# CHAMBERSBURG SIGNALS

*Mike Mudry, P.E., PTOE*

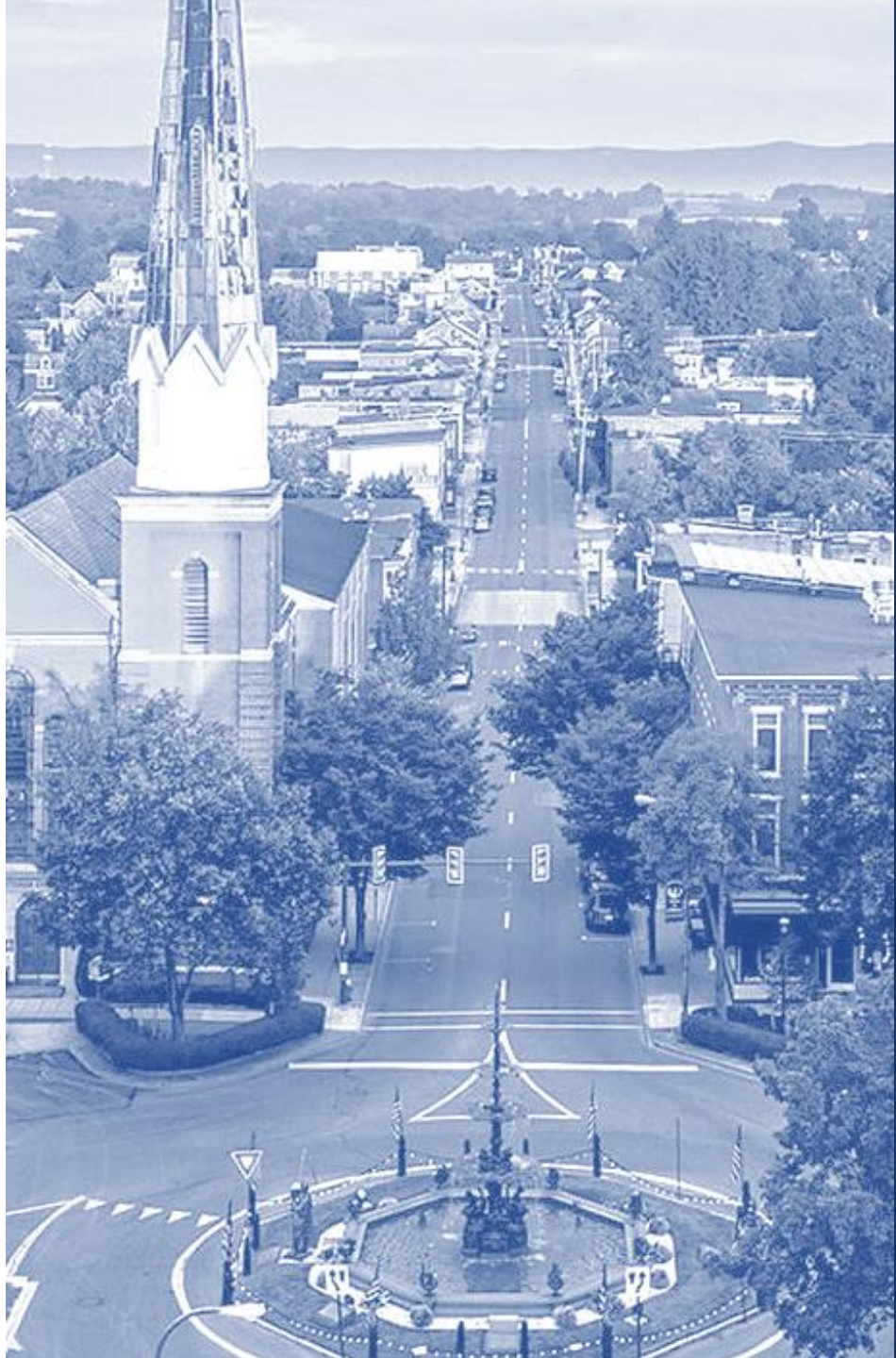
*MASITE Annual Meeting*

*9/29/2025*

MOVING **FORWARD** ***TOGETHER***®

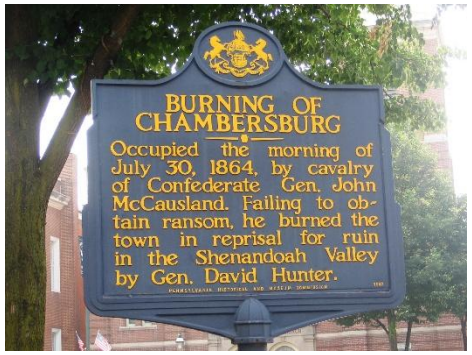
# Overview

- Project Background and Overview
- Phase One (Section 100)
  - Upgrades
  - Construction Costs
- Phase Two (Section 125)
  - Upgrades
  - ATSPM Case Study
  - Construction Costs
- What's Next
- Q&A



# Chambersburg Fun Facts?

- Chambersburg is the only major Northern community burned by Confederate Forces during Civil War.
- ChambersFest is held annually to commemorate this event.
- Only municipality in PA operating electric, gas, water, and sanitary sewer utilities.
- Largest municipal electric system in PA and the only one to own/operate electric generating plants.
- County Seat of Franklin County.
- Franklin County has its own MPO, supported by the Franklin County Planning Department.




# Chambersburg Signals

- Chambersburg owns 47 traffic signals.
- Additional signals maintained by Chambersburg
  - Guilford Township: 14 intersections
  - Hamilton Township: 3 intersections
  - Peters Township (Ft. Loudon): 1 intersection
- Project signals NOT maintained by Chambersburg
  - Greene Township: 2 intersections
- TOTAL NUMBER OF INTERSECTIONS: 67
- Major roadways – US 30, US 11, PA 316, I-81

# Chambersburg Signals

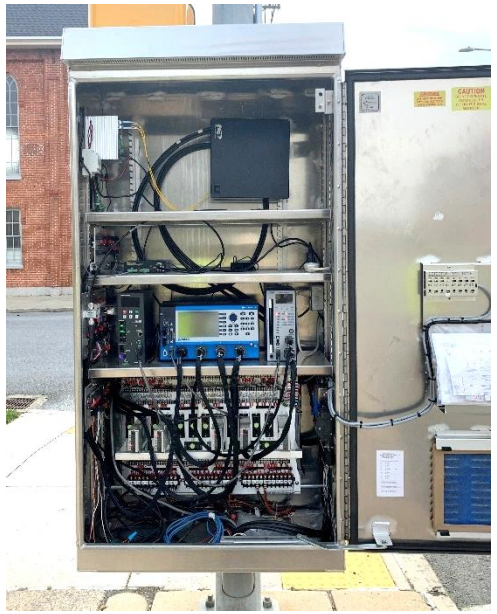
- Phase One
  - SR 0011 Section 100
  - January 2018 – April 2022

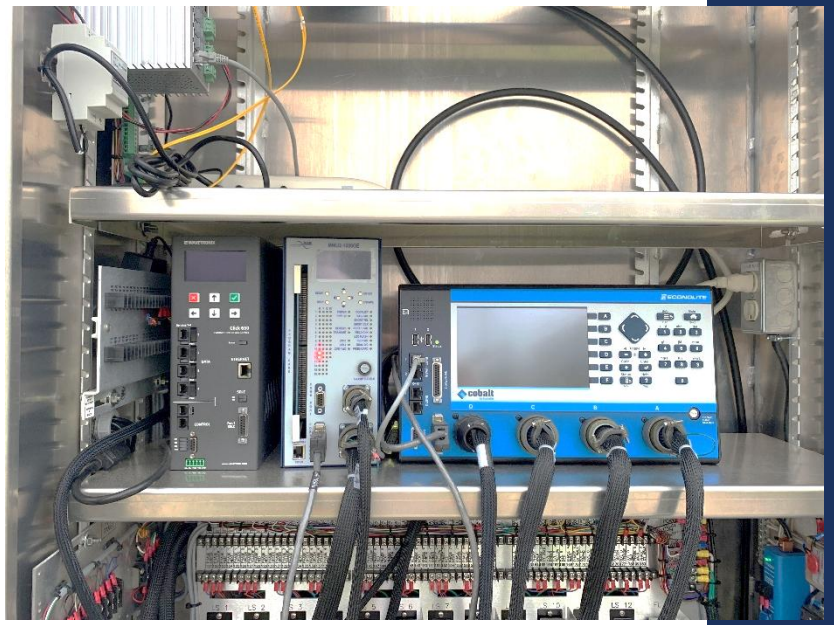
- Phase Two
  - SR 0011 Section 125
  - August 2023 – December 2026
  - Currently under construction

# Phase One Improvements

## Signal Upgrades

- 57 new cabinets with Econolite Cobalt controllers
- 215 Wavetronix advance and stop bar detectors
- Countdown ped signals at 13 intersections
  - Downtown signals feature a mix of rest in walk (phase 2+6) and actuated all ped phases
- 458 Backplates
- 49 CCTV Cameras – Borough Intersections Only
- Over 14 miles of new fiber, interconnecting 59 of the 67 intersections
- Established communication with PennDOT via an existing T-1 line along I-81





# Phase One Improvements

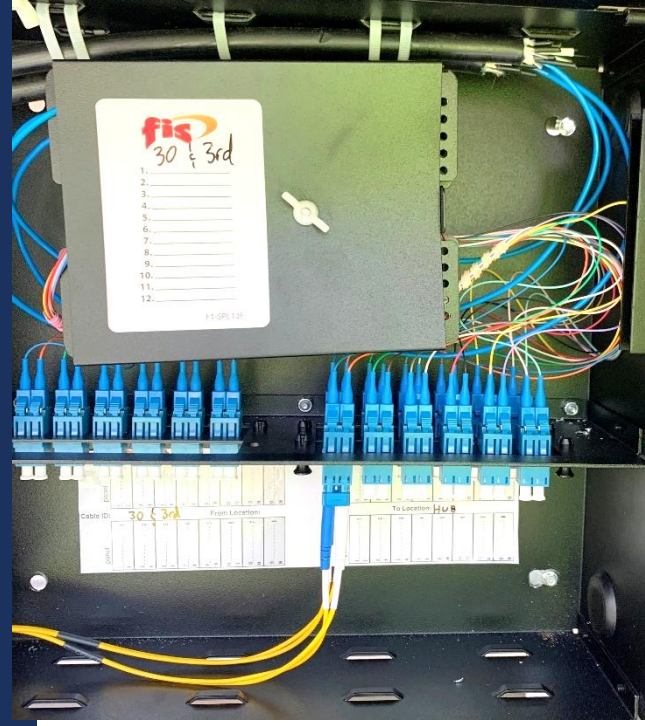
## Design Decisions

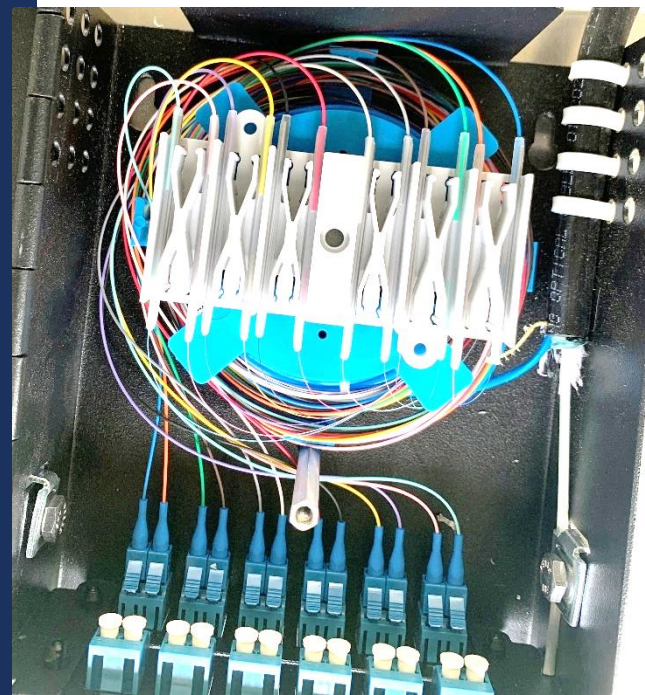
- No survey scoped; relied on existing permit plans, which presented challenges:
  - Digitized existing permits into CADD
  - Conducted ROW and Utility research (Susquehanna Civil)
  - SUE Quality Level C (more like SUE QL C'ish)
- Evaluated detection options and central monitoring systems
  - Video vs Radar
  - MAXVIEW vs Centrax

# Phase One Improvements

## Fiber Optic Layout

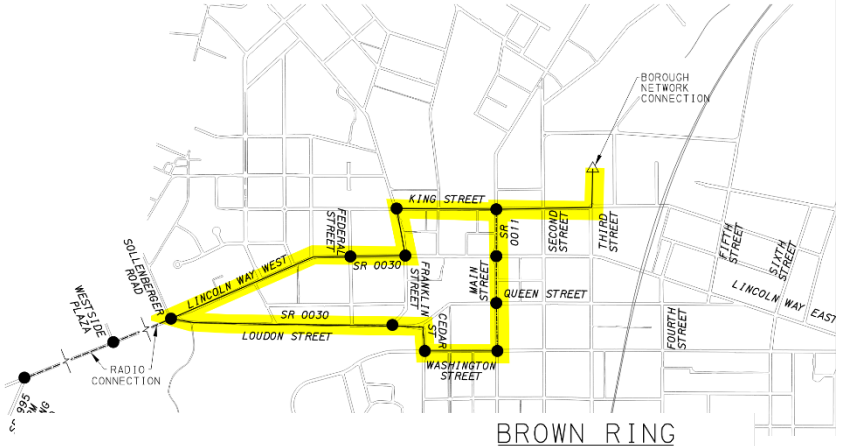
- Multiple fiber optic rings and radial runs for redundancy
  - Four separate fiber rings and one radial line
  - One trunk line run between Borough and PennDOT
  - CCTVs connected only to the Borough, not PennDOT
- Retipping of existing fiber on Norland Avenue and Route 30 East of I-81 – 14 intersections
- Managed Level 2 Ethernet switches

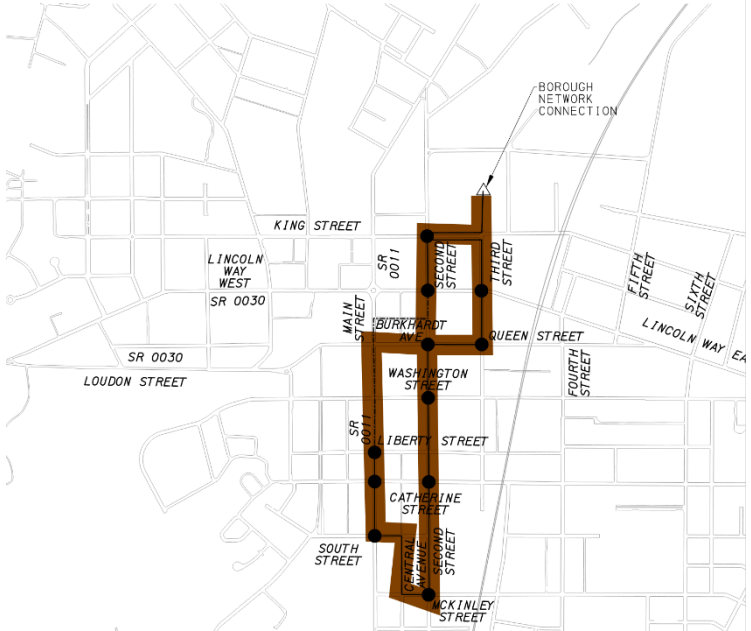



# Phase One Fiber Layout

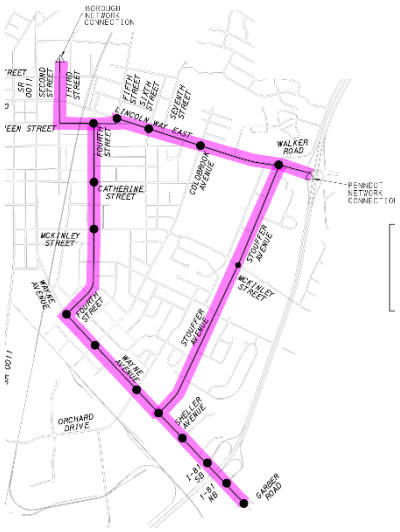
YELLOW RING



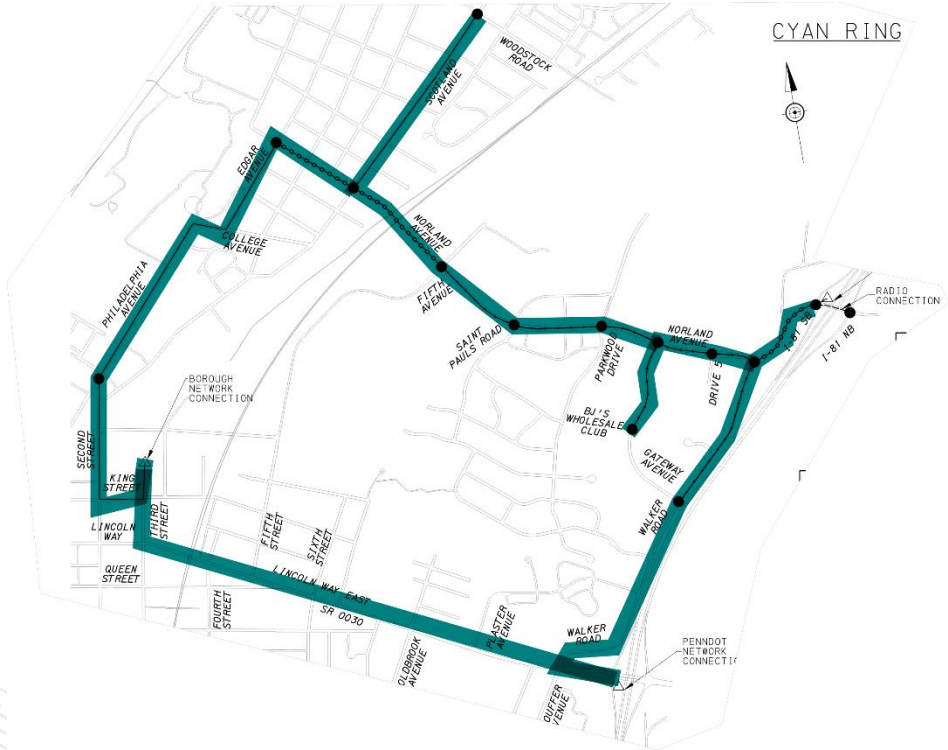

BROWN RING




PINK RING




CYAN RING





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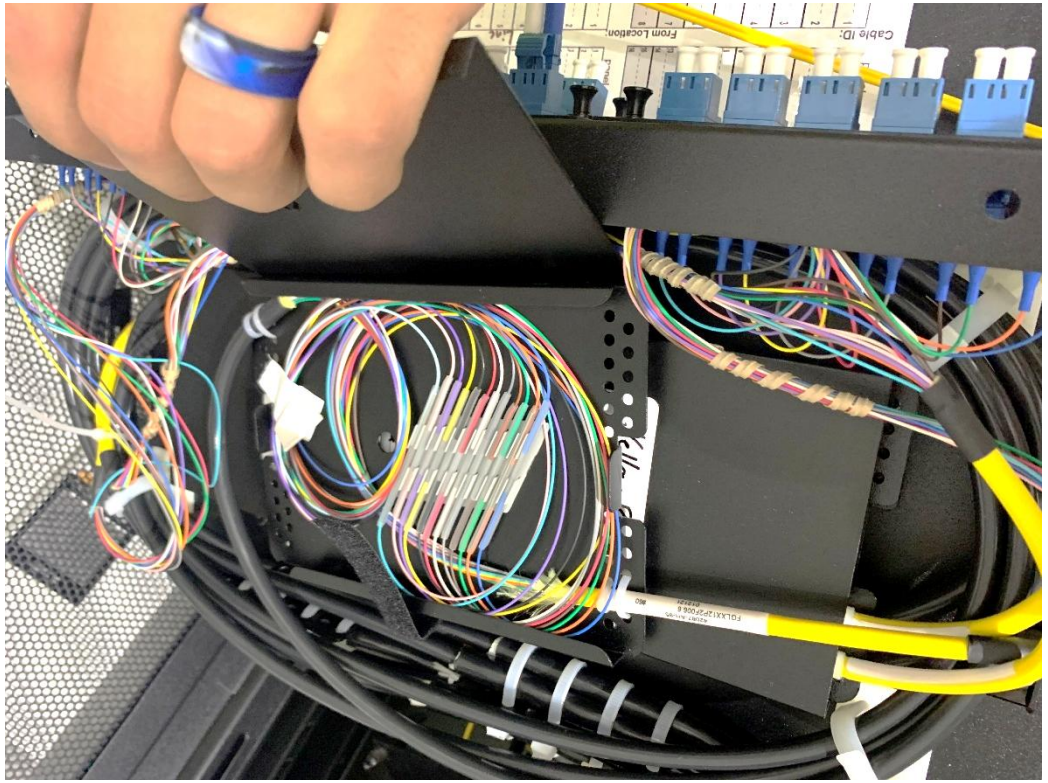
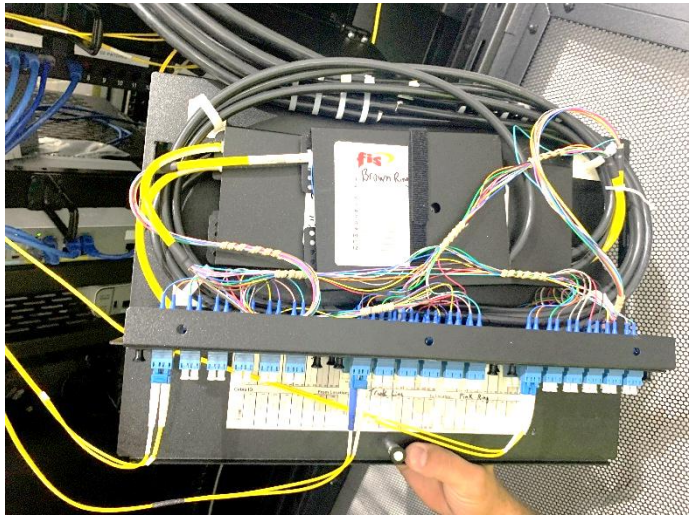
# Phase One Improvements

## Borough Server House





# Phase One Design Schedule/Clearances

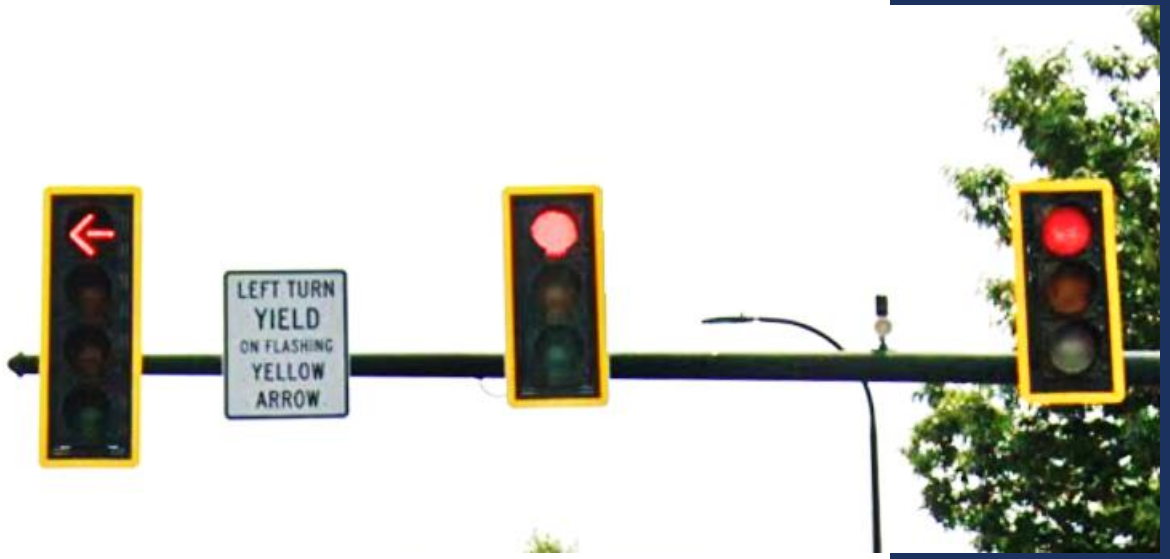

- Environmental/ROW/Utility Clearances
  - No environmental impacts (BRPA)
  - No ROW takes; Borough has numerous utility easements throughout project
  - Utilities: Borough owned all the utility poles (except 4)

# Phase One Construction Cost

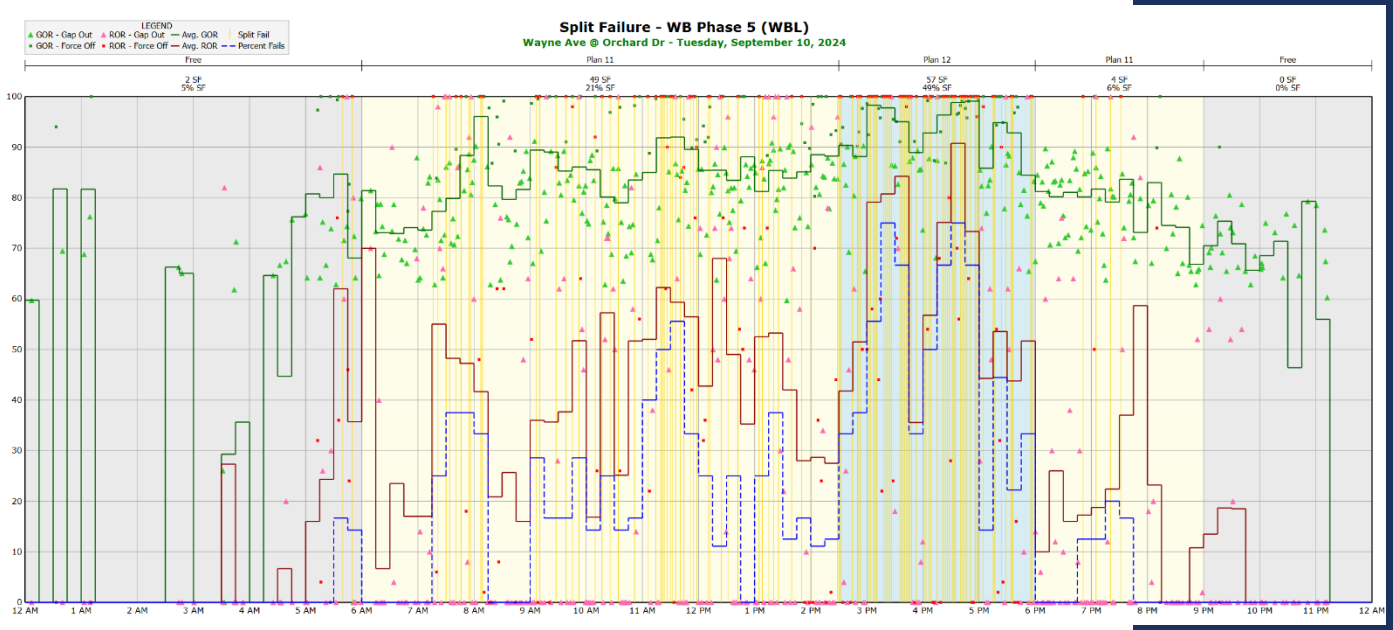
- Final Construction Estimate  $4.078 Million
- Bids – Significant outlier!
  - CM High  $3.114 Million
  - Kuharchik  $4.050 Million
  - Herr  $4,101 Million
- The good – our estimate hit the median bid
- The bad (but actually good)  – The CM High bid was 1.5 standard deviations from the mean – a statistical outlier – WHY?
- Minimal change orders: $55,000
  - Added 3 new controller boxes and added 2,000’ fiber

# Phase Two Improvements

## Signal Upgrades




- Limited to 59 intersections interconnected with fiber
- Signal timing adjustments based on ATSPM data
- Currently developing I-81 incident timing plans (DRIVE Engineering)
- Safety review of existing signals
  - Flashing Yellow Arrow (FYA) Upgrades
  - Clearance time adjustments
  - Replace 8” signals with 12” signals
- Evaluate phasing and operations
  - Add left turn phasing
  - Add right turn overlaps



# Phase Two Improvements

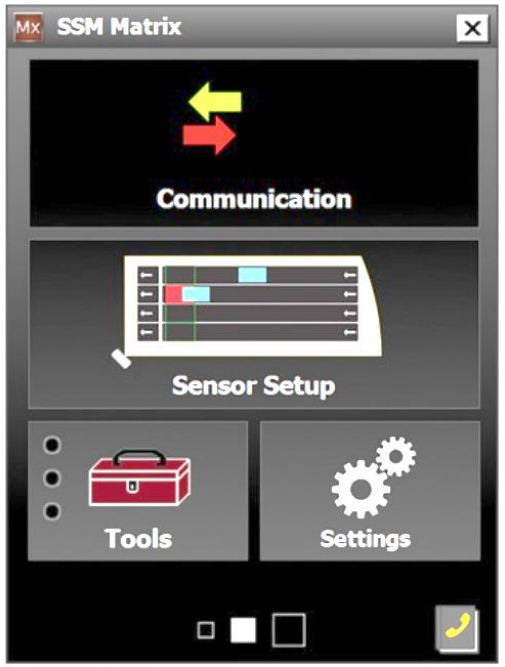
## Design Decisions

- Timing adjustments based on ATSPM data
  - Overwhelming amount of data
  - Decided to do spot counts using CCTV cameras
- Incident management timing plans (DRIVE Engineering)
  - Used RITIS data to identify actual incidents
  - Correlated incidents on I-81 with ATSPM data anomalies to develop incident timings
  - Began work after PS&E – will continue during construction and will be implemented in late 2026
- Safety evaluation - review crash data to identify type of signal improvements that address crashes.
  - FYA with peak hour protected-prohibited operation


# Phase Two Improvements

## ATSPM timing adjustments – Step 1

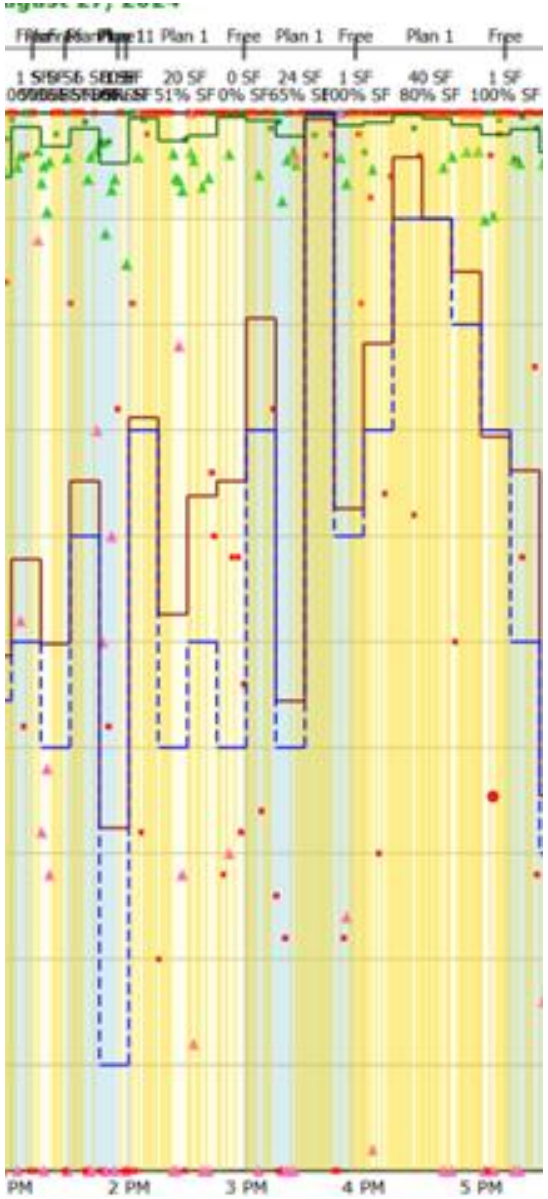
- Verify intersection operation using remote front panel interface and Wavetronix software
- Identify discrepancies and evaluated oversize pedestrian logic
- Confirm vehicle detection and ped pushbutton operation
- Evaluate ATSPM count data; radar counts varied +/- 30% in some locations – “we were spinning our wheels”
- Decided to spot count using CCTV feeds and update Synchro Model




# Phase Two Improvements

## ATSPM timing adjustments – Step 2

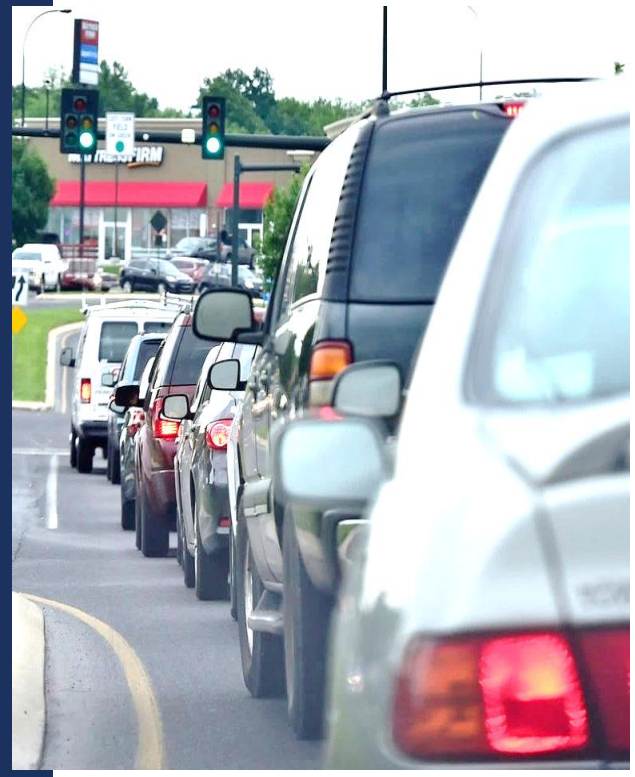
- Evaluate phase performance through split failure analysis
- Evaluation criteria
  - Split fail count and percentage  (High value = insufficient green)
  - Vehicle occupancy during green and red  (assess queuing behavior)
  - Interpretation
    - High max out and split failure indicate a need more split time
    - High gap out and low split failure indicate a potential split reduction



# Phase Two Improvements

## ATSPM timing adjustments – Step 3

- Evaluate coordination and assess offsets to evaluate arrivals during green
  - Platoon Ratio Calculation (Arrivals on Green/Green Time)
  - Ratio > 1.15 is favorable (similar to HCM arrival type 4)
  - Adjust offsets to improve platoon ratio



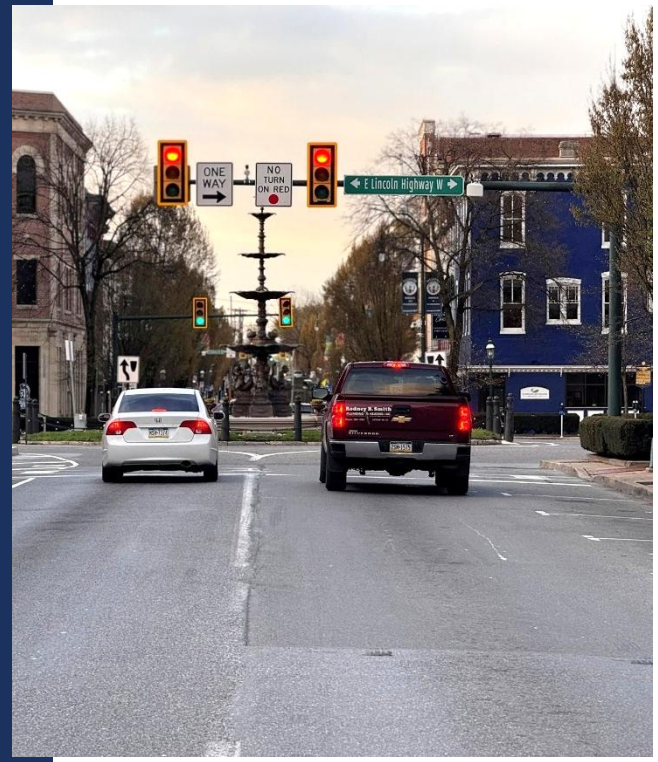
| Arrival type | Range of platoon ratio ($R_p$) | Default value ($R_p$) | Progression quality |
|---|---|---|---|
| 1 | ≤0.50 | 0.333 | Very poor |
| 2 | >0.50–0.85 | 0.667 | Unfavorable |
| 3 | >0.85–1.15 | 1.000 | Random arrivals |
| 4 | >1.15-1.50 | 1.222 | Favorable |
| 5 | >1.50-2.00 | 1.667 | Highly favorable |
| 6 | >2.00 | 2.000 | Exceptional |

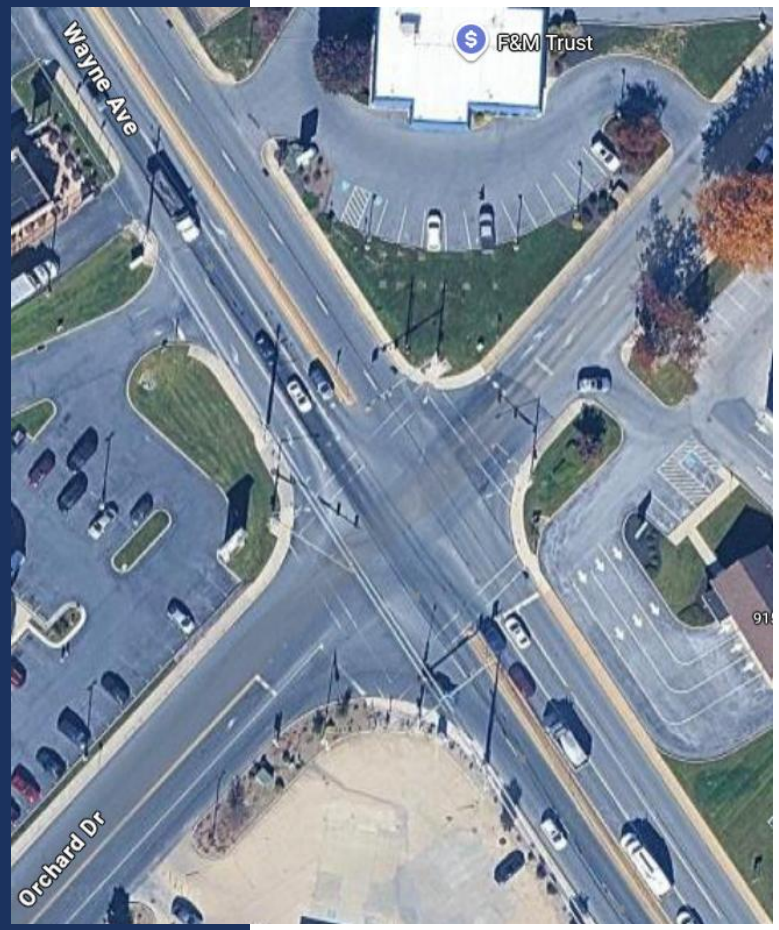
Relationship between Arrival Type and Platoon Ratio (R p ) (Transportation Research Board 2000)

# Phase Two Improvements

## ATSPM timing adjustments

- Lessons Learned
  - Closely spaced intersections don’t always require coordination
  - Oversaturated intersections may operate better with free operation and dynamic maxes.
  - Don’t always need to avoid oversized peds, which can allow shorter cycle lengths
  - Don’t be quick to assume anomalous data is due to an equipment malfunction – most likely due to an event.
    - Could be an accident, illegally parked car, or trick-or-treaters
    - CCTV footage was invaluable for identifying data anomalies






# Phase Two Improvements

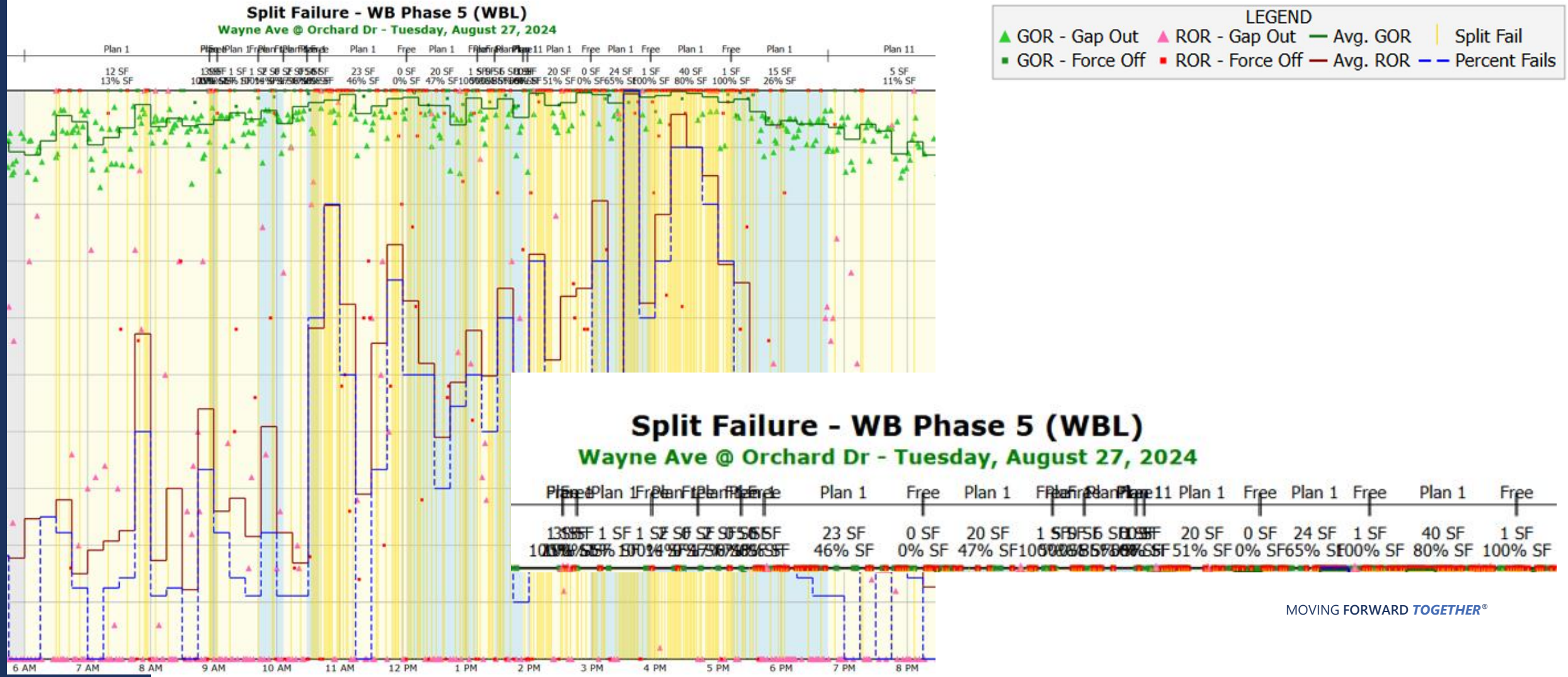
## ATSPM Example – Wayne & Orchard

- High-volume WB left turn movement without left turn phasing
- Evaluate optimizing both splits and offsets at this intersection
- Left turn phasing for EB and WB movements on Orchard will be incorporated as part of Phase 2 construction
- As an interim improvement, used ATSPM data and spot counts from CCTV to improve traffic flow during peak hours

| | Westbound | | | Eastbound | | |
|---|---|---|---|---|---|---|
| Peak Hours | ThruRight | Left | Thru | ThruRight | Left | Thru |
| AM Peak: 11:45 AM to 12:45 PM | 90 | 288 | 160 | 53 | 83 | 278 |
| PM Peak: 4:15 PM to 5:15 PM | 140 | 322 | 198 | 73 | 80 | 347 |

# ATSPM Example – Wayne & Orchard

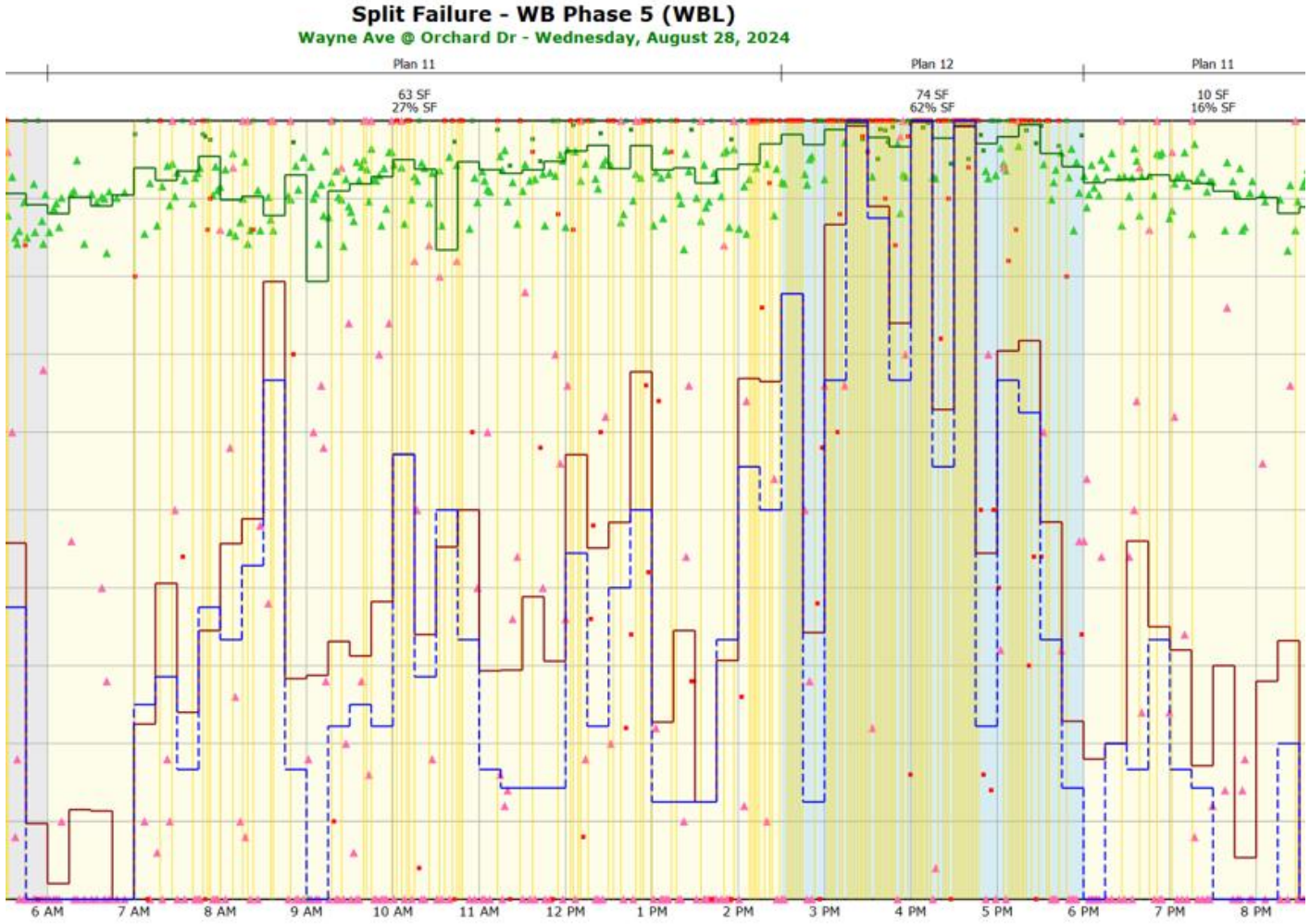
- Phase 5 WB left turn split failures – controller frequently goes out of coordination due to oversized ped actuations.




Split Failure - WB Phase 5 (WBL)
Wayne Ave @ Orchard Dr - Tuesday, August 27, 2024

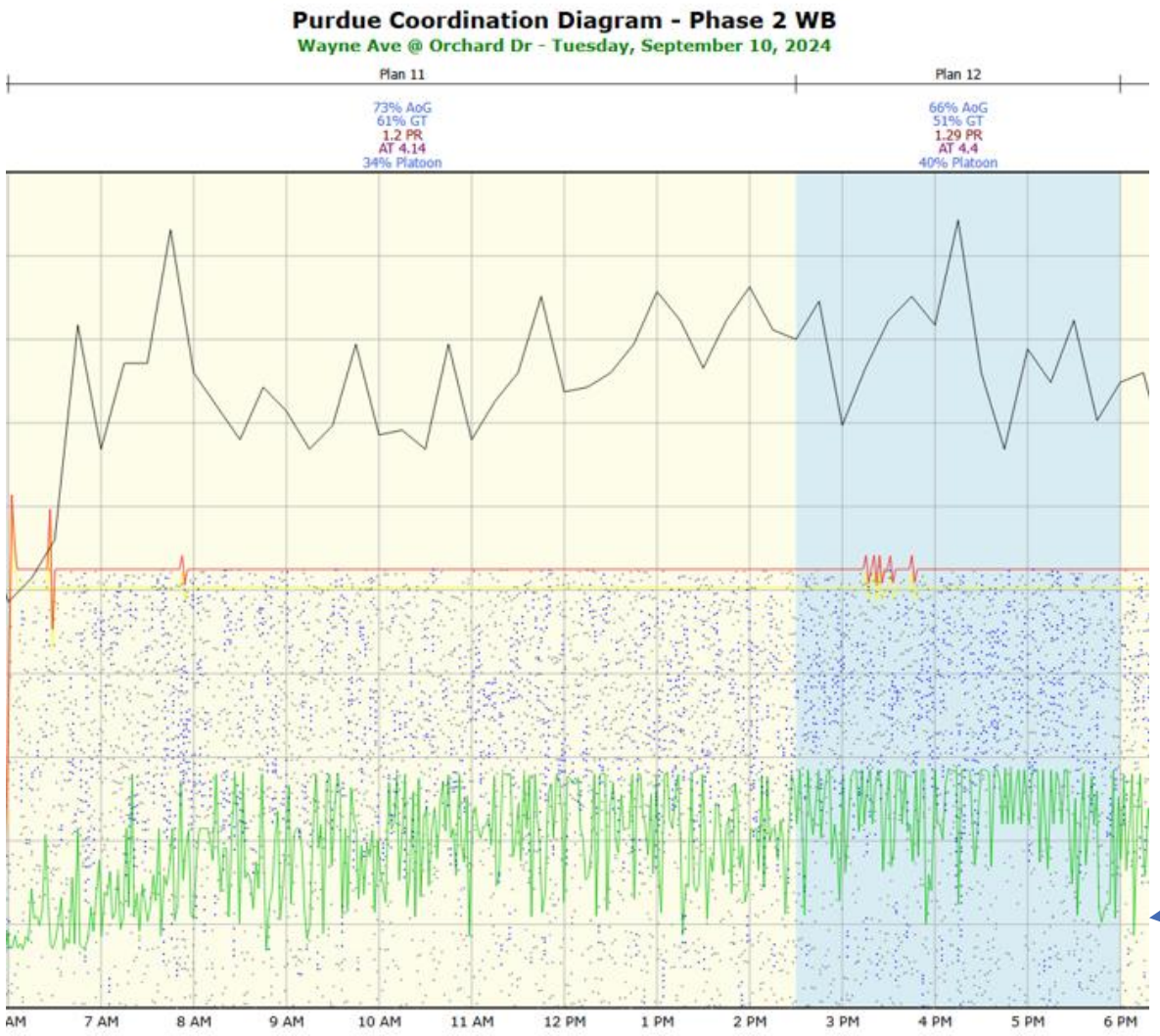
# ATSPM Example – Wayne & Orchard

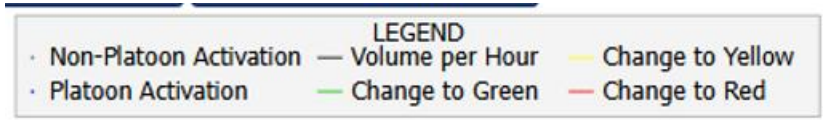
After 5 iterations, new timing plans and offsets reduced split failures. During the afternoon )2:30-5:30 PM) split failures remain high.  Increased cycle length from 90 to 105 seconds to prevent oversized ped calls from knocking signal out of coordination.



# ATSPM Example – Wayne & Orchard

- Purdue Coordination Diagram shows high percentage of vehicles arriving on green after implementing new timings.




Platoon Ratio

AM/Midday = 1.2

PM = 1.29

Favorable Progression

More blue dots above green = arrival on green

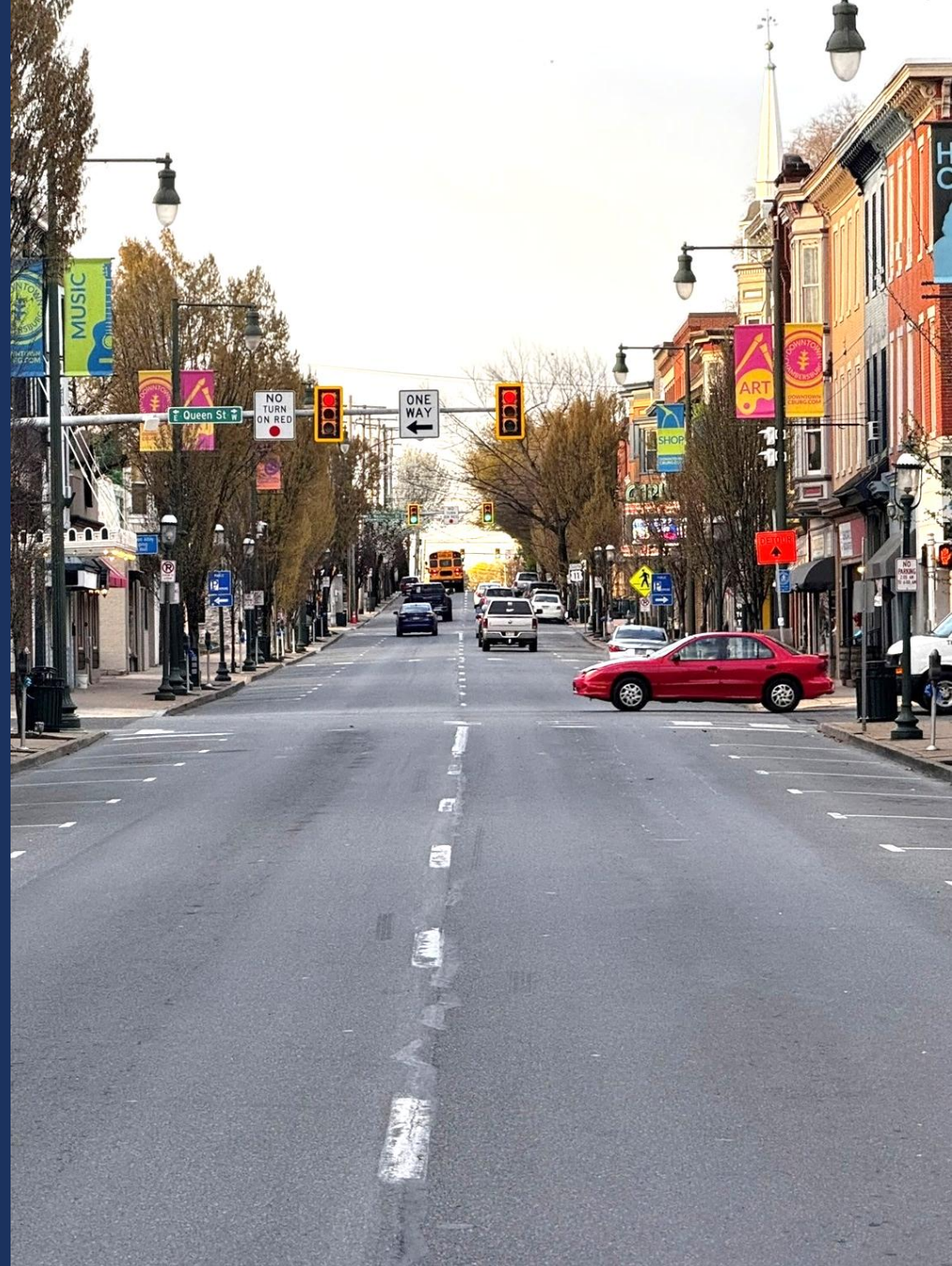
Below green line = arrival on red

# Phase Two Design Schedule


- Design Plans – limited to 28 intersections with equipment upgrades
  - FYA
  - Additional radar detectors at I-81/Route 30 intersection
  - 12” signal heads
- Timings continue to be implemented by TPD “on the fly”

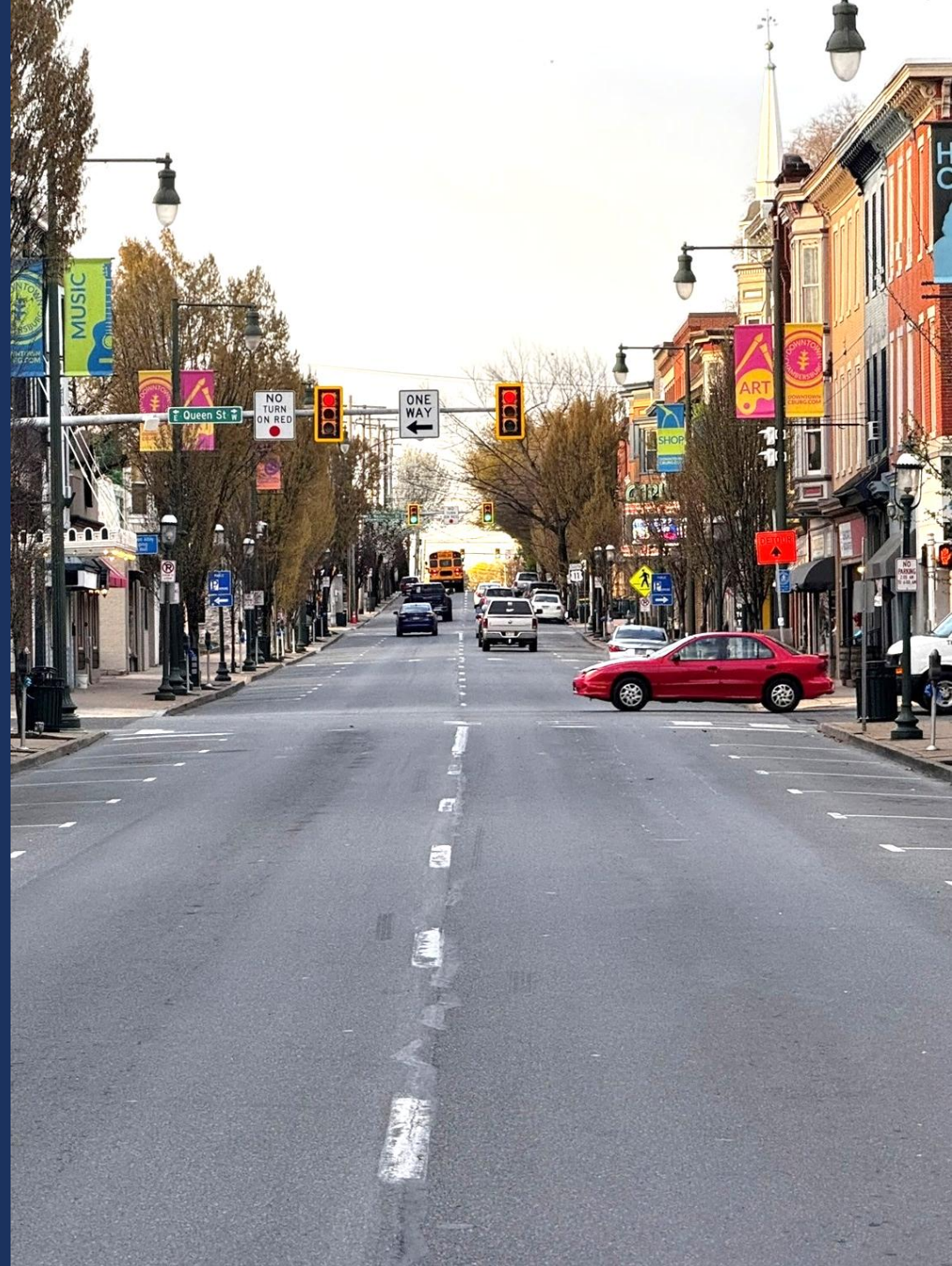
# Phase Two Construction Cost

- Final Construction Estimate  $449,745
- Bids
  - B/M  $398,120
  - Herr  $403,130
  - Dixon  $404,670
  - CM High  $427,000
  - Kuharchik  $526,895
- Mean bid price was $431,963.  TPD bid included 15% for mobilization/MPT.  Low bid was 6%.
- Final Design Phase for TPD/DRIVE will remain open through 2026 to allow additional timing updates preparation of as-build signal permits.



# What's Next

- After construction: re-evaluate signal timings with new FYA operations and phasing additions
- Incident management timings: evaluate incidents on I-81 using RITS data and identify signals affected by diverted traffic;  there are 3 exits along I-81 within the project area
- Evaluate if the system will continue to operate on Econolite Centrax or migrate to new Kinetic Signals ATMS system
- Long term: traffic volumes are relatively predictable; continue evaluating adaptive signal control
- Short term operations – collaborate with Chambersburg to identify future monitoring of the system beyond 2026; consider applying for a Green Light Go grant for future monitoring.



# Chambersburg Signals

# SR 0011 Sections 100 and 125

## QUESTIONS?

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www.TPDINC.com