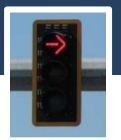
Signal Timing in Burlington County

State Transportation Innovation Council

STIC

May 7, 2019

Team Partners



- **Traffic Signal Timing Initiative Team Partners:**

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

BOARD OF CHOSEN FREEHOLDERS 1694 BURLINGTON COUNTY, NEW JERSEY

DEPARTMENT OF TRANSPORTATION THE STATE OF NEW JERSEY

- **Consultant Team:**

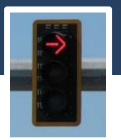
TWT Taylor Wiseman & Taylor ENGINEERS | SURVEYORS | SCIENTISTS

AG Albeck Gerken, Inc. Transportation Engineers

Imperial TRAFFIC & DATA COLLECTION

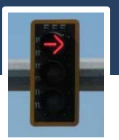
McMAHON TRANSPORTATION ENGINEERS & PLANNERS

Project Champions for New Jersey



- **DVRPC**
  - **Christopher King:** Manager, Office of Transportation Operations Management
  - **Paul Carafides:** Senior Transportation Planner, Office of Transportation Operations Management
- **Burlington County**
  - **Marty Livingston,** Traffic Engineer, Burlington County
  - **Michael J. Nei,** Principal Engineer, Traffic, Burlington County

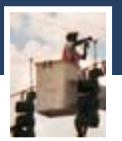
Project Development/History



- Concept discussed for years
- TIP Line Item
- Collaboration with Burlington, Camden, Gloucester and Mercer Counties to initiate development
- Aware of NJDOT optimization contracts, focused solely on County Highways
- DVRPC Contracts, TIP, CMP, LRP at table from beginning
- Based on successful PennDOT 6-0 contract, now in its second iteration (first contract TWT, second Albeck Gerken)

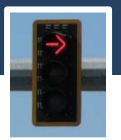
Financial Support





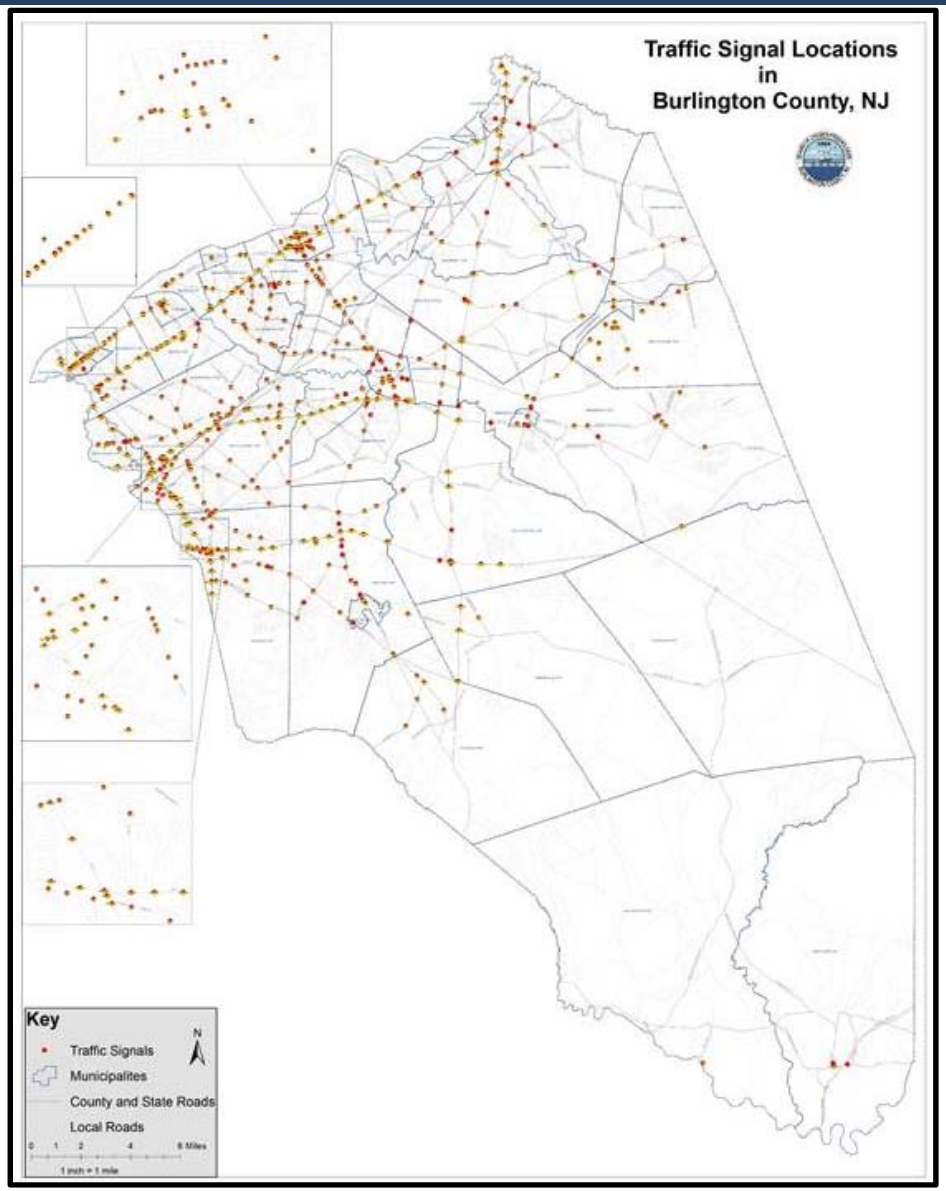
- **DVRPC's *Connections 2040* Long Range Plan**
  - Transportation Investment Priorities
    - Preserve and maintain existing transportation system and rights of way
    - Improve the operation of existing transportation facilities
    - Increase the capacity of existing multimodal transportation system, limiting the addition of through travel lanes
- **100% CMAQ funded through the TIP**
- **Contract through DVRPC**
  - Open Ended, set up for multiple years
  - $350,000 a year for four years
  - Flexible scope to meet needs of each corridor

Project Accomplishments to Date

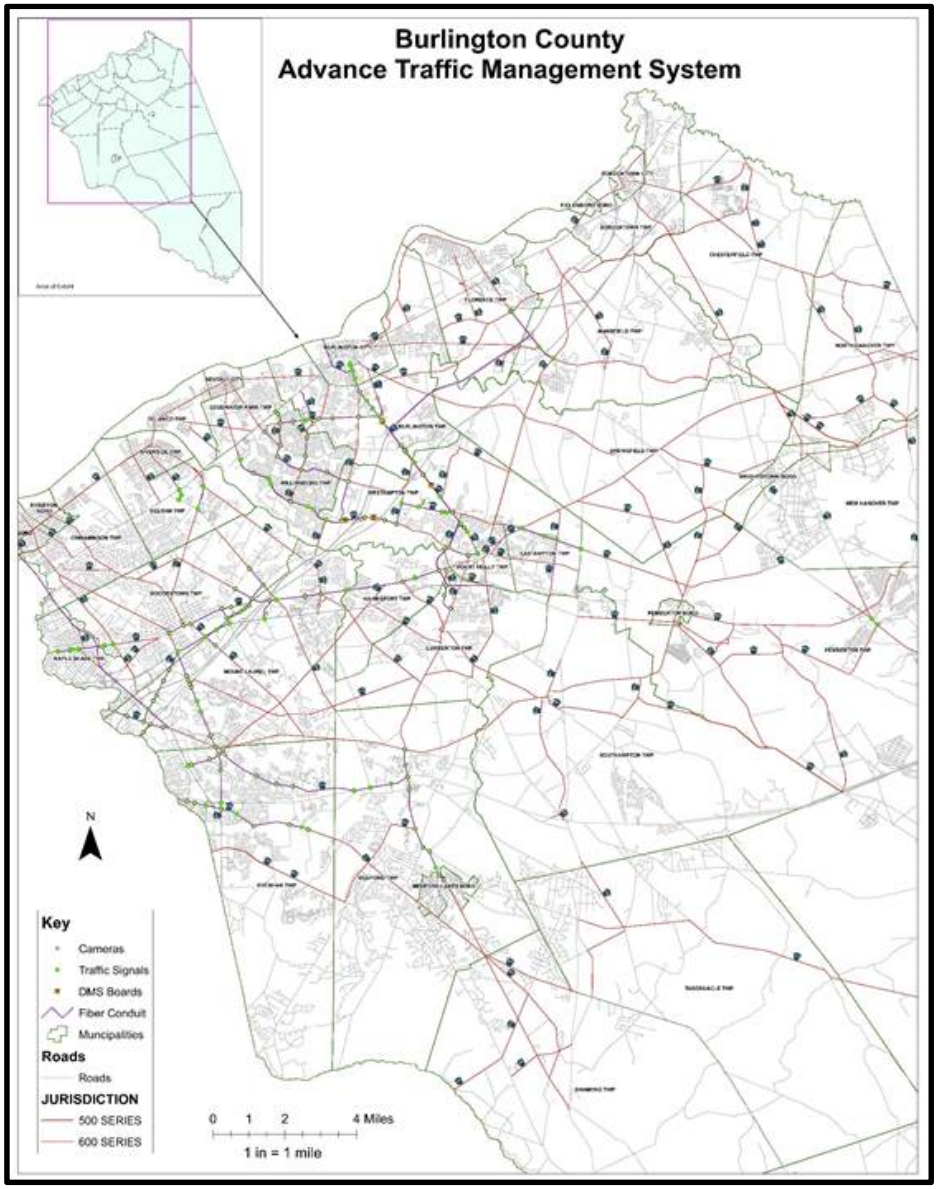


- Consultant team met with each County to identify candidate corridors.
- Each corridor/intersection quickly assessed for operational issues (communication, detection, controller time clock)
- Consultant team had second meetings to rank candidate corridors and begin actual design/implementation of new timings.
  - Managing expectations, identifying constraints
- 10 Corridors identified in Burlington County as initial potential candidates
- First corridor implementation completed August 2018
  - Burlington (CR 541), 19 intersections
  - 20% improvement in travel time, delay, stops

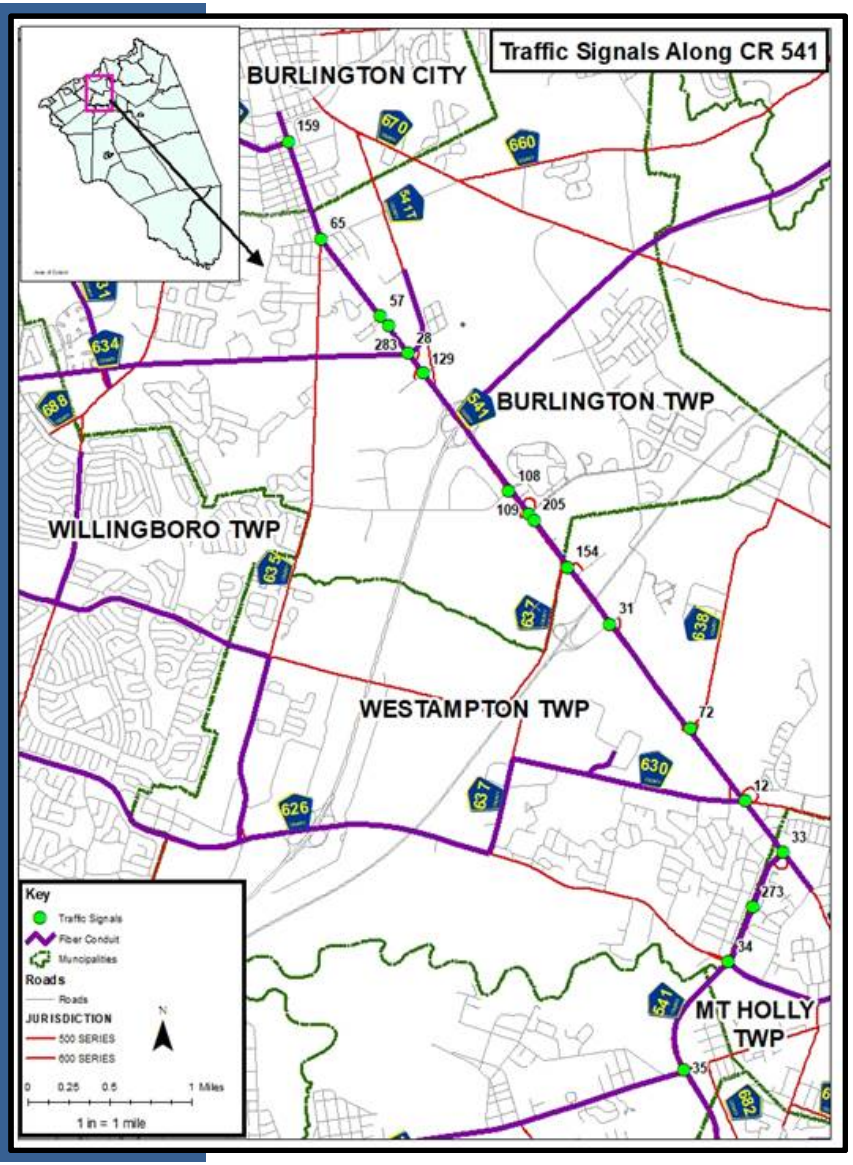
Burlington County Traffic Signals Map



Burlington County ATMS Map

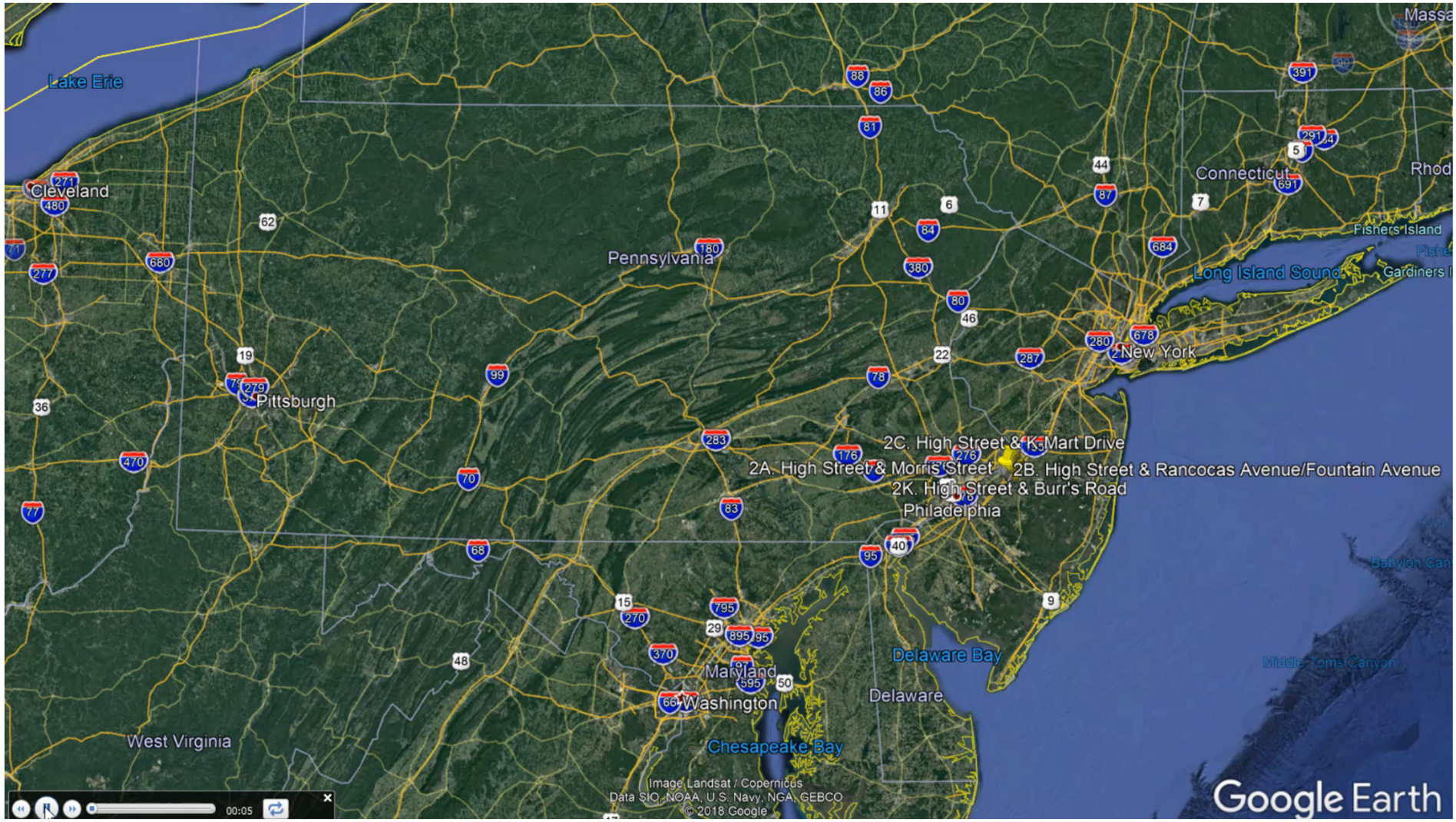


County Route 541 Corridor



- 19 total intersections
- Roadway character changes from 2-lane roadway to 6-lane roadway.
- Connects US Route 130 to the North with NJTPK, I-295 and Mt. Holly Bypass.
- Speed limit changes
- Project controlled by Burlington County central system (Econolite CENTRACS)
- Dealt with operational issues for the intersection of CR 541 and CR 635 to provide link between change in traffic characteristics and improvement in metrics (stops, delays, travel time)
- Concerns over impact of I-295 and NJ Turnpike
- Burlington City High School impacts on corridor.
- Corridor has optically-based emergency preemption.

Burlington County 541



Diversions from NJTPK—Hancock Lane



- Even if Turnpike has major diversion, critical factor is toll booth (2 lanes off, 2 lanes on)
- Maximum Queue length of 700 feet was reviewed.
- Burlington County had pre-existing crisis plan to be implemented if necessary.

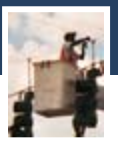
Project Process



- Met with County to identify candidate corridors
- Rapid field assessment
  - Controller heartbeat, detection (pedestrian and vehicular), communication check. Existing controller information uploaded from CENTRACS.
    - Only two minor maintenance concerns identified, quickly resolved by Burlington County maintenance.
- Extensive data collection
- Custom programs developed for AM ramp-up, AM Peak, Mid-Day Peak, PM peak, PM Late night, Weekend Programs.
- Consultant team, working with Burlington County and Signal Control Products, downloaded new timings from Burlington County TOC
- Fine Tuning in the Field
- Final reports, measures of effectiveness.

The Signal Timing Process





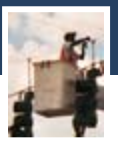
- Minimize Delays
- Reduce Emissions
- Manage Queues

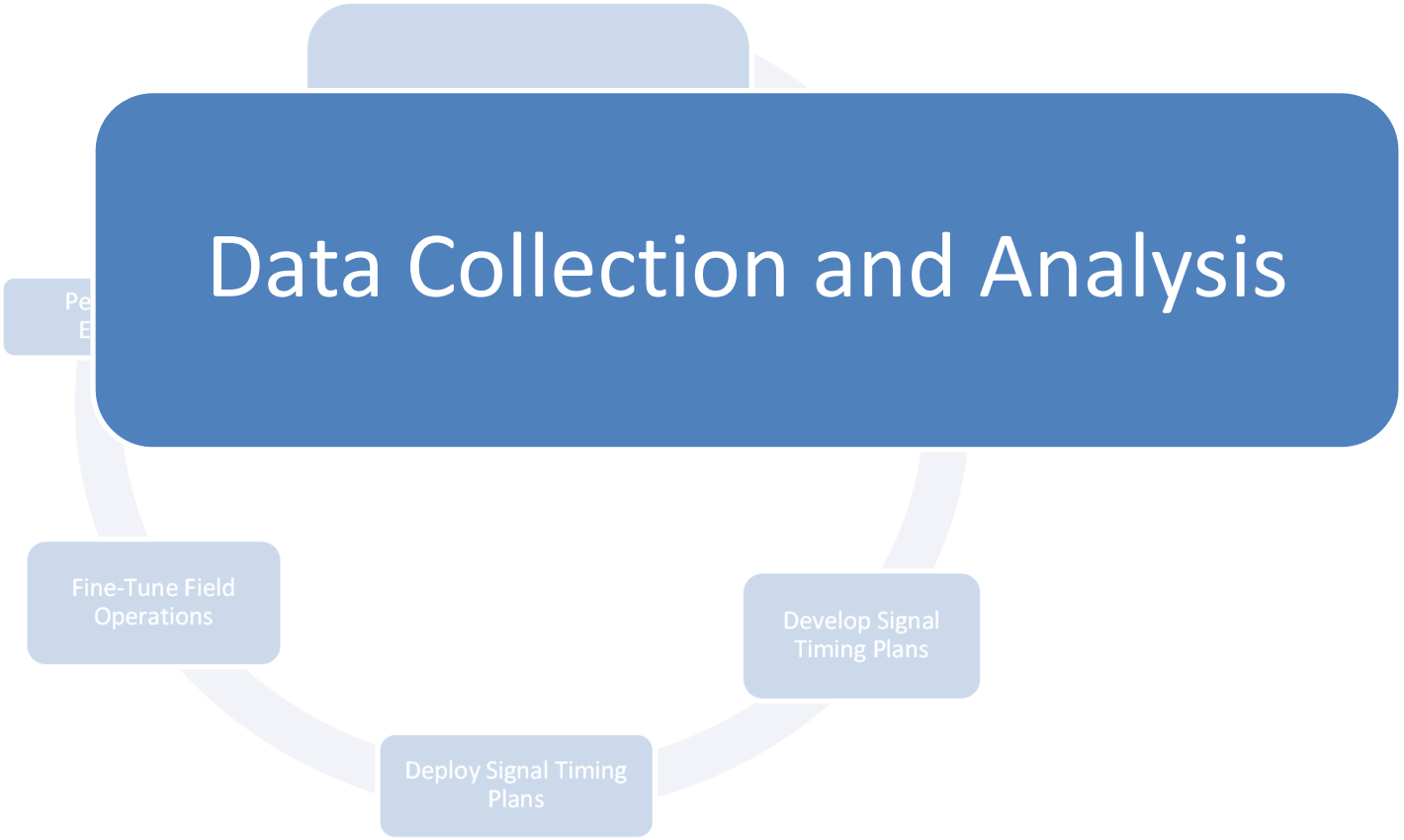
Determine Project Goals, Define Success, Determine Schedule

- Reduce Stops
- Reduce Complaints
- Increase Throughput

Six-Step Signal Timing Process

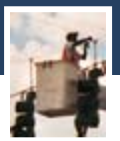




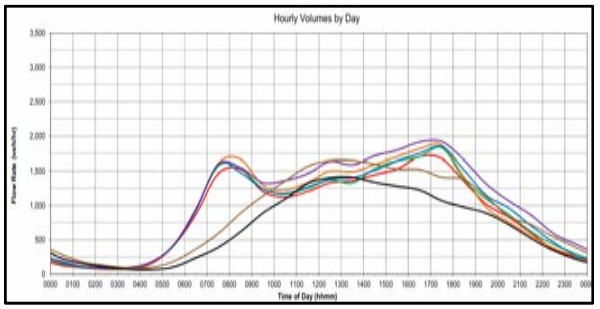


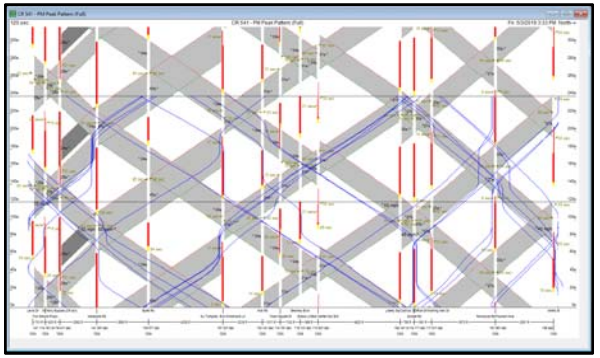
Data Collection



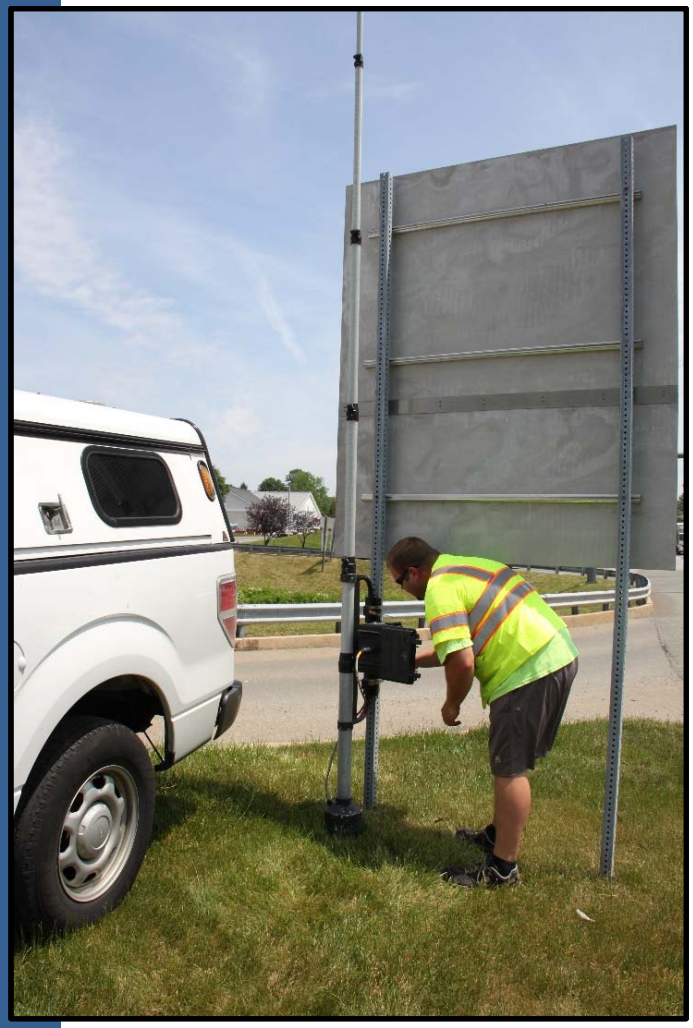


- 24-Hr Weekly Volume Profiles
- Turning Movement Counts
  - Miovision SCOUT units deployed
- Travel Time Runs
  - Tru-Traffic w/ Video
- Signal System/Intersection Inventory
  - Link lengths
  - Lane widths and types
  - Controller Type
  - Condition of Signal Equipment
  - Existing Communication Equipment
  - Detection Devices
  - Existing Timings and Phasing
  - Status of time clock?





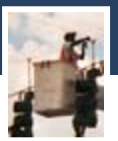
Lessons Learned: Data Collection

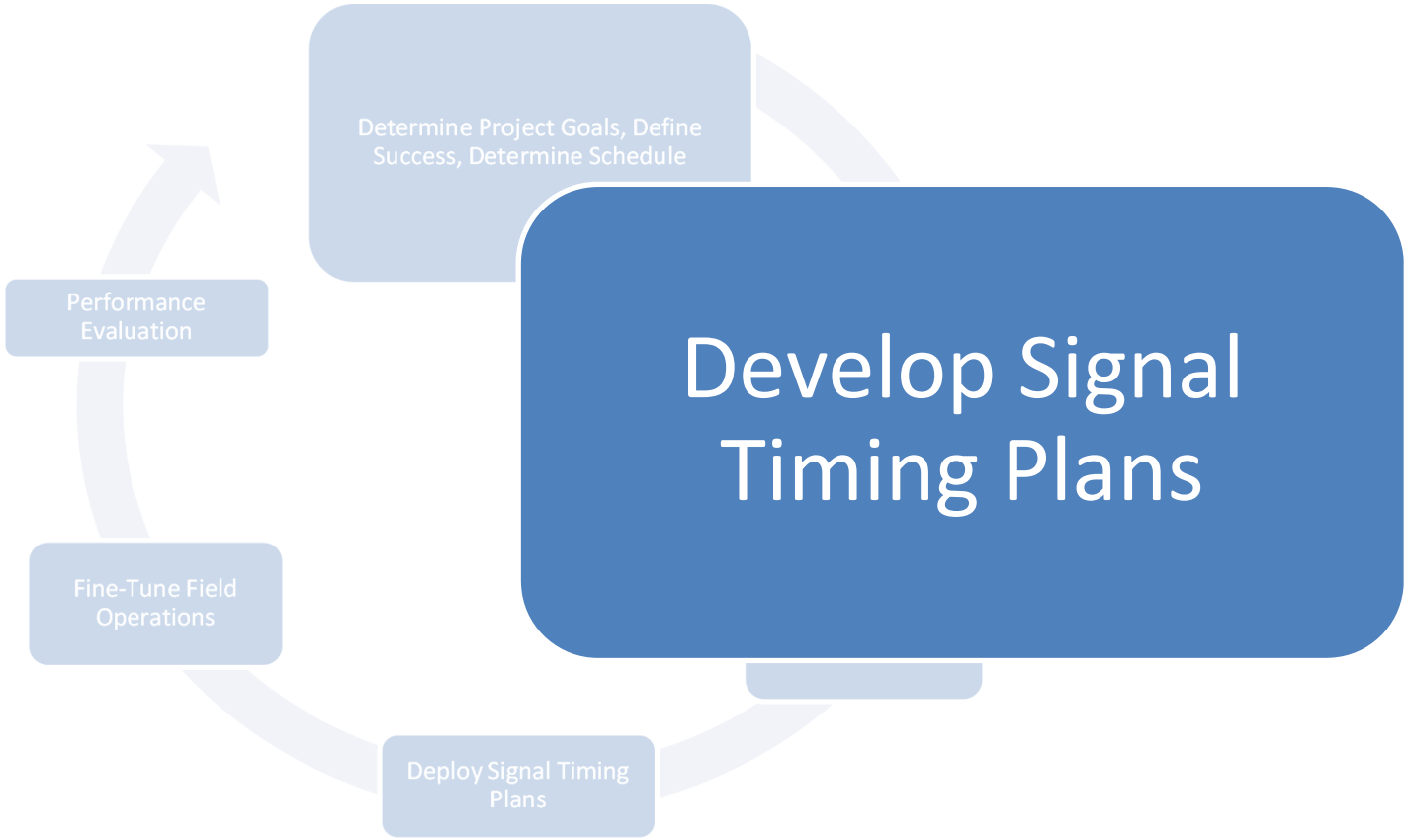


- Use of Miovision has greatly improved accuracy of data and reduced costs
- ATR counts provide valuable insight into traffic patterns
  - Most traffic patterns are recurring
- ATR counts/manual turning movement counts done concurrently for QA/QC

Six-Step Signal Timing Process



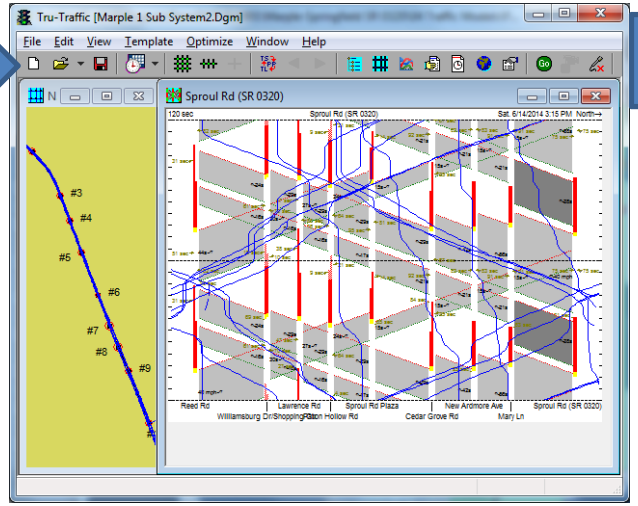




Model Building / Optimization

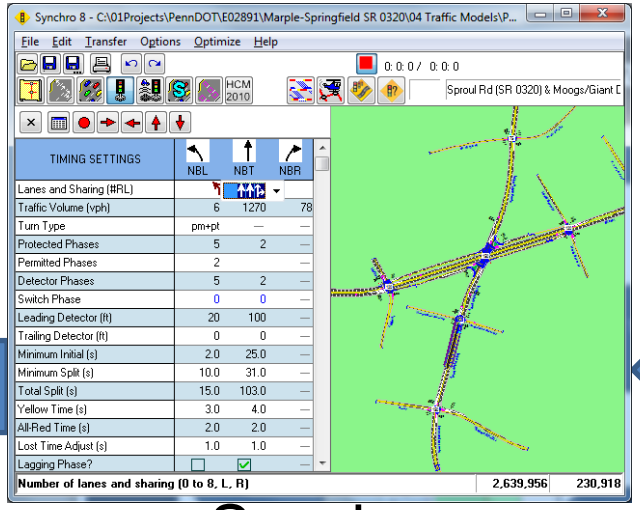


Tru-Traffic



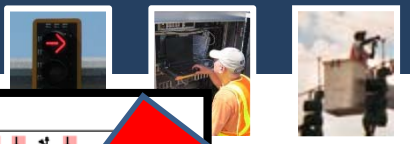
Universal Traffic Data Format (UTDF)

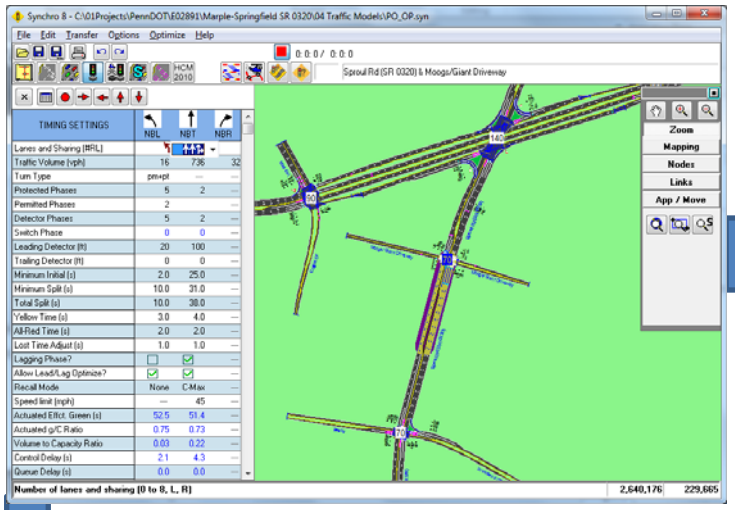
Universal Traffic Data Format (UTDF)



Synchro

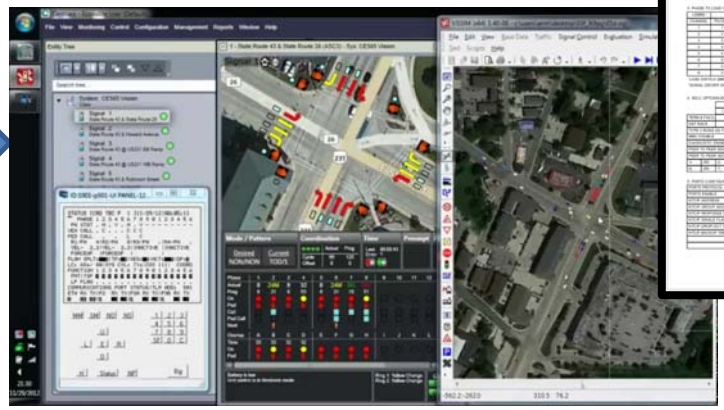
Create CENTRACS Timing File

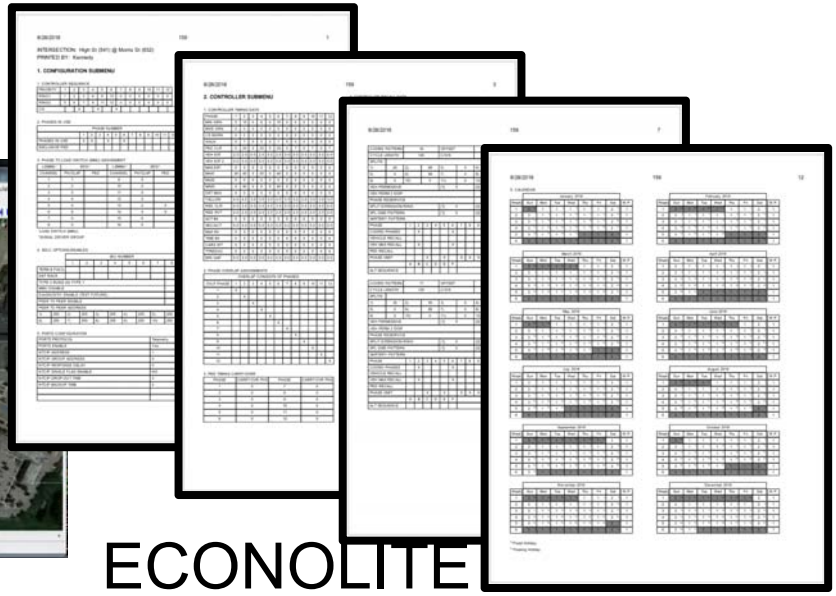




Synchro

CENTRACS





ECONOLITE

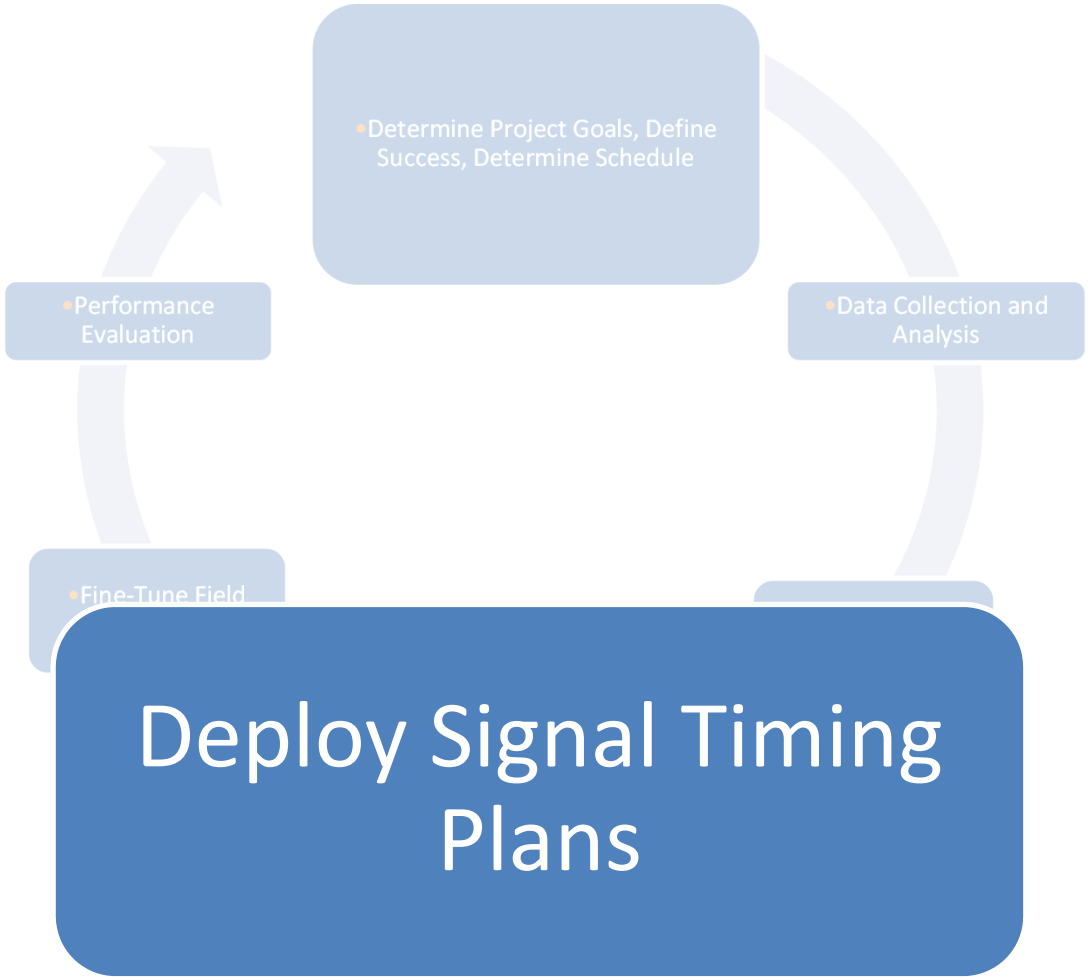
Lessons Learned: Development of Timing Plans



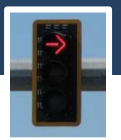
- Pedestrian timing and clearance/change intervals checked and updated to current standards.
- Special program developed to deal with Burlington City High School egress at Fountain.
- Left turn phase at Town Center was changed by time of day (Lagging LT during PM) to optimize progression.
- Mid-day peak, early evening peak (6 PM to 10PM), weekend time periods typically are not addressed well.
  - ATR data illustrates project needs.

Six-Step Signal Timing Process



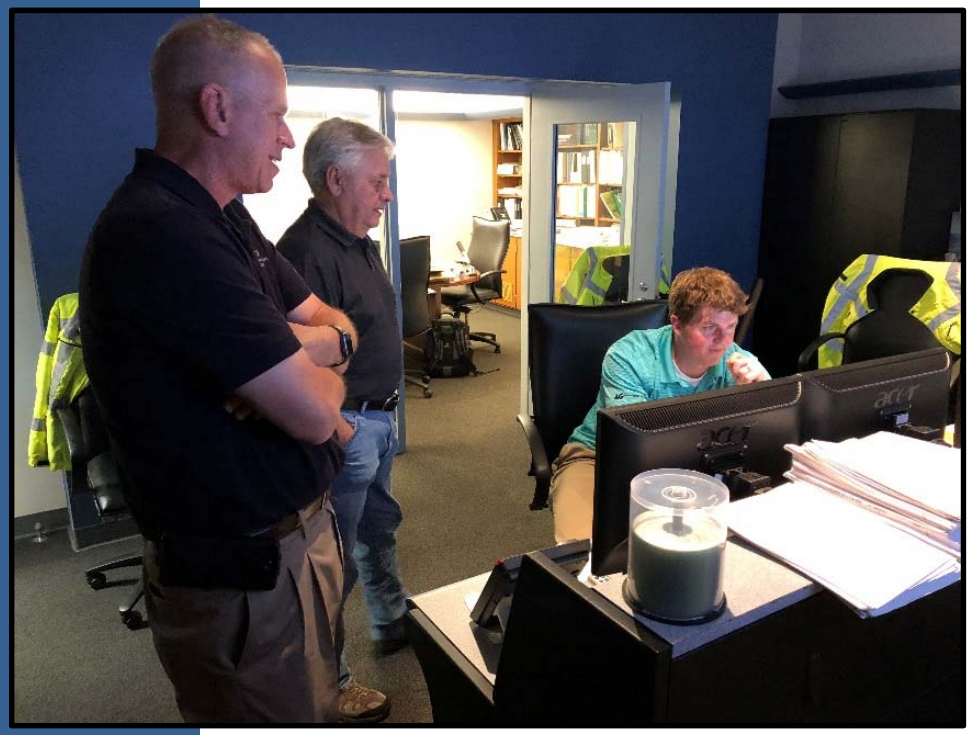


Deploy Signal Timing Plans



- Download plans via Econolite CENTRACS.
- Drive system using Tru-Traffic to determine if patterns are functioning as desired
- Never allow pattern to operate unobserved
- Burlington County assisted and observed total corridor from TOC using camera coverage.
- Changes were made in field to split/offsets. Documented by project team.
- At the end of implementation, CENTRACS database coordinated (upload/download)

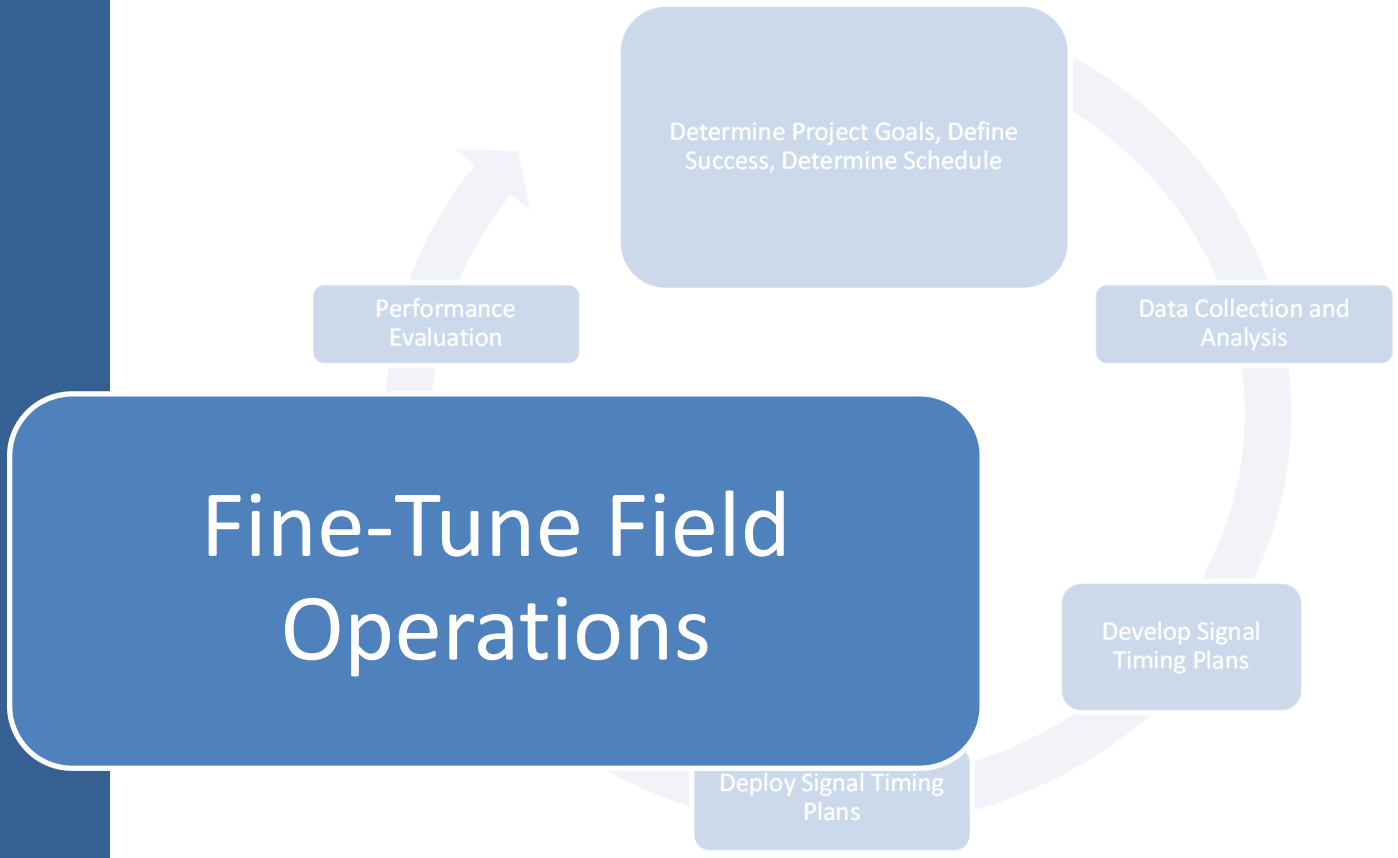
Lessons Learned: Deployment of Timing Plans



- The ability to direct connect and download settings is invaluable. The Burlington County TOC made the process easy.
- Tru-Traffic gives you immediate insight into the operation of the system.
- Relations with Contractors & Signal Vendors very important
  - Signal Control Products
  - Techna Pro Electric, LLC

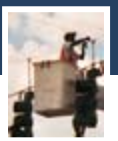
Six-Step Signal Timing Process





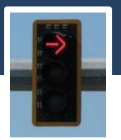
Fine-Tune Field Operations





- Use Tru-Traffic to fine-tune pattern timing
- Monitor critical intersections, drive the corridor using Tru-Traffic adjusting necessary settings to achieve goals
  - More than just Cycle / Offset / Split
  - Use controller/central system features to achieve goals
  - Unique to every system, but knowing the hardware can support the timing plan
- During implementation and fine-tuning, use the system to troubleshoot operations, identify issues, and monitor traffic
  - Queue spillback, cycle failures, “excess” green time
- Long days, but the team did not leave until it’s right!

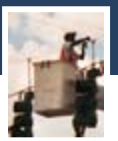
Lessons Learned: Fine Tuning

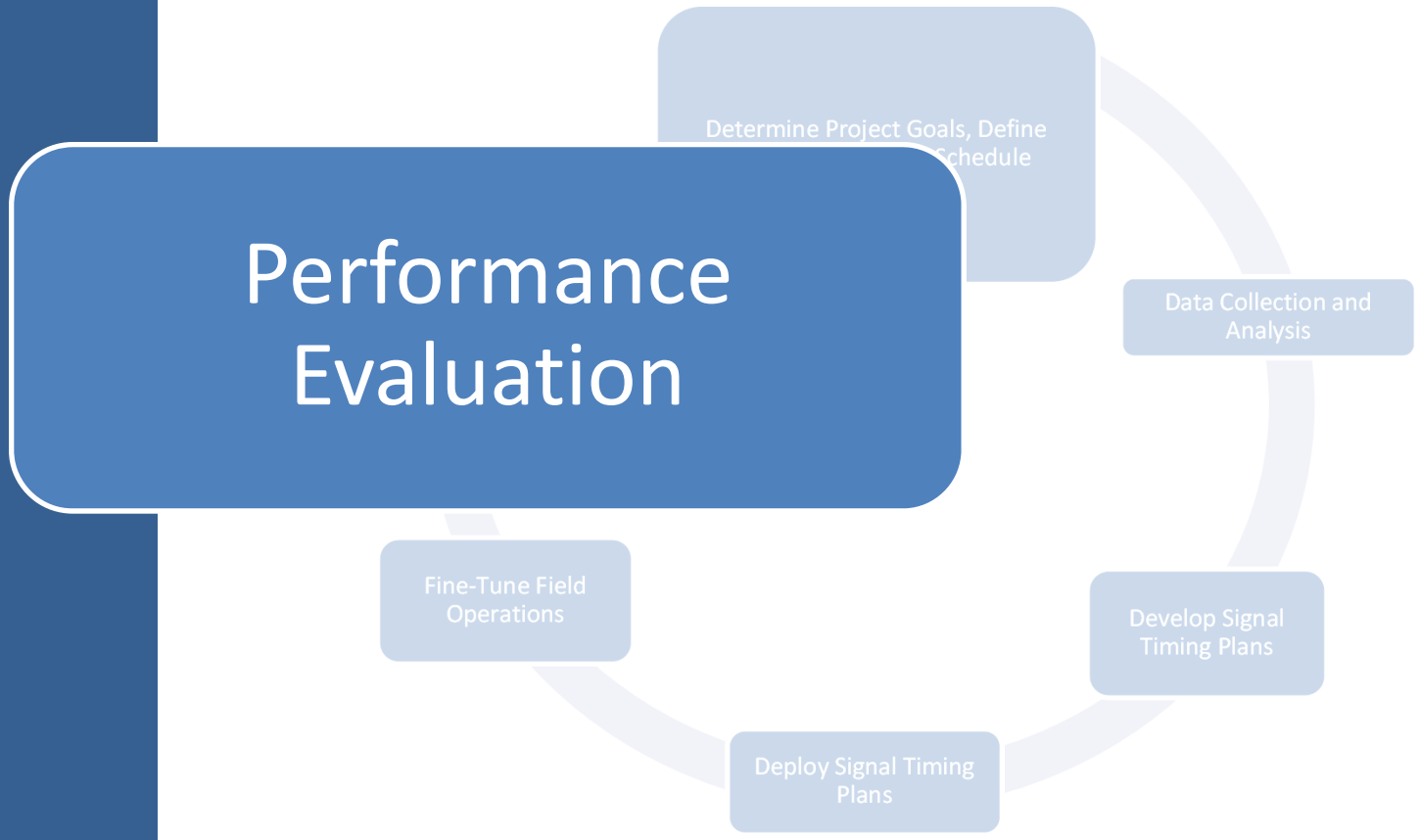


- Signal timing parameters can be adjusted effectively—despite what Synchro says
  - Bandwidth vs. Getting the Queue moving
  - Watch side street and left-turn delays
  - Understand pedestrian impacts, as well as emergency preemption
- Maintain communications with stakeholders and actively seek their involvement

Six-Step Signal Timing Process







County Route 541 Modeled Network Wide MOEs



Saturday Peak Hour Period Weekday (1100 to 1300)	Travel Time (seconds)	Delay (seconds)	Number of Stops	Fuel Cons (gal)
Existing	647	290	25,014	1,025
Implemented (w lead/lag)	626	270	21,839	977
% Difference	-3.2%	-6.9%	-12.7%	-4.7%

County Route 541: Northbound Field Travel Time



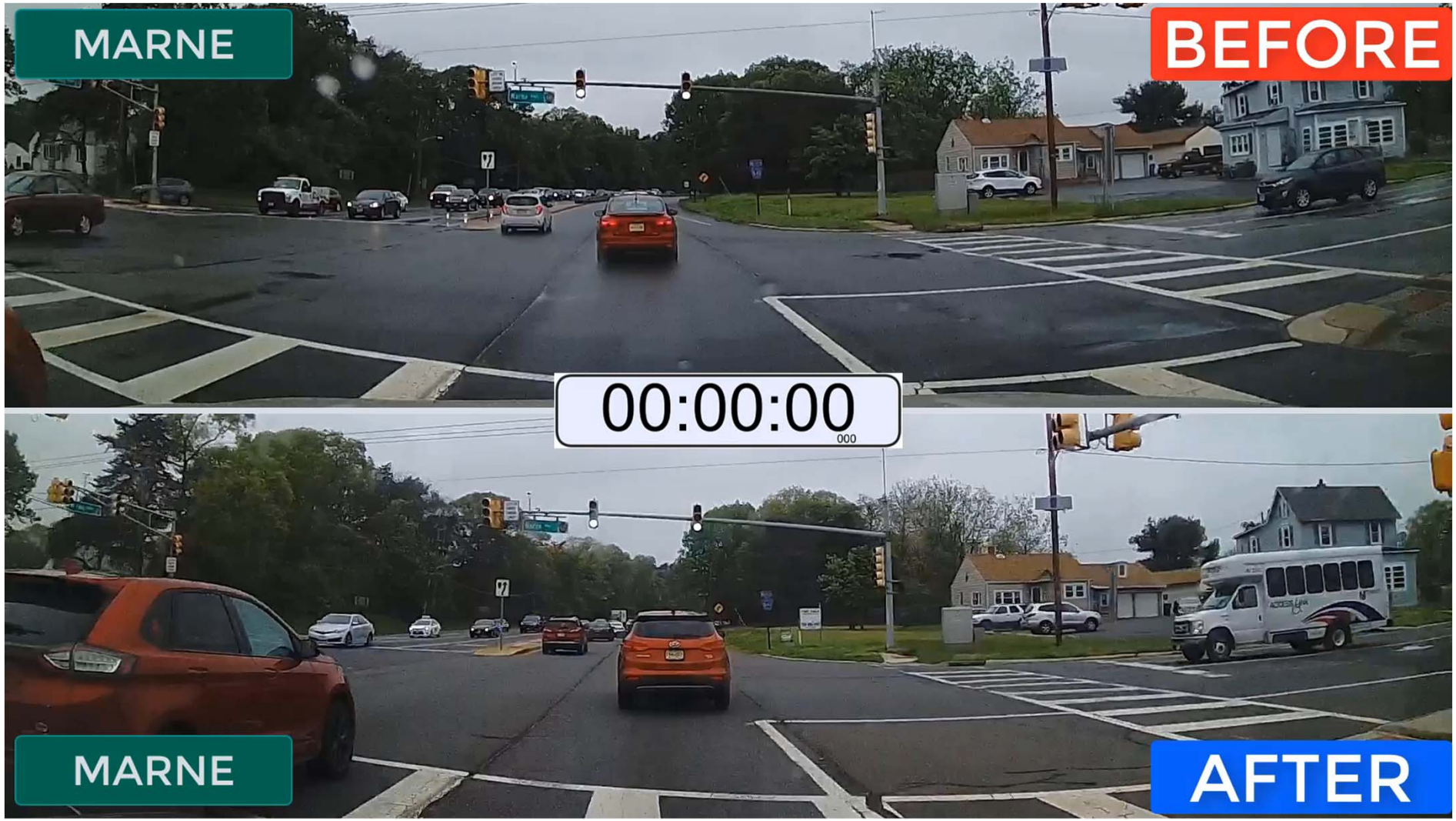
PM Peak Hour Period Weekday (1600 to 1800)	Travel Time (seconds)	Delay (seconds)	Number of Stops	Speed (mph)
Before	768	306	7.4	26.1
After	605	143	3.2	33.2
% Difference	-21.2%	-53.3%	-56.8%	27.2%

County Route 541: Southbound Field Travel Time



PM Peak Hour Period Weekday (1600 to 1800)	Travel Time (seconds)	Delay (seconds)	Number of Stops	Speed (mph)
Before	689	232	6.4	29.0
After	529	72	2.6	38.1
% Difference	-23.2%	-69.0%	-59.4%	31.4%

County Route 541
Before vs. After



County Route 541 Signal Retiming Project Summary



- **Traffic signal operations can be improved by simple retiming initiatives—with returns similar to that of adaptive.**
- **Success depends on collaboration, cooperation, coordination, and consensus building**

Questions



Paul Carafides
pcarafides@dvrpc.org

Marty Livingston
mlivingston@co.burlington.nj.us

Doug Freudenrich
freudenrich@taylorwiseman.com

Brian Jatzke
bjatzke@albeckgerken.com

Lindsey Klein
lklein@imperialtdc.com