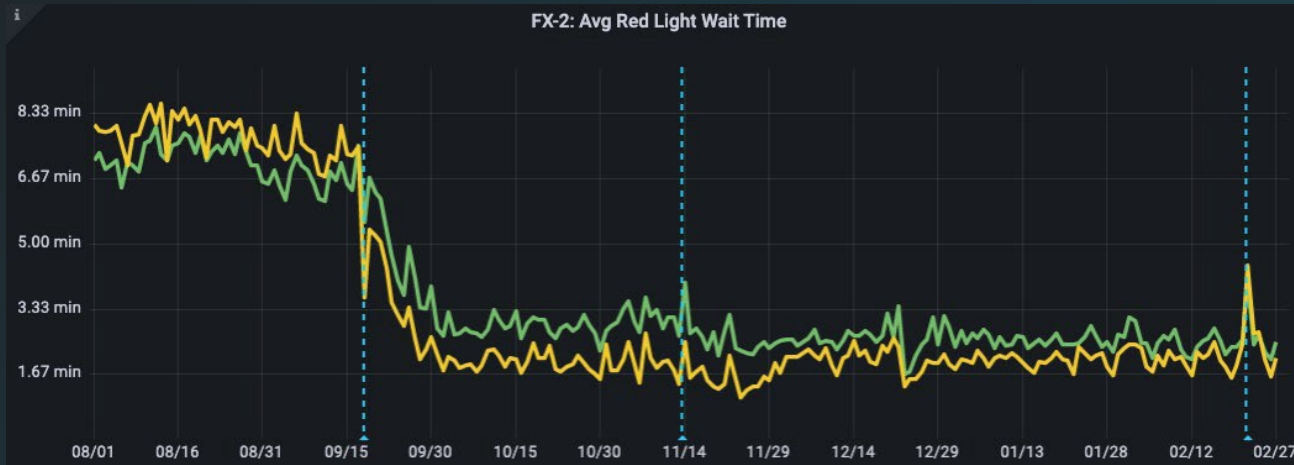
Keeps learning, gets better with age

- Vehicle activity
- Speed over time
- Speed limit
- Traffic over time
- Dwell times
- Road capacity

Decision-making based on
Machine Learning



TriMet, PBOT, ODOT, & City of Gresham, OR Success



In less than six months after launch:

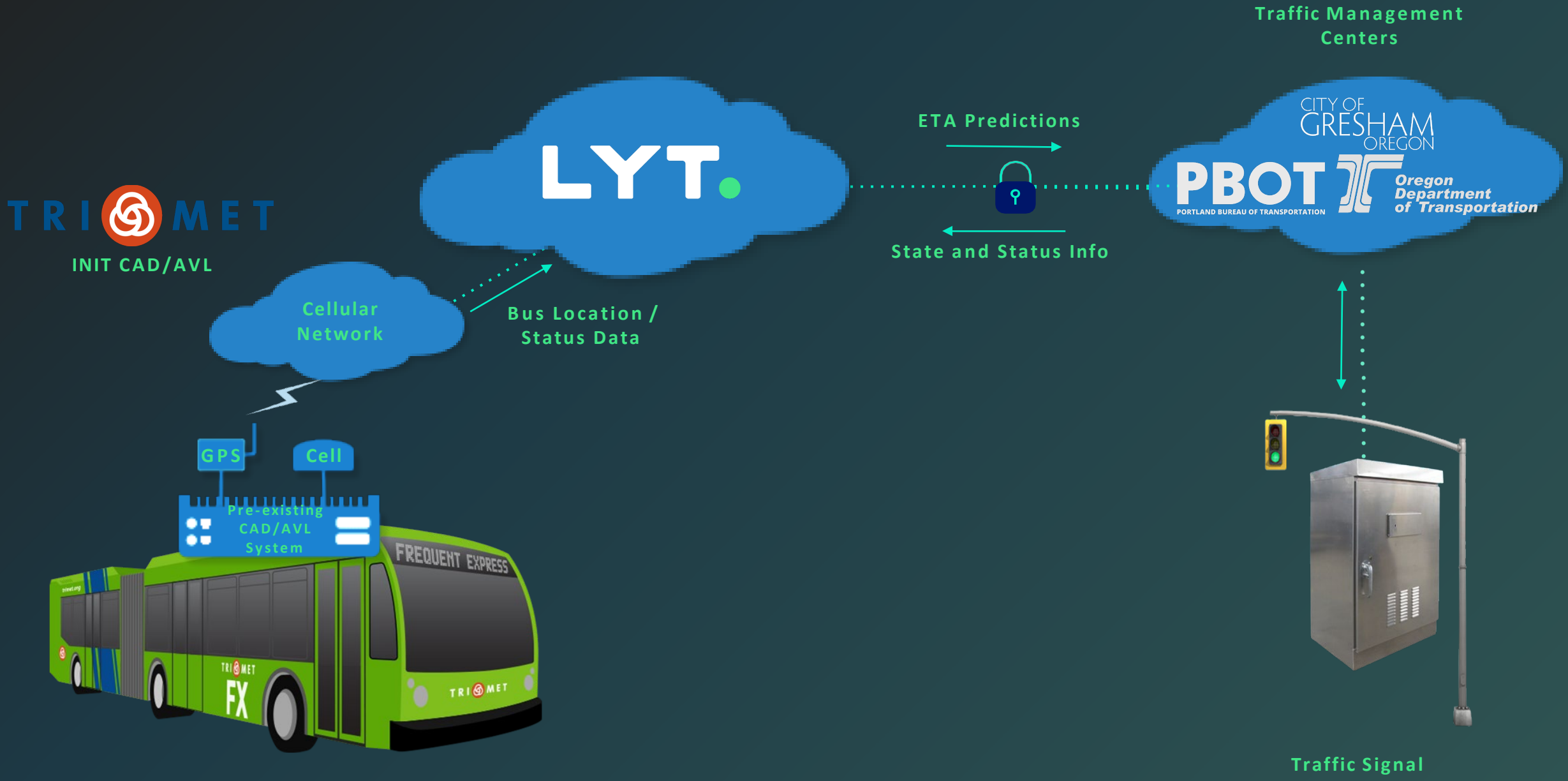
- ~70% reduction in signal delay: ~5-6 minutes each way
- ~30% increase in green light success rate (Green on arrival)
- TSP system operated seamlessly during sudden, unplanned fleet swap

News

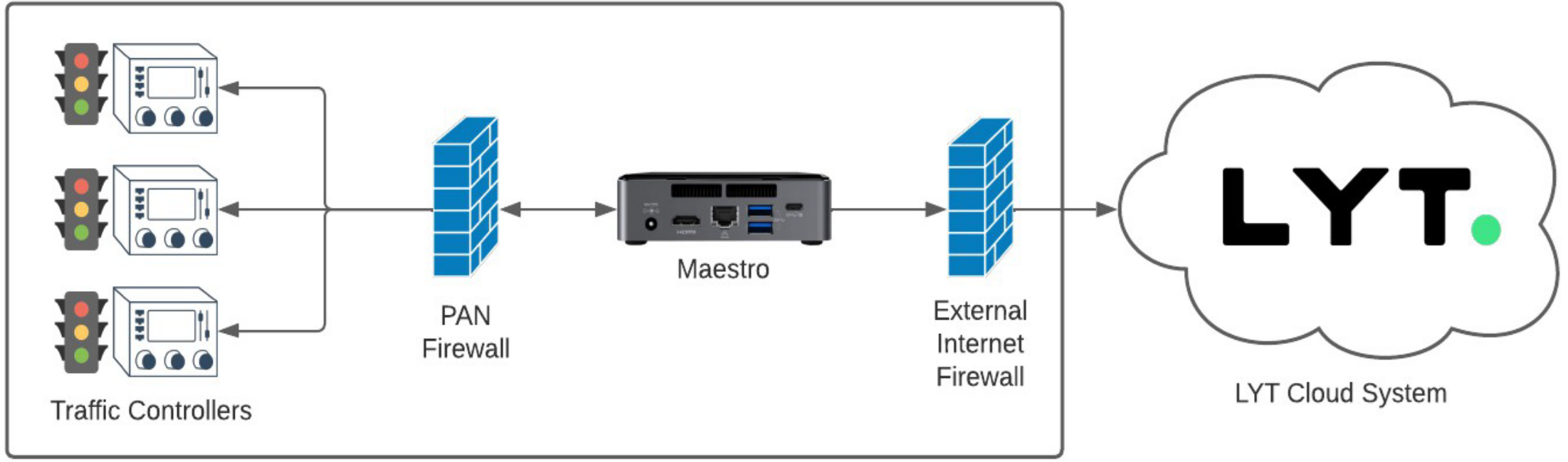
TriMet pulls FX2 rapid buses off the street in ‘abundance of caution’

Updated: Nov. 07, 2022, 3:18 p.m. | Published: Nov. 06, 2022, 12:41 p.m.

LYT. Architecture Overview of LYT.transit

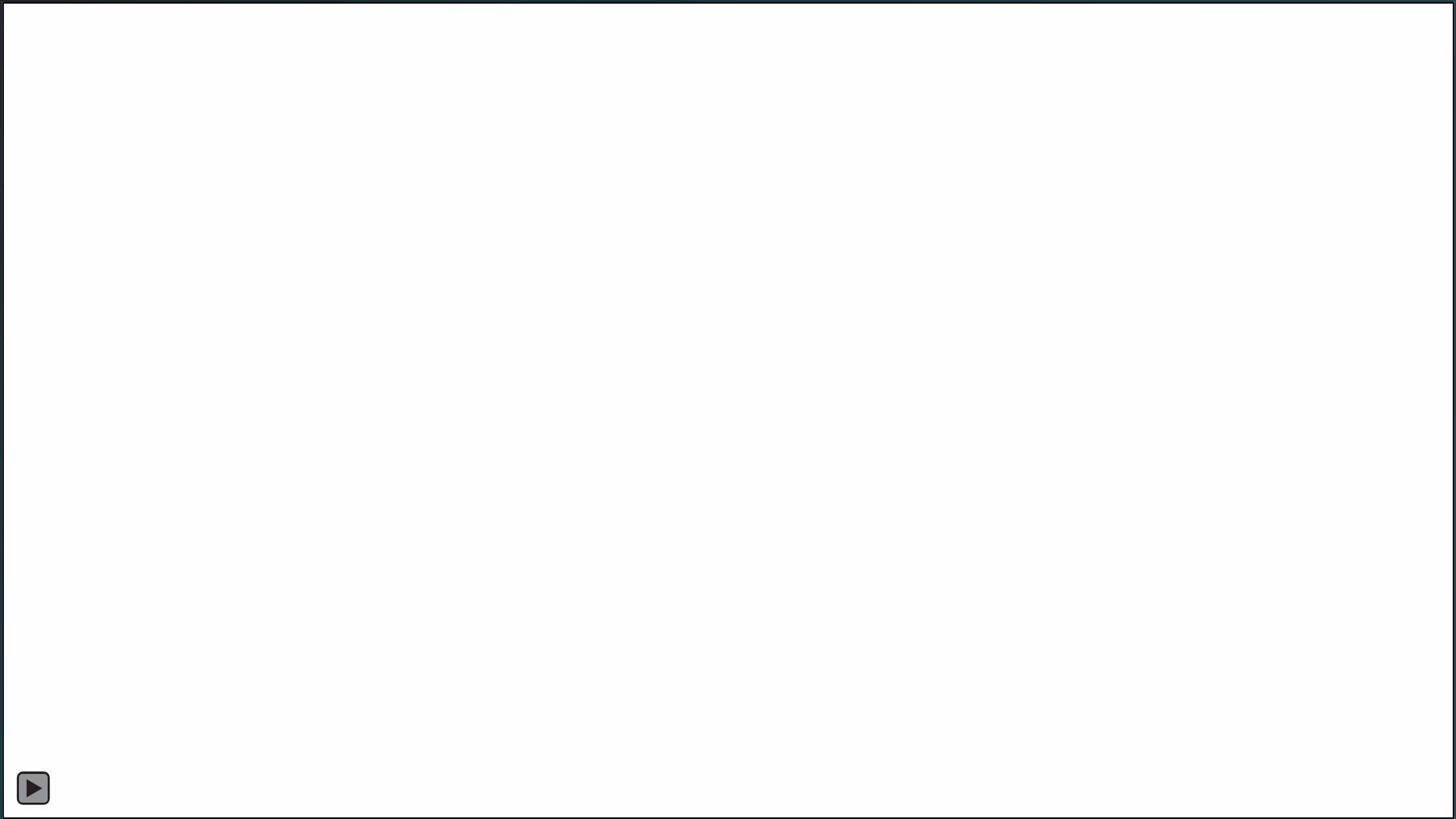


LYT. Architecture Overview of LYT.transit



Traffic Partner Agency Traffic Management Center Network

LYT. Architecture Overview of LYT.transit



Transit Signal Priority – A Brief History



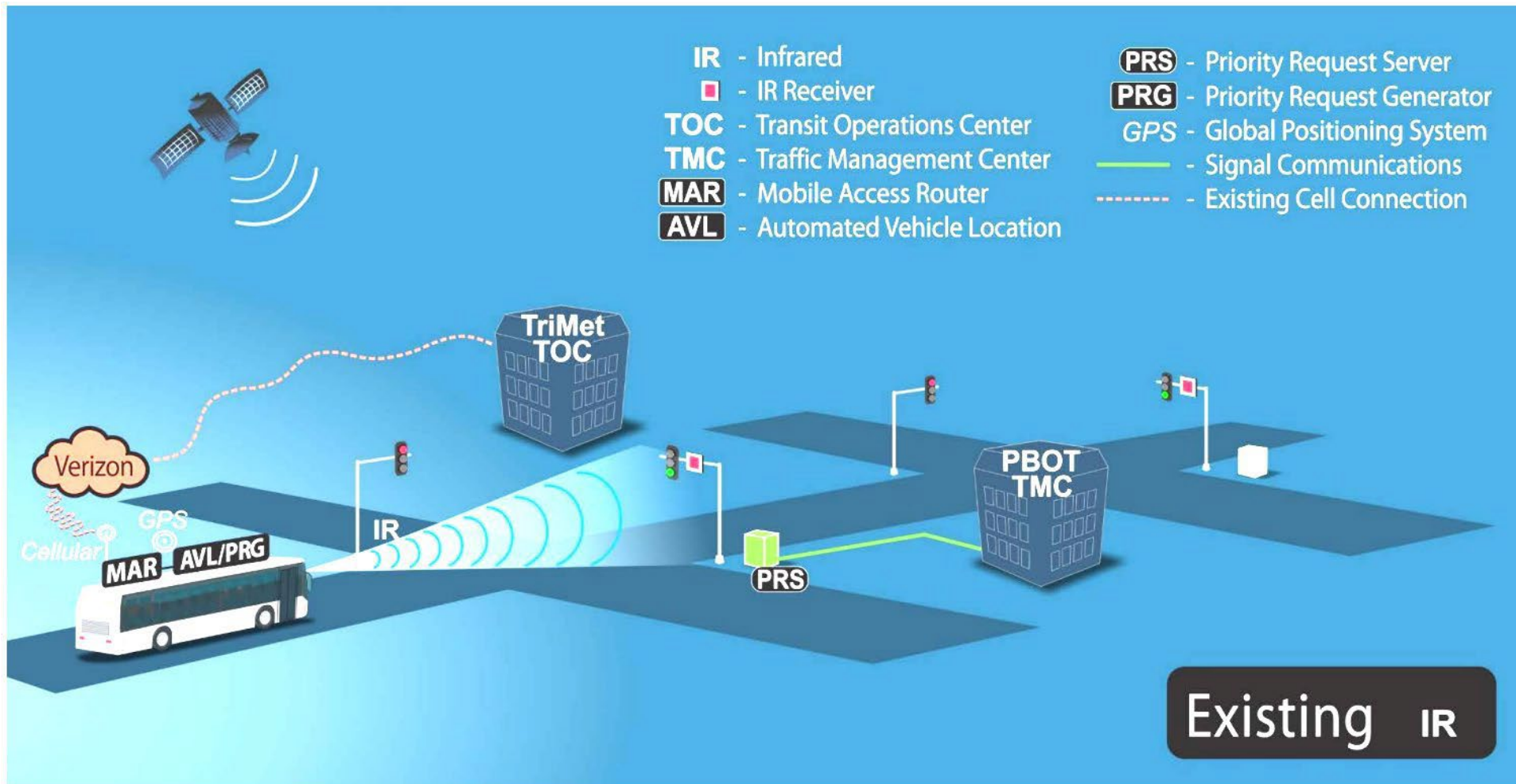
Traditional Camera
Any questions?
Detector Unit

Why do we use Bus Priority?

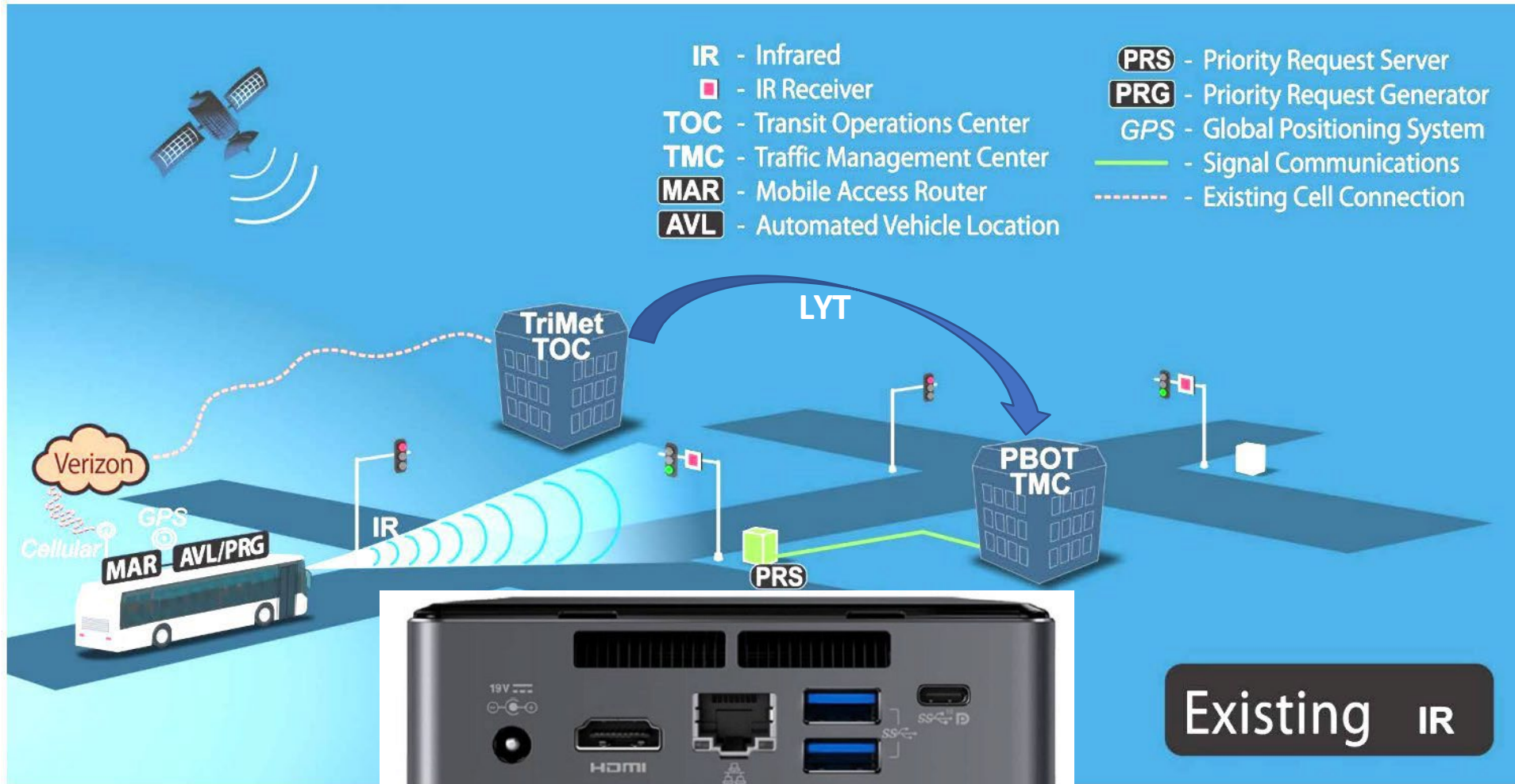
- OAR 734-020-0310
 - “Bus priority system... provide buses the capability to modify green intervals but not the display sequence of a traffic control signal.”



Transit Signal Priority – A Brief History Continued



Transit Signal Priority – A Brief History

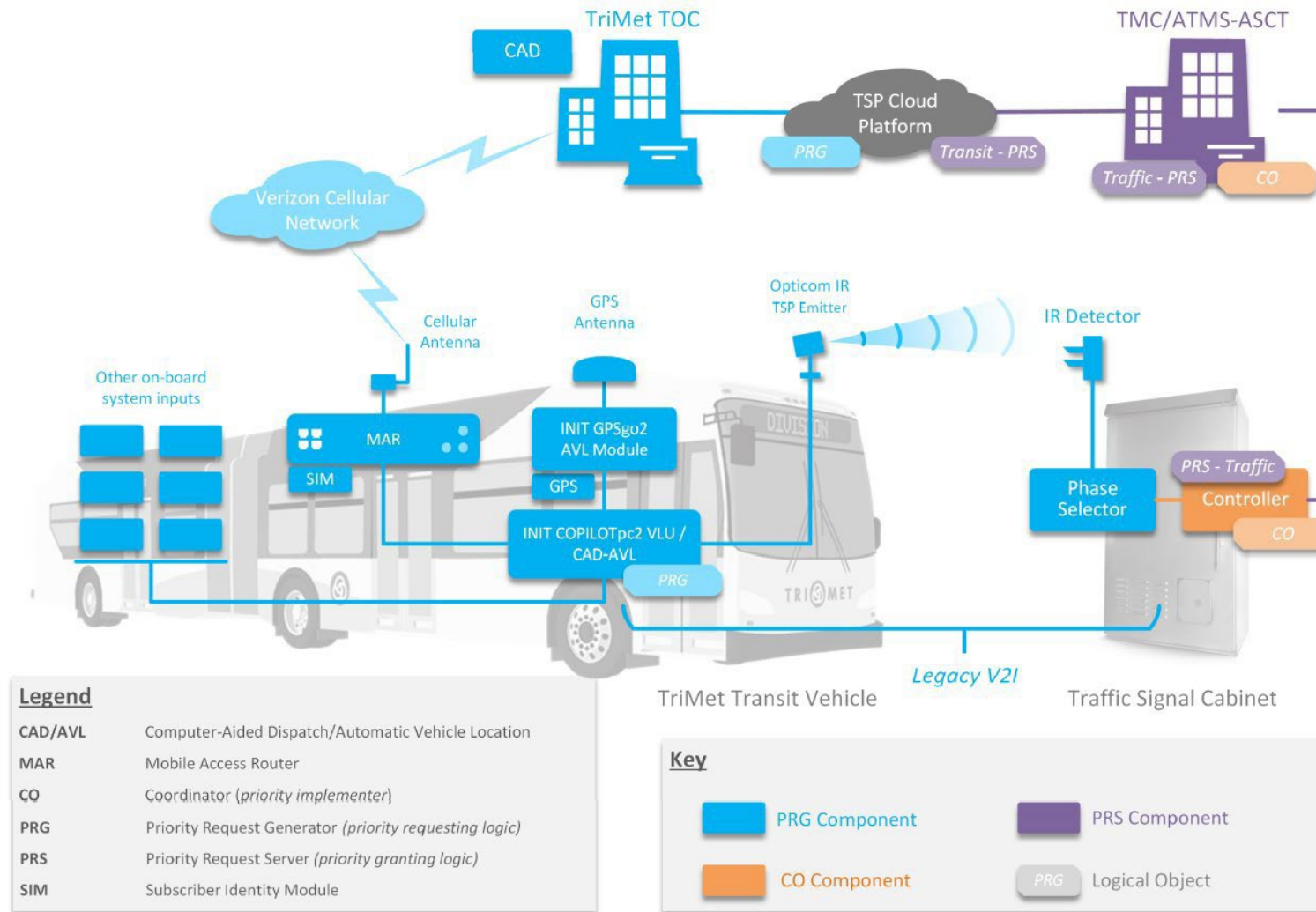


Maestro Device

Existing IR

So, what did we go with?

TriMet NextGen TSP – Concept Architecture
PRG, PRS, and CO Physical Components



Internal Features...

Prioritor Configuration

Enabled

Active

Prioritor Options

Lockout

Present

Prioritor Phase Selection

Show All Priorities

Prioritor	Enabled
2	Enabled
6	Enabled



Free Pri Max
Max Green
Max Green

User Programs – Ped Priority

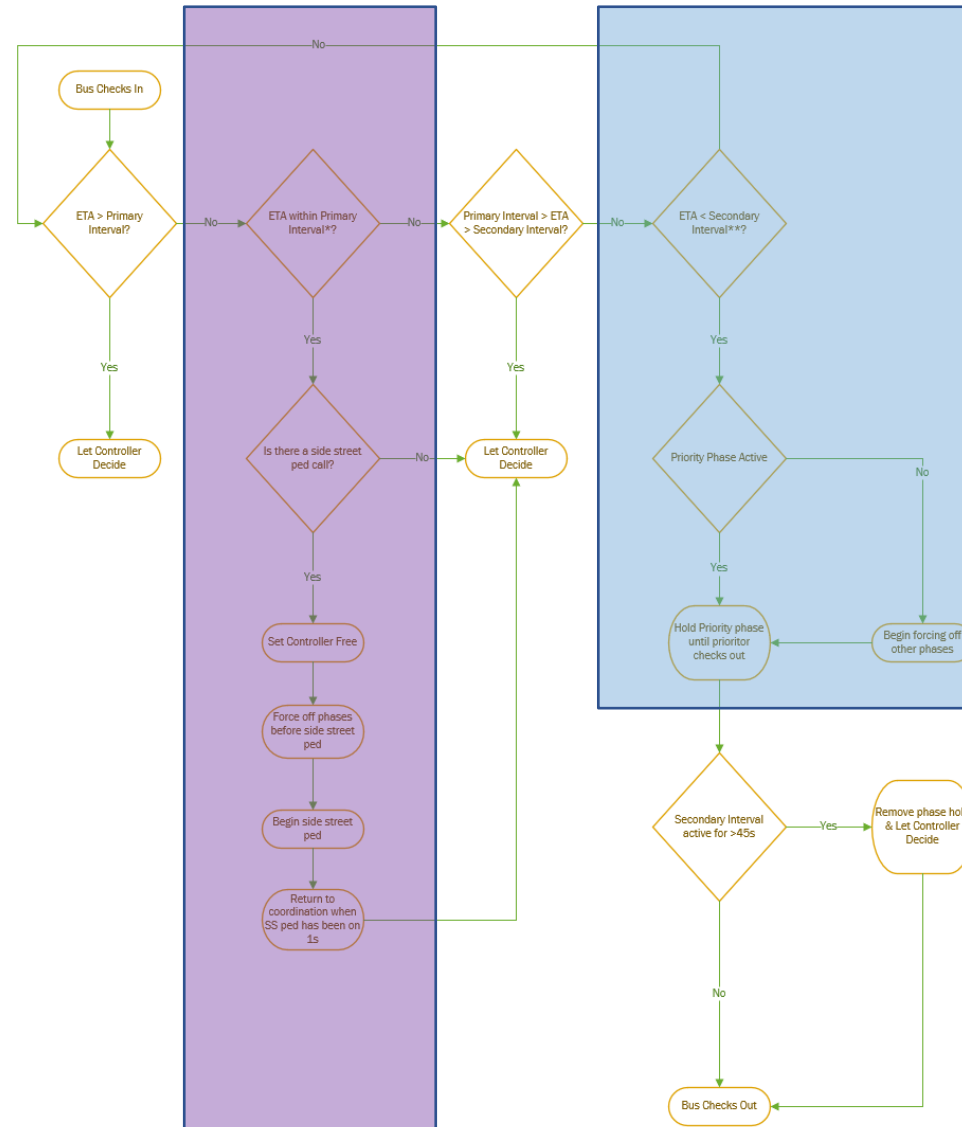
Program Statements

Program 3

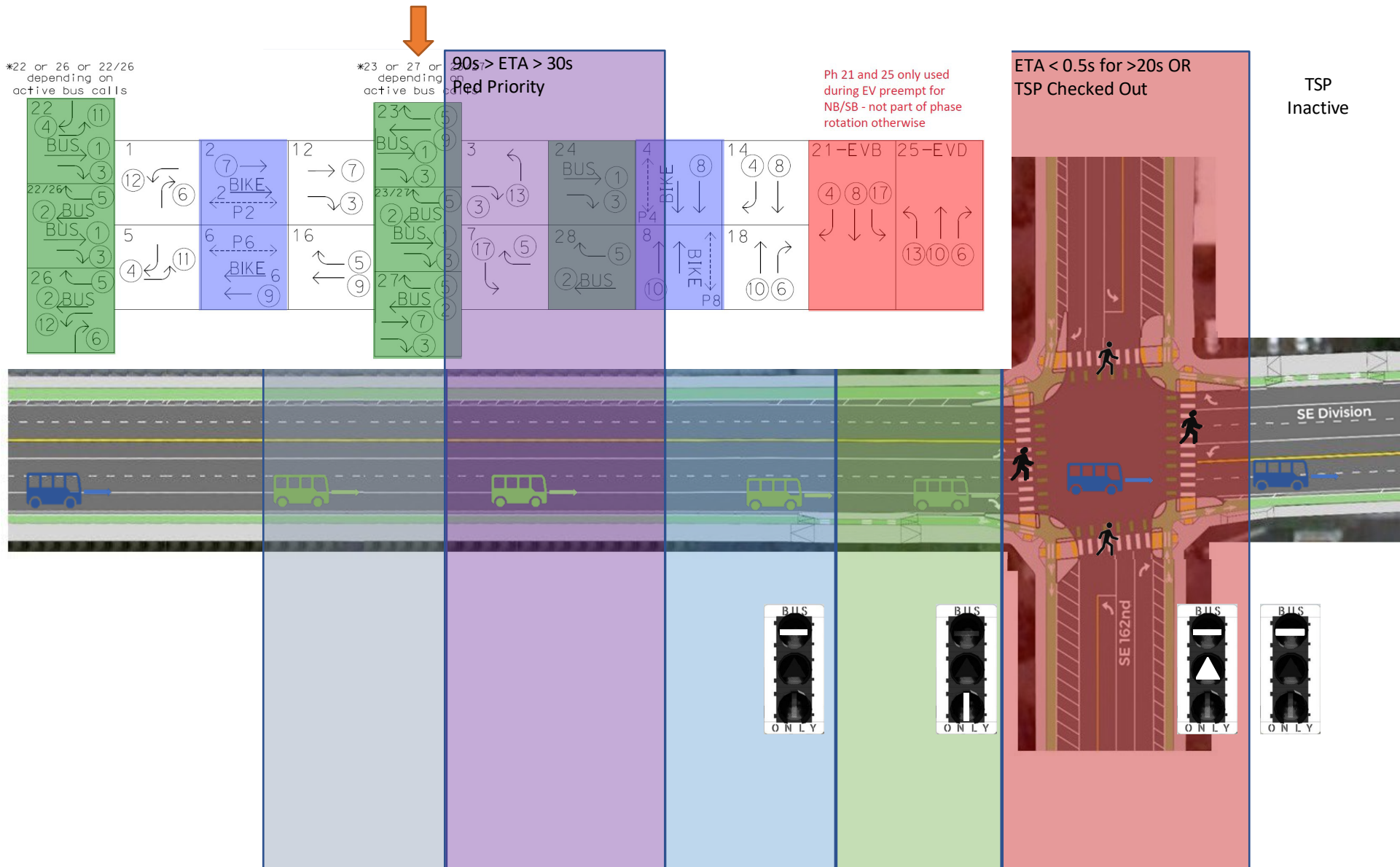
Show All Statements

Statement	Result Value	Result	Index	Operation	Parameter A	Index	Parameter B	Index	Delay	Ext.	Description
1	1	Global Variable	1	Result=A	Phase Vehicle Call	2	None	0	0.0	0.0	Blue Light
2	0	None	0	Result=(A OR B)	Ped Call	3	Ped Call	7	0.0	0.0	>Activate ped priority when Side Street Ped
3	0	Local Variable	1	Result=(A if B)	Previous Line Result	0	Prioritor Status	0	5.0	0.0	-Side Street Ped Call Active
4	1	None	0	Countdown A seconds if B	Number	45	Overlap Green	1	0.0	0.0	-No TSP Call Active
5	0	Local Variable	2	Result=(A AND B)	Previous Line Result	0	Local Variable	1	0.0	0.0	-EB Thru green for 45s<
6	3	Local Variable	3	Result=A	Current Action	0	None	0	0.0	0.0	Set LV 3 = Current Action by TOD
7	0	None	0	Result=(A == B)	Local Variable	3	Number	1	0.0	0.0	Current Action = 1
8	0	Coordination Free Switch	1	Result=(A if B)	Local Variable	2	Previous Line Result	0	0.0	0.0	>If LV 2 and Current Action = 1
9	0	Phase Force Off	2	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Set controller free and force off ph 2
10	0	Phase Force Off	6	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 6
11	0	Phase Force Off	1	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 1
12	0	Phase Force Off	5	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 5<
13	0	None	0	Result=(A == B)	Local Variable	3	Number	2	0.0	0.0	Current Action = 2
14	0	Coordination Free Switch	1	Result=(A if B)	Local Variable	2	Previous Line Result	0	0.0	0.0	>If LV 2 and Current Action = 2
15	0	Phase Force Off	2	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Set controller free and force off ph 2
16	0	Phase Force Off	6	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 6
17	0	Phase Force Off	1	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 1
18	0	Phase Force Off	5	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 5<
19	1	None	0	Result=(A == B)	Local Variable	3	Number	3	0.0	0.0	Current Action = 3
20	0	Coordination Free Switch	1	Result=(A if B)	Local Variable	2	Previous Line Result	0	0.0	0.0	>If LV 2 and Current Action = 3
21	0	Phase Force Off	2	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Set controller free and force off ph 2
22	0	Phase Force Off	6	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 6
23	0	Phase Force Off	1	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 1
24	0	Phase Force Off	5	Result=A	Previous Line Result	0	None	0	0.0	0.0	-Force off phase 5<
27	0	Phase Force Off	2	Result=(A if B)	Phase Vehicle Call	9	Prioritor Status	0	5.0	0.0	Call ph 9 if vehicle sitting to turn right, then

User Programs - TSP



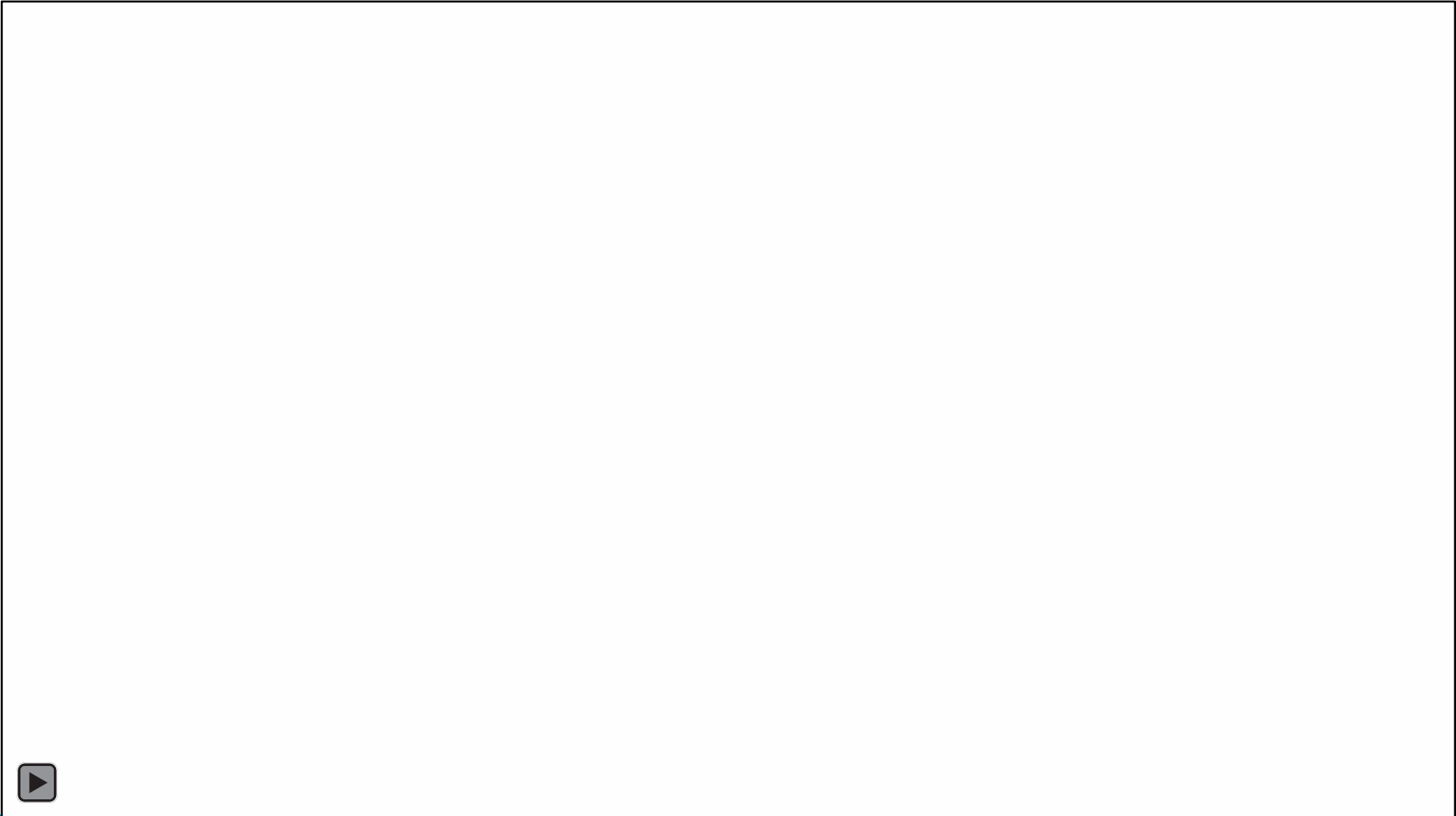
Transit Signal Priority Routine



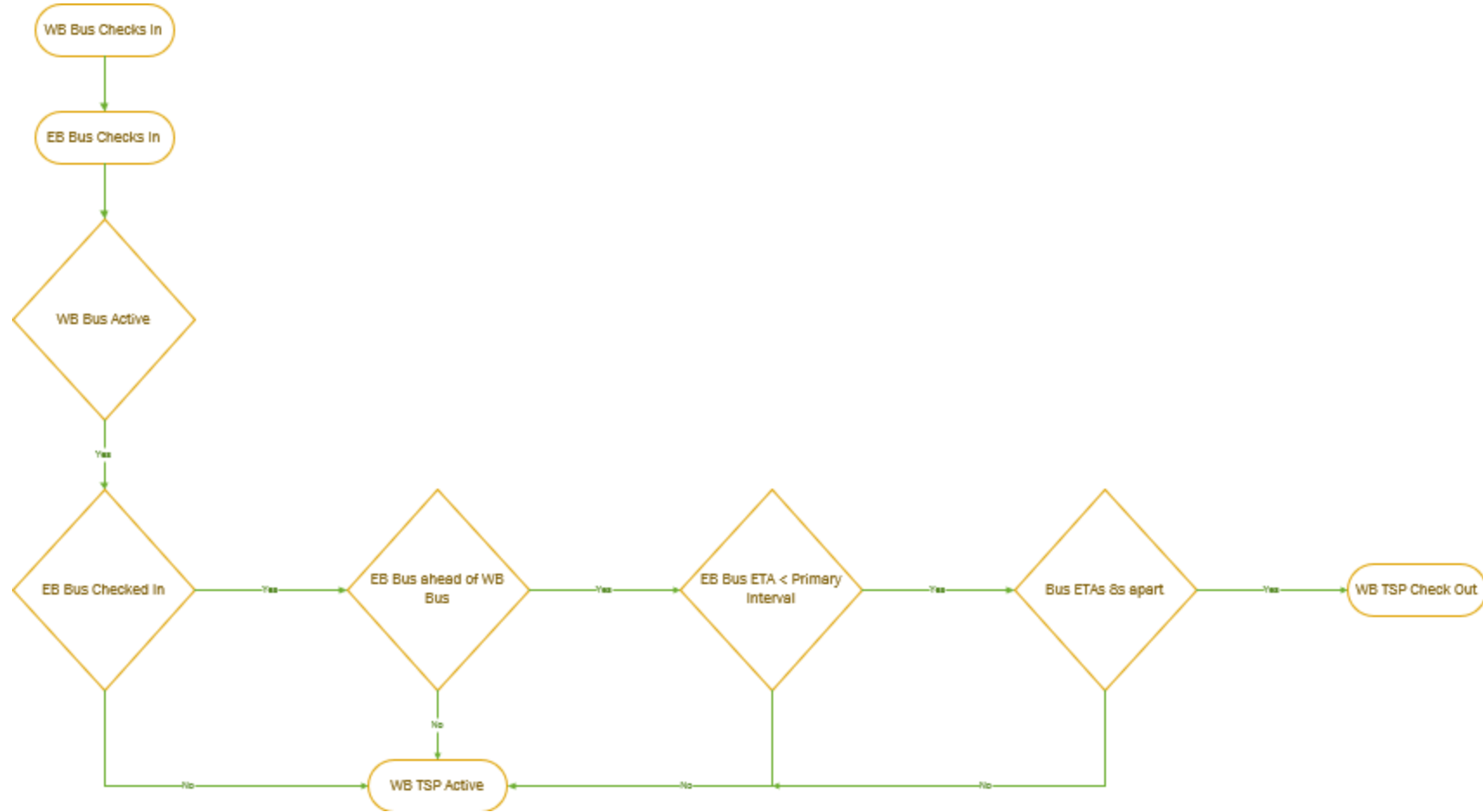
Testing...



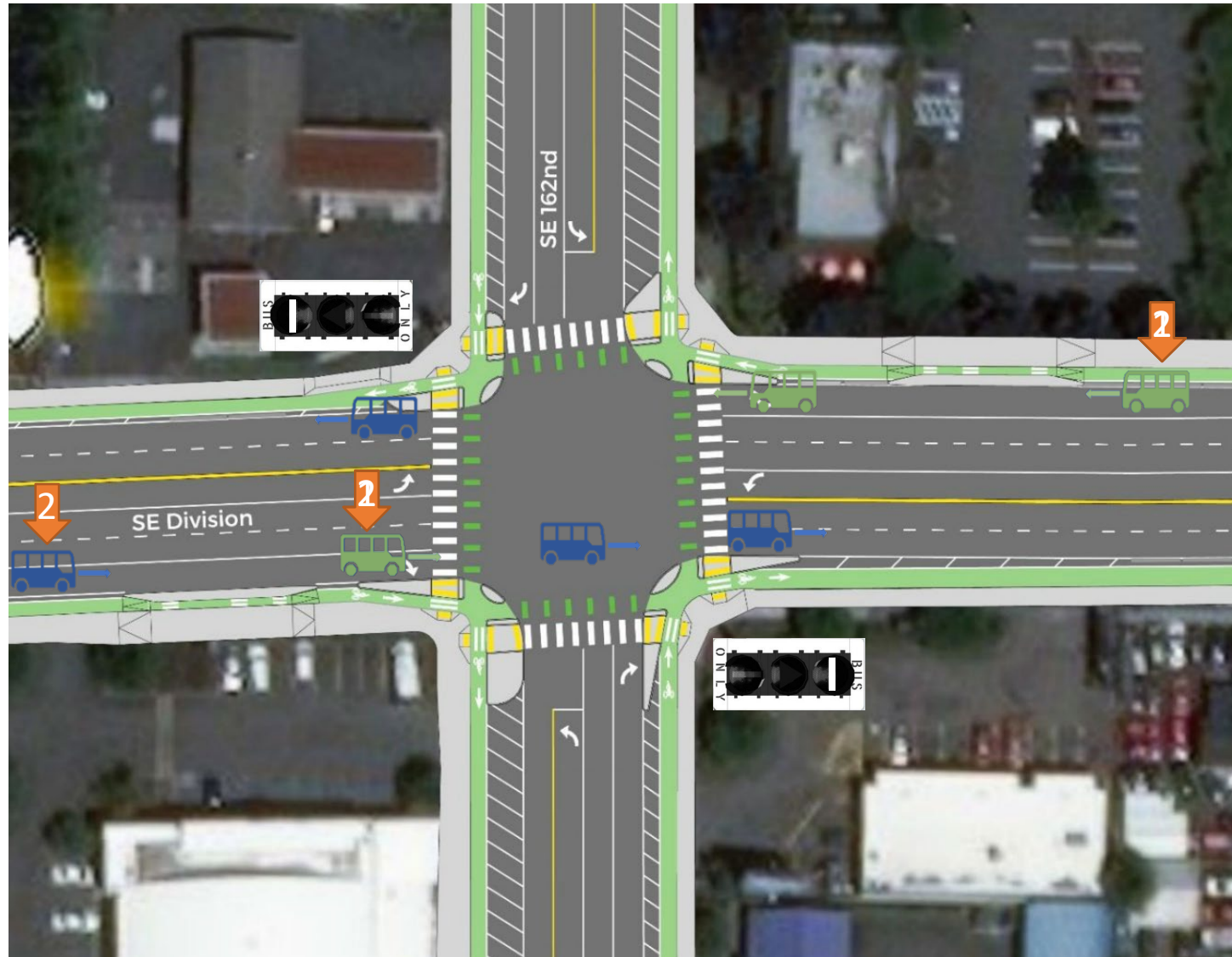
Bus Signal



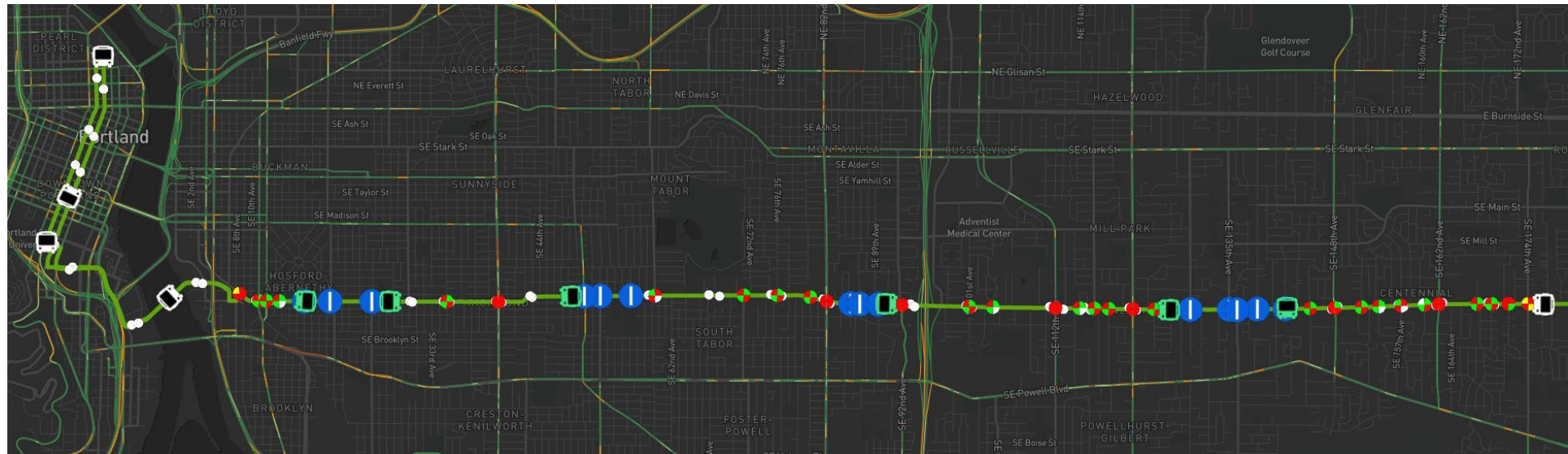
User Programs – TSP – Two Buses



Two Buses – One Passing



Whole System View



Before/After Results

- TSP and PBOT logic reduced bus travel time by about 8.2 minutes round trip
- TSP alone reduced travel time by about 5% - with PBOT logic enabled, the reduction in travel time was 10%
- On-time percentage increased from 65% to 76% with TSP and PBOT logic enabled
- Headway adherence improved from 53% to 67% with TSP and PBOT logic enabled
- Pedestrian and bicyclist delay increased with TSP alone, but were returned to baseline (TSP off scenario) after PBOT logic was enabled
- Motorist delay and split failures increased with TSP alone, but were returned to baseline (TSP off scenario) after PBOT logic was enabled


Questions?



Mark Haines, PE
ITS Engineer
City of Portland
mark.haines@portlandoregon.gov

What's next for TSP and FX?





Line 72 Existing Conditions

TRIMET
How life moves

Line 72 – A Transit Workhorse for our Community

Highest Ridership Bus Line – approximately 6,000 daily trips (More than Yellow & Orange MAX lines)

Major Transit connections:

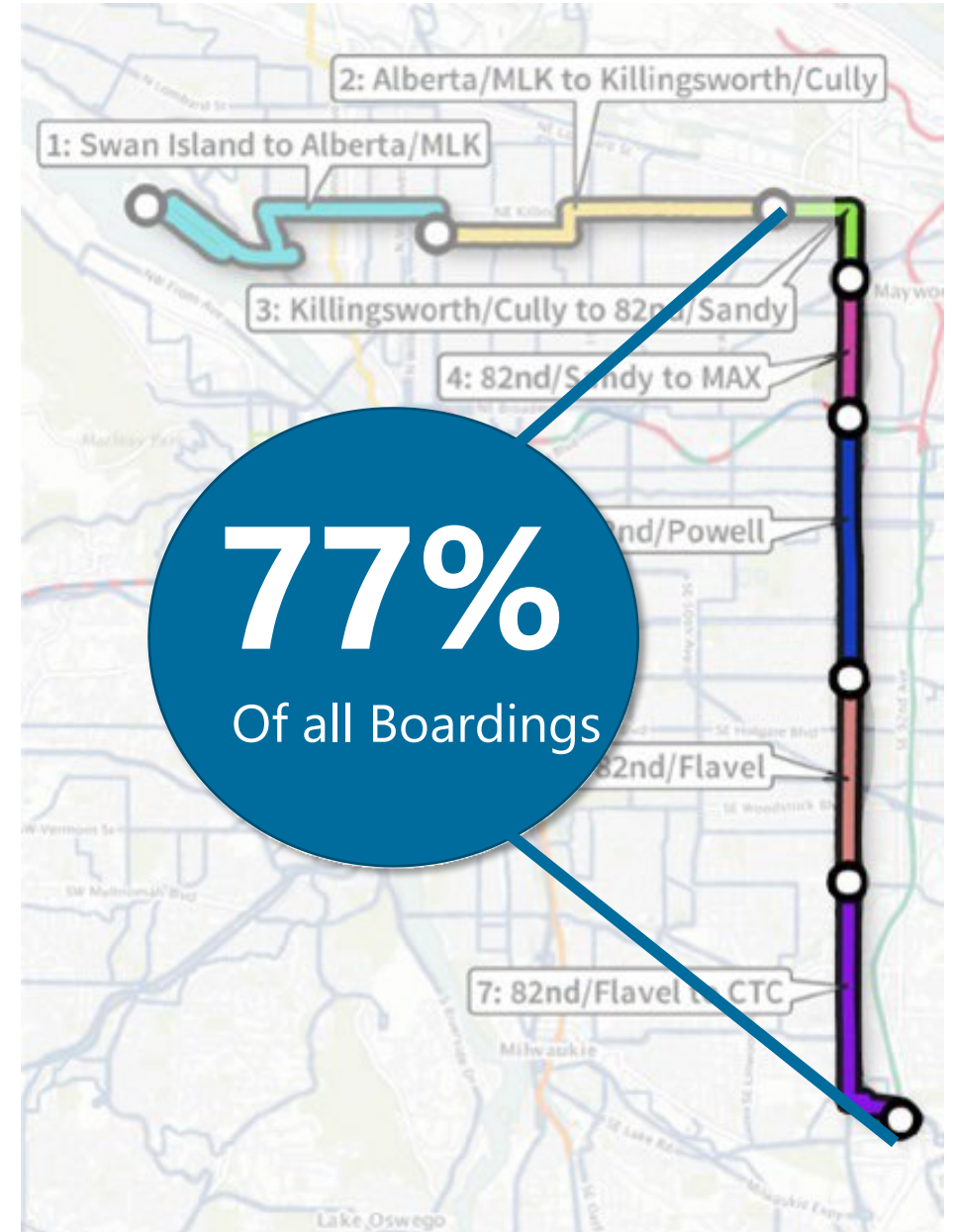
- MAX Blue, Green and Red Lines
- Intersecting 6 frequent service lines

Connection to key destinations:

- Downtown Portland
- Downtown Gresham
- Milwaukie City Center

Key Transfers (Downtown PDX, Gresham, Milwaukie)

An important way in which people get to school, work, shopping, medical appointments and everyday needs.



Line 72 - Regular Bus Delay

Line 72 ranks 1st for cumulative passenger delay

Within Line 72, delay is greatest along 82nd Ave

15 min average delay for Line 72
(13 mins SB, 21 mins NB)

12.9 mph average bus speed through 30 MPH corridor

(Fall 2021 average bus speed data without acceleration/decelerations)



And its only going to get worse...

72 KILLINGSWORTH-82ND

82nd Avenue Transit Project

Partners: *Metro, TriMet, PBOT, ODOT, Clackamas County, Multnomah County, Port of Portland and community stakeholders*

TRI  MET
How life moves

056

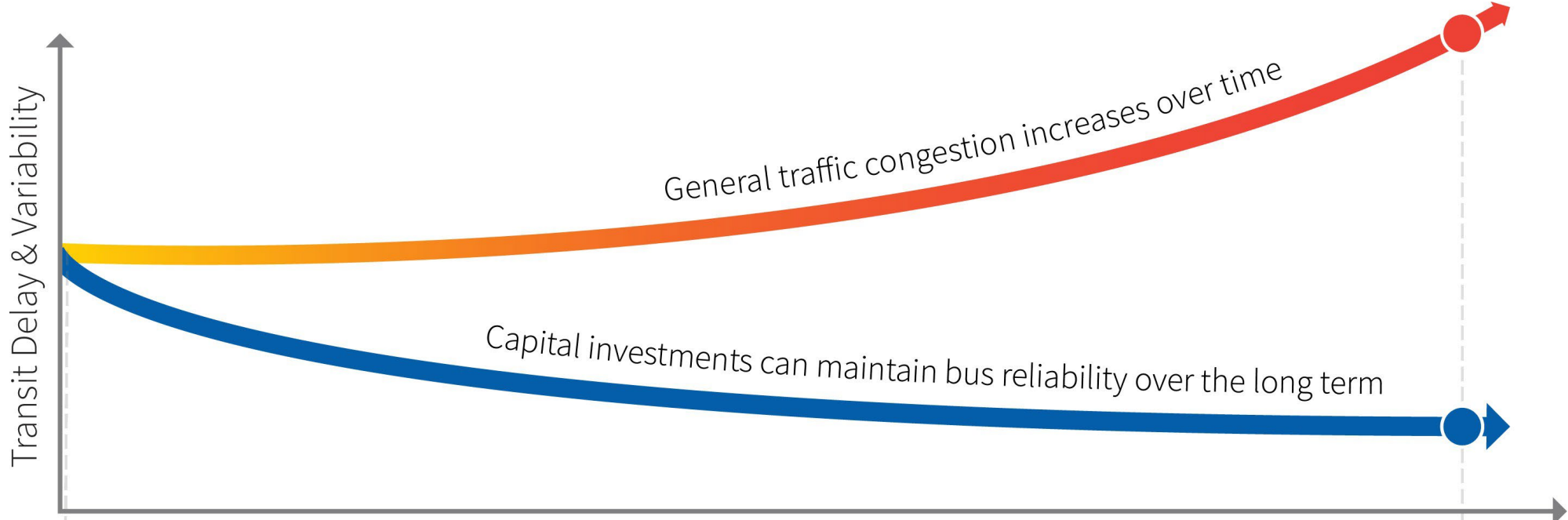
82nd Avenue Transit Project: Purpose & Need

The purpose of the project is to improve transit speed, reliability, capacity, safety, comfort, and access on 82nd Avenue. Address the needs of people who live, work, learn, shop, and travel within the corridor both today and in the future – in particular, BIPOC and low-income individuals – through context-sensitive transit improvements in a constrained corridor.

Why are we exploring a project here:

- Improve transit speed and reliability
- Address high travel demand in a constrained corridor
- Improve safety and safe accessibility
- Provide improved service to transit-dependent communities
- Address climate goals by increasing transit ridership and reducing reliance on single-occupant vehicles

Ensure Transit Reliability Into the Future

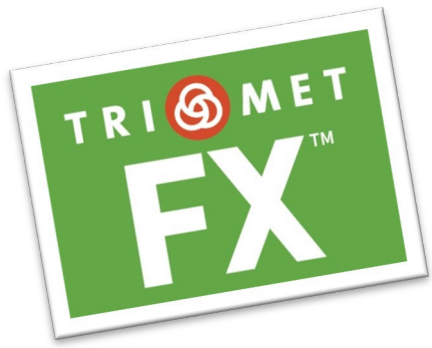


Today



In 10 years





FX as a System

DEDICATED BUS LANES

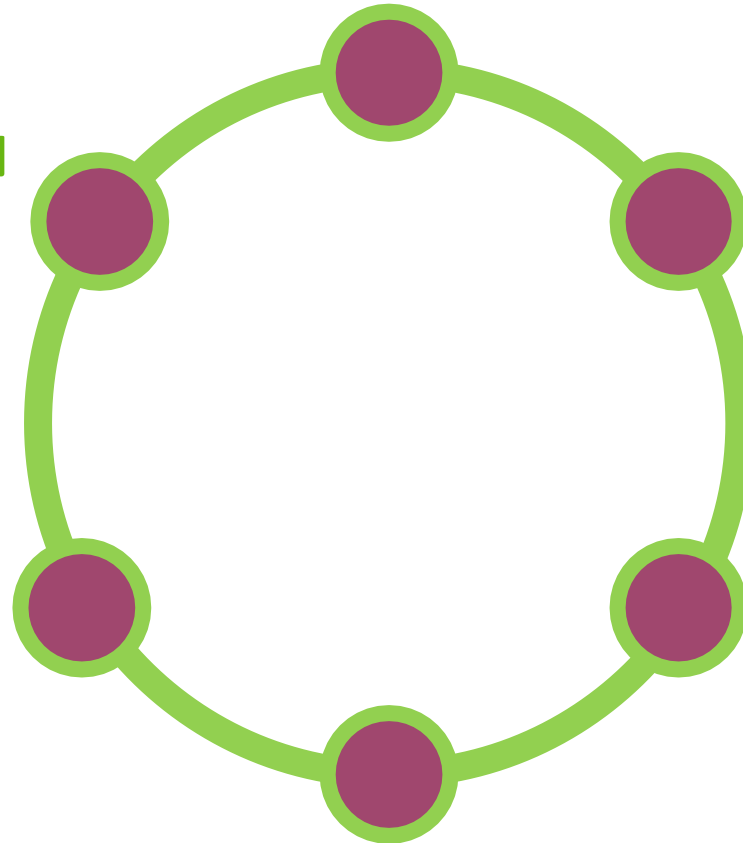
TRANSIT AND PEDESTRIAN
INFRASTRUCTURE

STOP BALANCING

TRANSIT SIGNAL
PRIORITY (TSP)

IN-LANE STOPS

HIGH CAPACITY BUSES



Stops to Stations- *Focusing & Leveraging Investments*

- **Focus investments** at key station areas to improve ease of use, accessibility and safety
- **Improve transit service** better travel times and overall reliability
- **Leverage and compliment other corridor investments** along 82nd Avenue (*pedestrian crossings sidewalks, street improvements*).

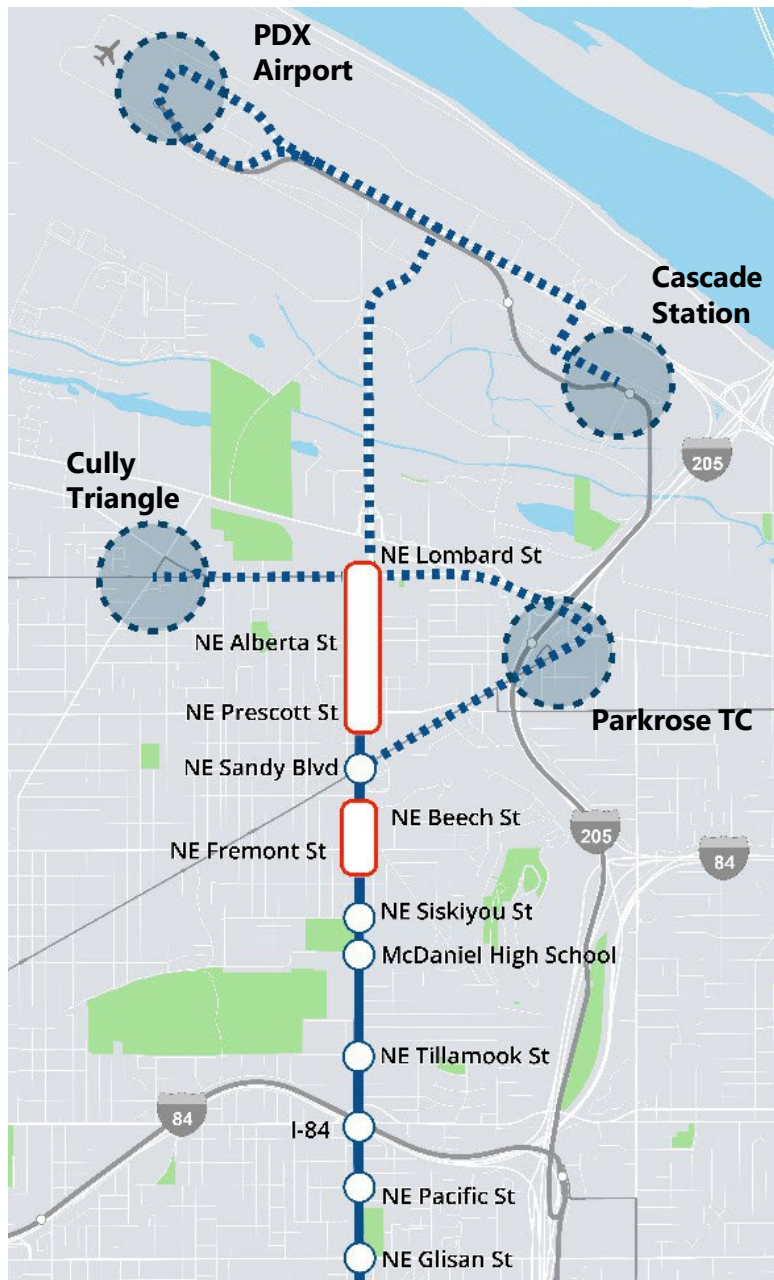


Line 2 - Division (2017)

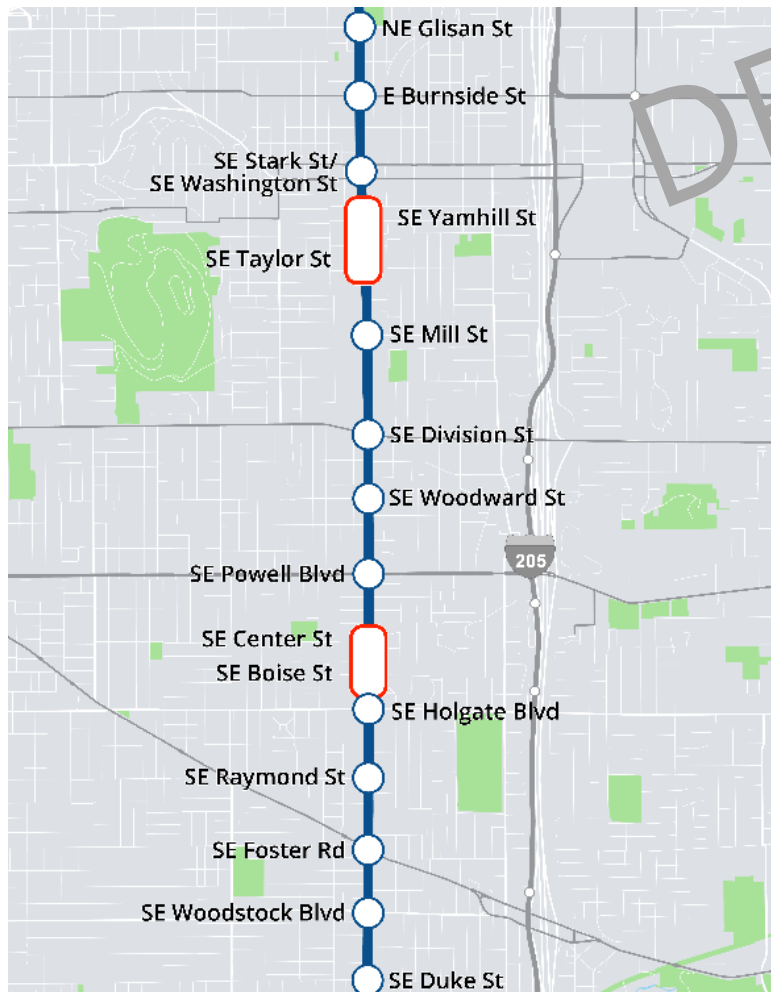


FX-2 Division (2022 - After Small Starts Investment)

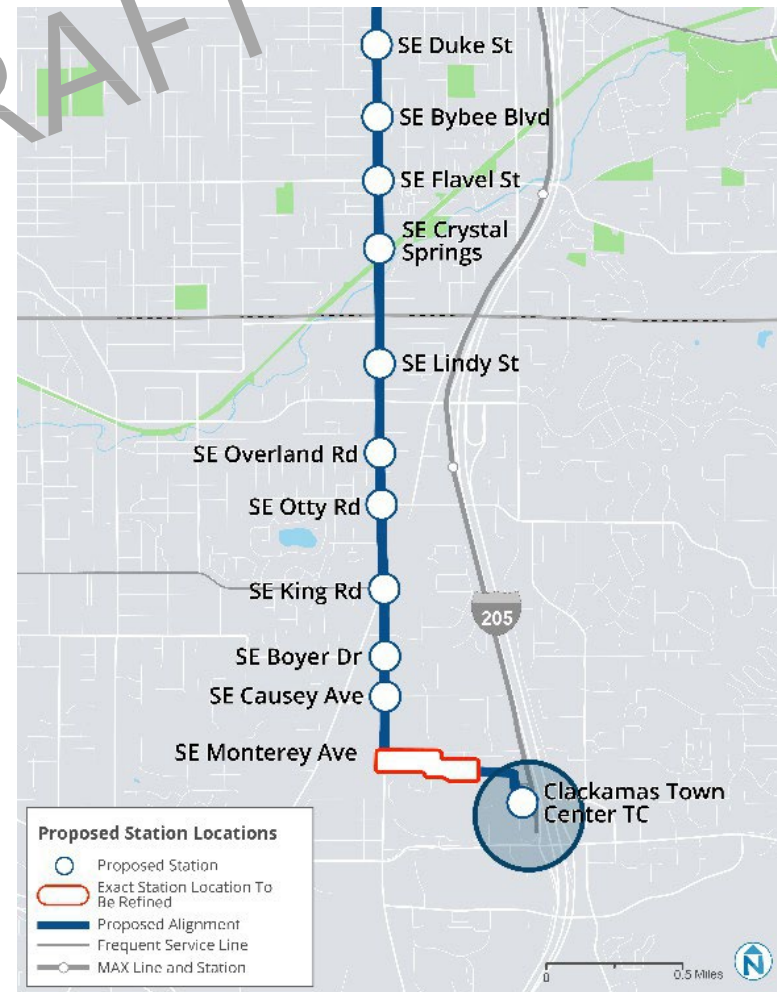
Proposed Stations (2/9/2023)



NE Portland



SE Portland



Far SE Portland & Clackamas

72 KILLINGSWORTH-82ND

82nd Civic Corridor Improvements (PBOT)

TRIMET
How life moves

056

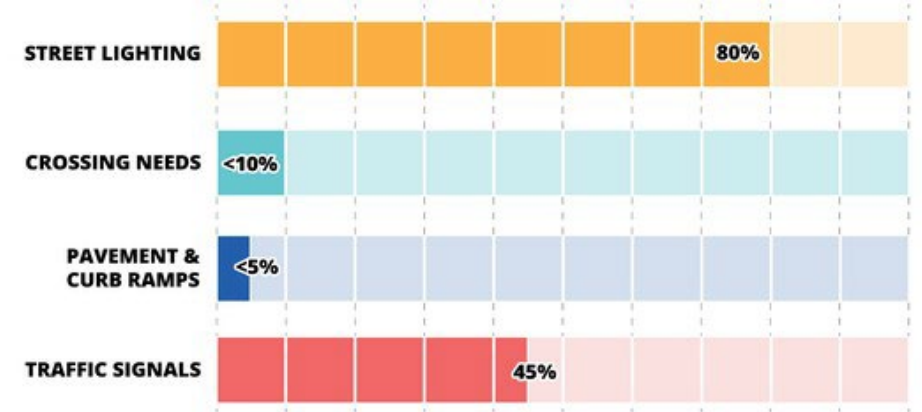
OREGON
E26721A



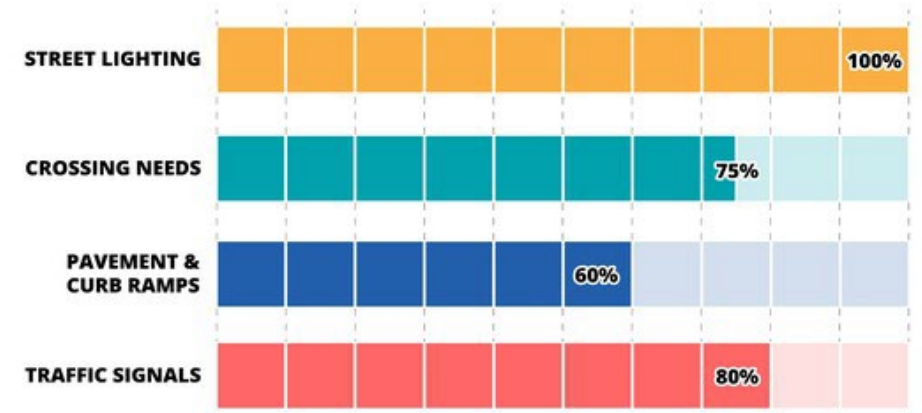
Critical Fixes – Outcome

- More lighting.
- New and upgraded crossings.
- Safety improvements to reduce speeding vehicles and improve visibility.
- Repaving.
- Curb ramp upgrades.
- Traffic signal replacements.

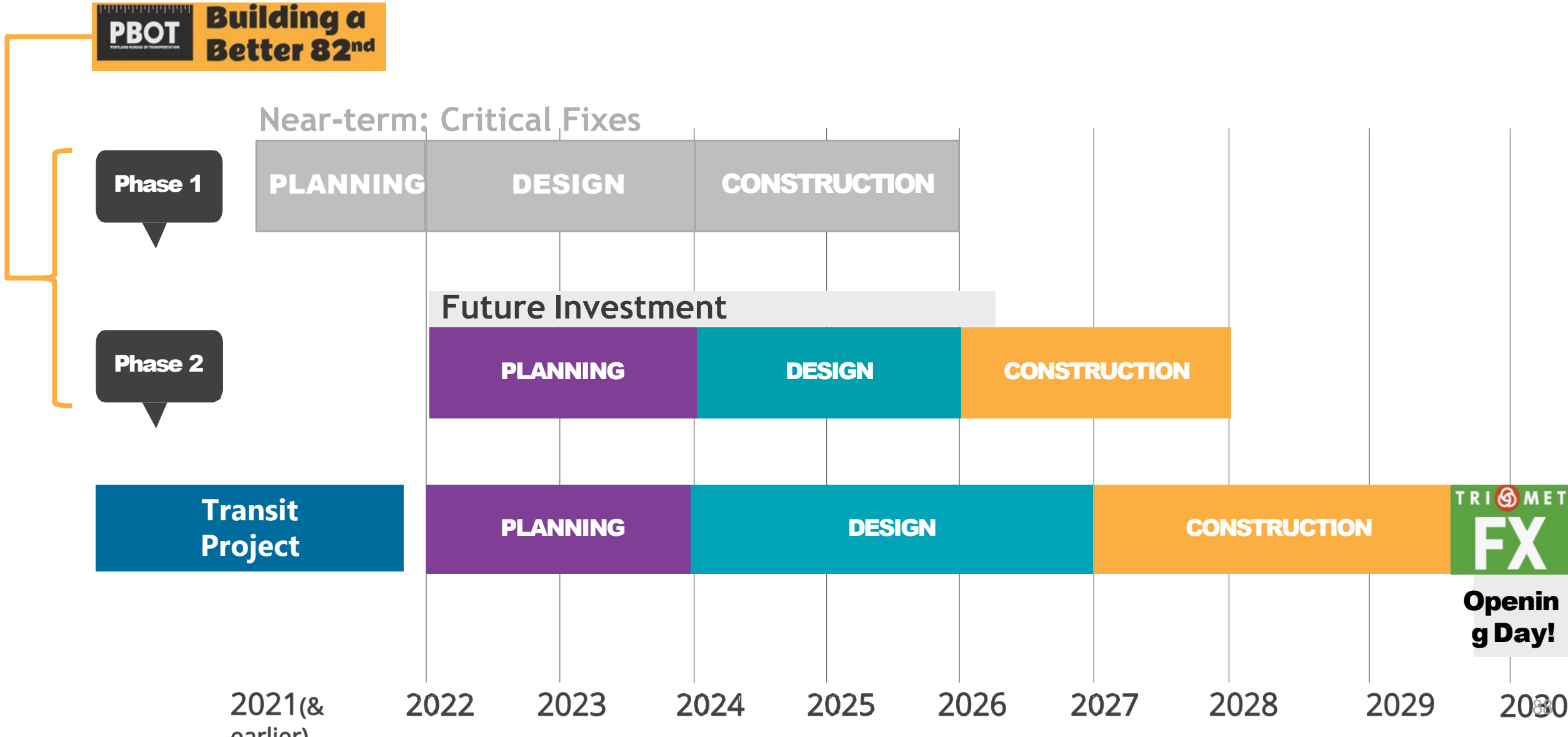
Conditions Today:



After 2026:



Coordinating with PBOT Concurrent Efforts



STATUS & NEXT STEPS

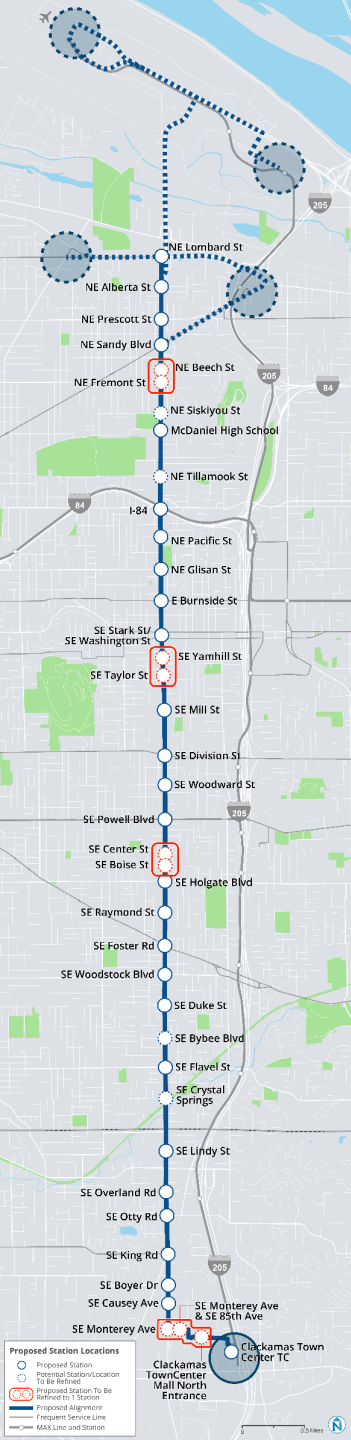
Summer 2023 – Ongoing analysis & coordination. Community & stakeholder engagement

Fall 2023 – Ongoing analysis and vetting of N. Terminus options. Updated baseline project estimate

Winter 2023 – N. terminus location(s) determined. Refined Station locations. Draft Funding Plan.

Spring 2024 – Steering Committee vote to endorse draft Locally Preferred Alternative (LPA)

Late Spring 2024 - Move into Project Development under the FTA Capital Investment Grant Program



Where do we go after that?



Goals:

- 1. Set a vision** that connects our communities by providing an FX system that serves the region with improved speed, reliability, access and comfort
- 2. Prioritize** FX projects for implementation
- 3. Identify strategies** to deliver an FX system region-wide
- 4. Learn** partners' needs and plan a system that responds to them

Coordination with other planning efforts

- **Forward Together 2.0** is planning potential service increases.
- Metro Plans including the **Regional Transportation Plan** and the **High Capacity Transit Strategy** create a framework for transportation that supports planned regional growth.

Current & next steps

- Collaborate with Metro's Investment Areas team to draft a detailed vision: **now**
- Hire consultant to help draft the Plan: **Fall-Winter 2023**
- Plan completion: **Fall 2025**