Getting Through the Green: Smarter Traffic Management with Adaptive Signal Control

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Outline

1. What is Adaptive Signal Control Technology?
   - Why We Are Pushing For It
2. Where We Have Deployed Adaptive Signals & Where We Are Planning On Deploying Them
3. What Is COAST-NJ?
   - How We Are Using It
4. How Adaptive Signals Help Us With Other Technologies

What Is Adaptive Signal Control Technology?

FHWA's Definition:

Adaptive Signal Control
refers to
technologies
that capture
current traffic demand data
to
adjust traffic signal timing
to
optimize flow
in
coordinated traffic signal systems.

Key Characteristics of Adaptive Signal Control Technology

- Collects/communicates current traffic data to a central computer or local processor, in real-time
- Proprietary algorithms are utilized to make timing adjustments in real time, based on traffic demand
- Can change cycle lengths, splits, offsets, and phasing
- Minimal future investment needed (no new data collection or timing development)
- Periodic parameter modifications and ongoing maintenance required

Equipment Attributes:

- Fully Actuated Vehicle and Pedestrian Detection at Intersection
- System Detection
- Local and Centralized Communication System (back to Arterial Management Center)
- Controlled Traffic Signal System (CTSS)
- Hardware Compatibility

Why Are We Pushing For It So Hard?
Adaptive Signal Benefits per FHWA

Adaptive Signal Qualitative Benefits over Conventional Signal Systems

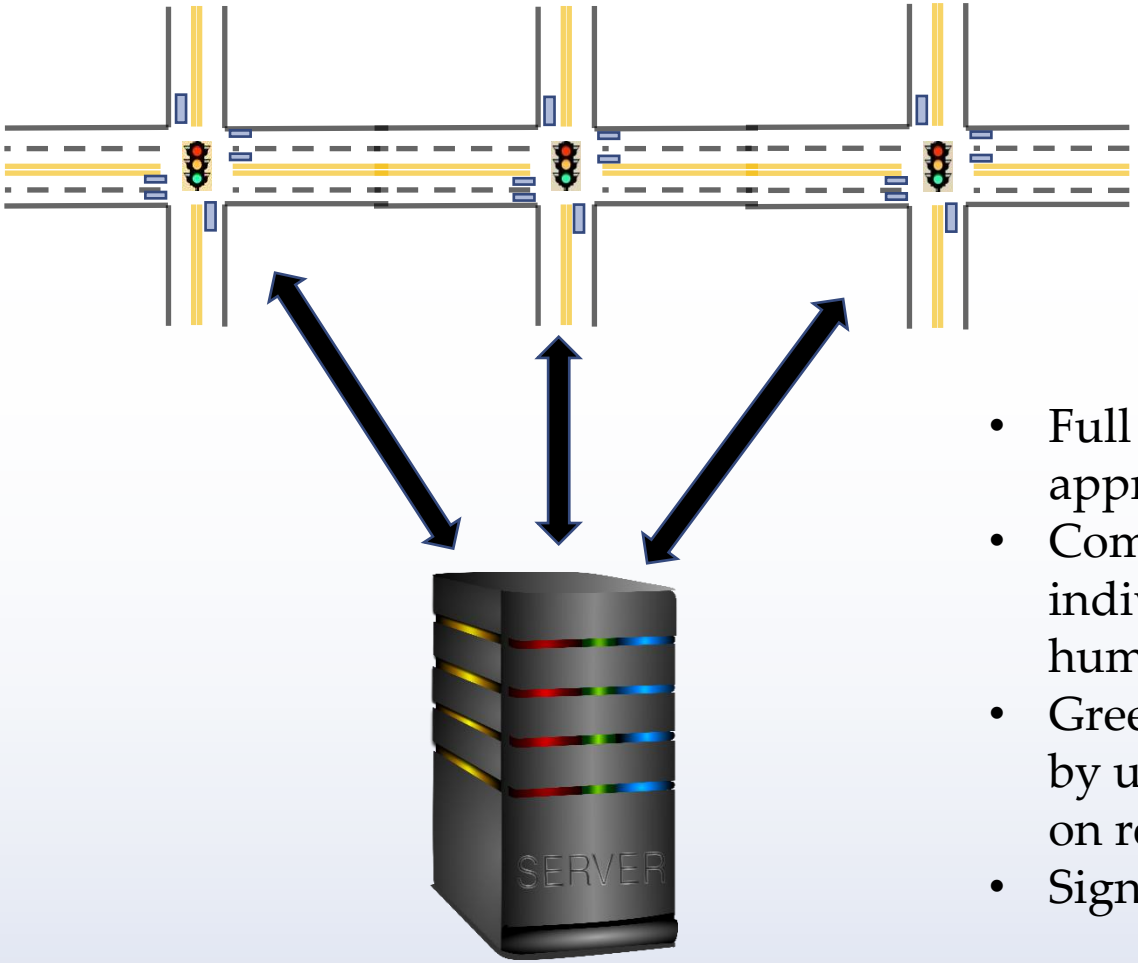
- Automatically adapt to unexpected changes in traffic conditions.
- Improve travel time reliability.
- Reduce congestion and fuel consumption - R**educes citizen complaints and frustration.**
- Prolong the effectiveness of traffic signal timing.

Why Are We Pushing For It So Hard?
Adaptive Signal Benefits per FHWA

Adaptive Signal Quantitative Benefits and Congestion Facts

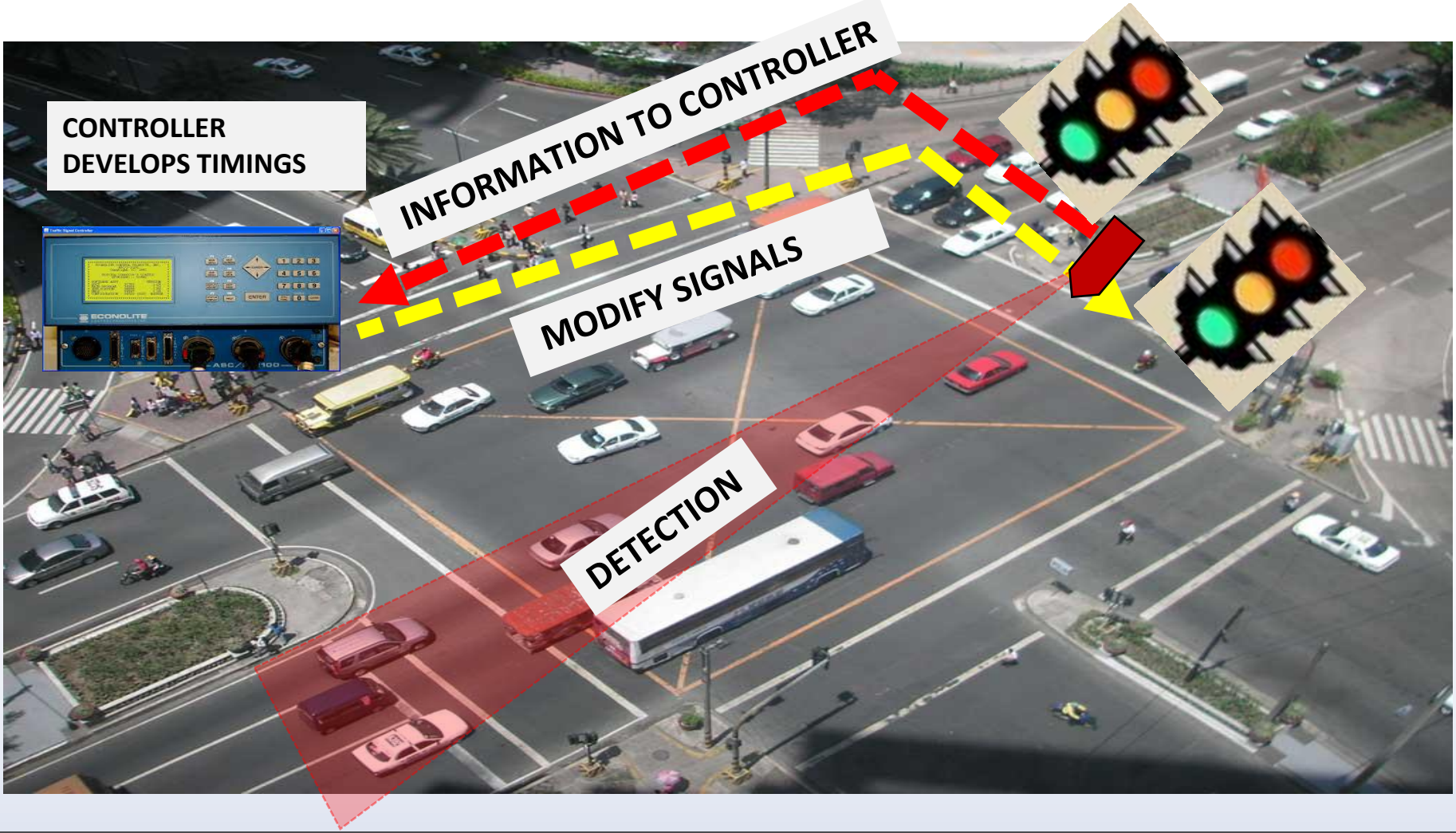
- FHWA studies have shown a 10% to 50% improvement in travel time and delay over traditional signal timing
- National Traffic Signal Report Card gave traffic signal management and operations practice a "D" - indicating that "agency programs that support efficient maintenance and operations of traffic signals are not as effective as they could be".
- According to the Texas Transportation Institute, annual traffic congestion cost is $87.2 billion or $750 per traveler.
- Outdated signal timing accounts for 10% of all traffic delays
- Crashes can be reduced by up to 15% through improved signal timing

Adaptive Signal Control Technology:



- Full detection (lanes and approaches)
- Communication between individual intersections without human intervention
- Green time is constantly adjusted by using smart technology based on real-time traffic
- Signals can be updated remotely

Adaptive Signal Control Technology



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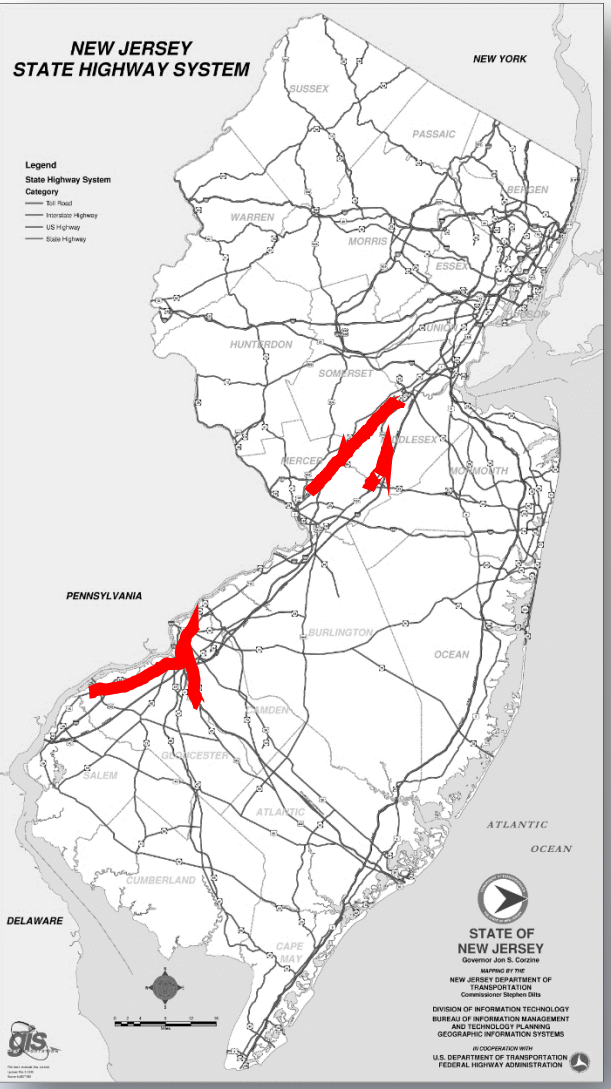
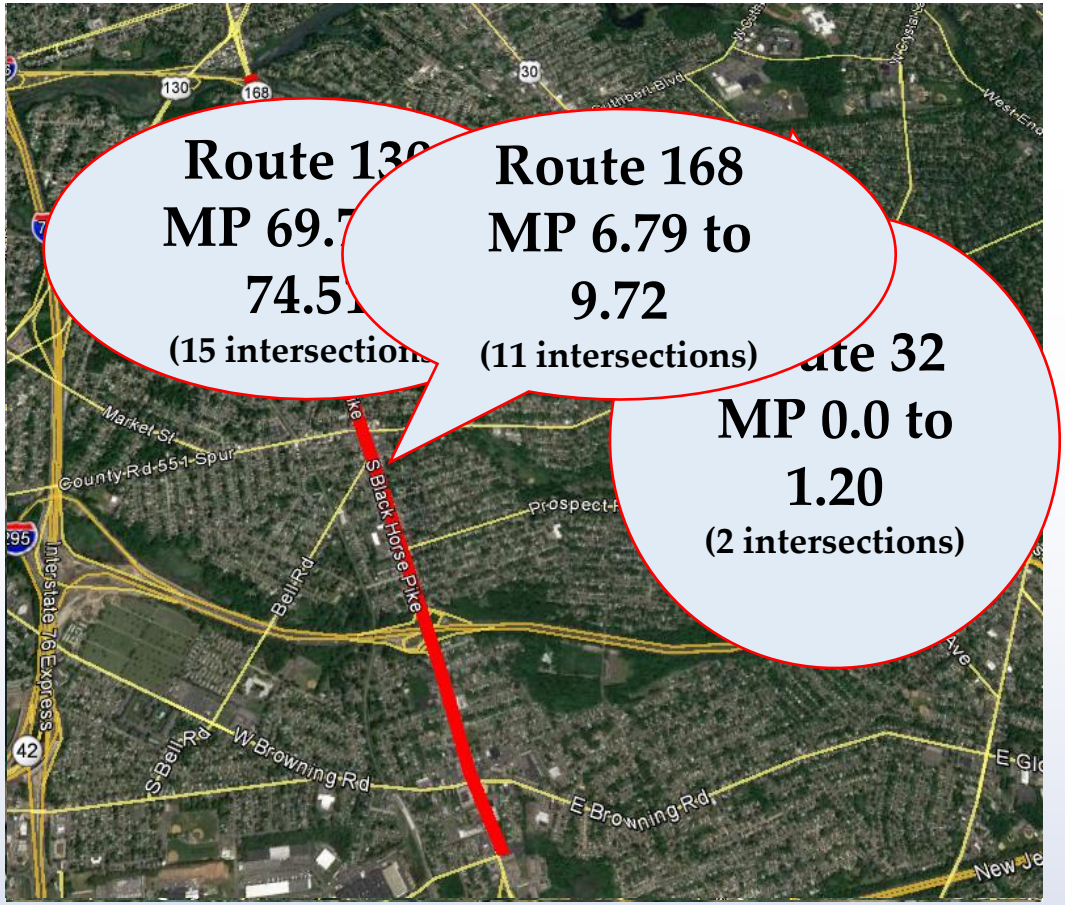
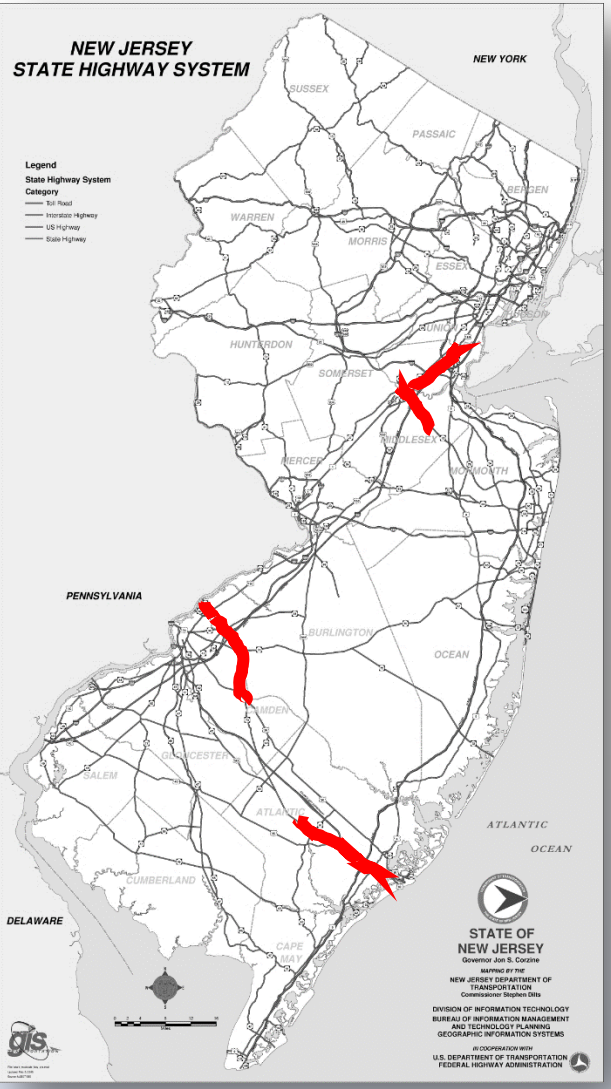
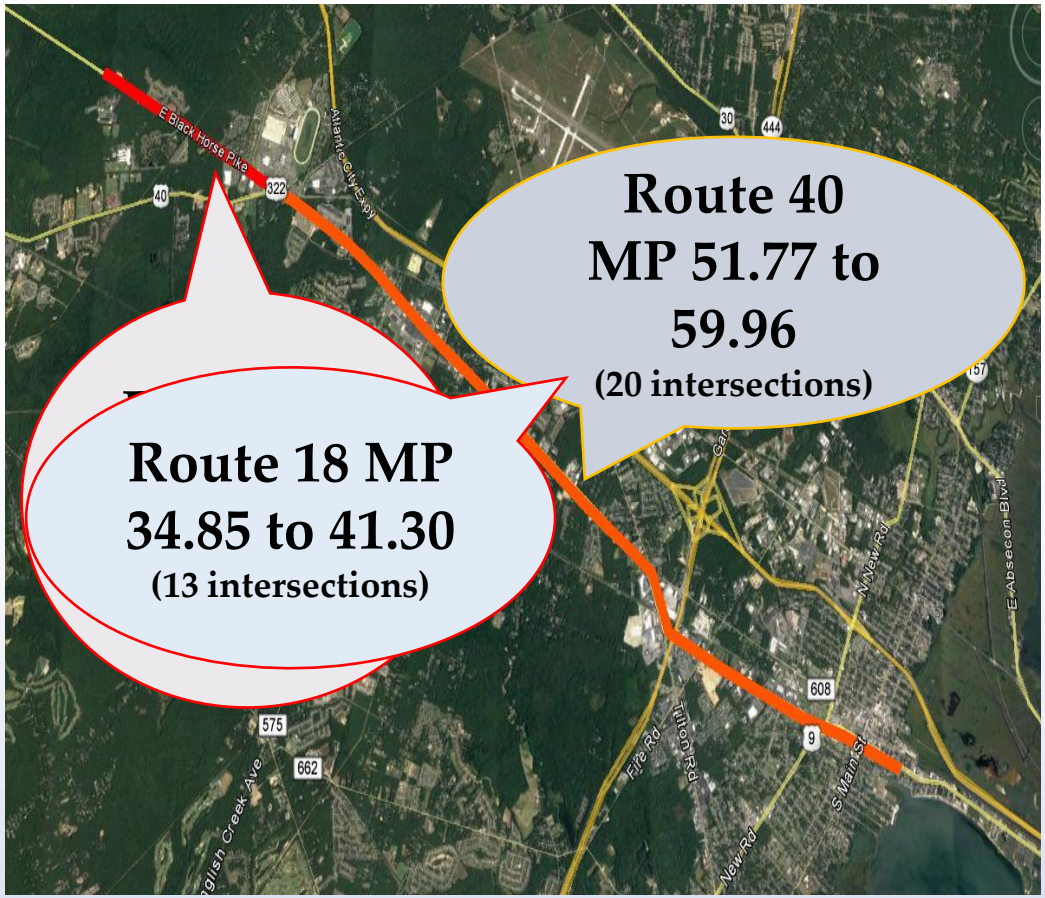


Locations with Adaptive Signals





Upcoming Adaptive Signal Corridors



Route 40
MP 51.77 to 59.96
(20 intersections)

Route 18 MP
34.85 to 41.30
(13 intersections)

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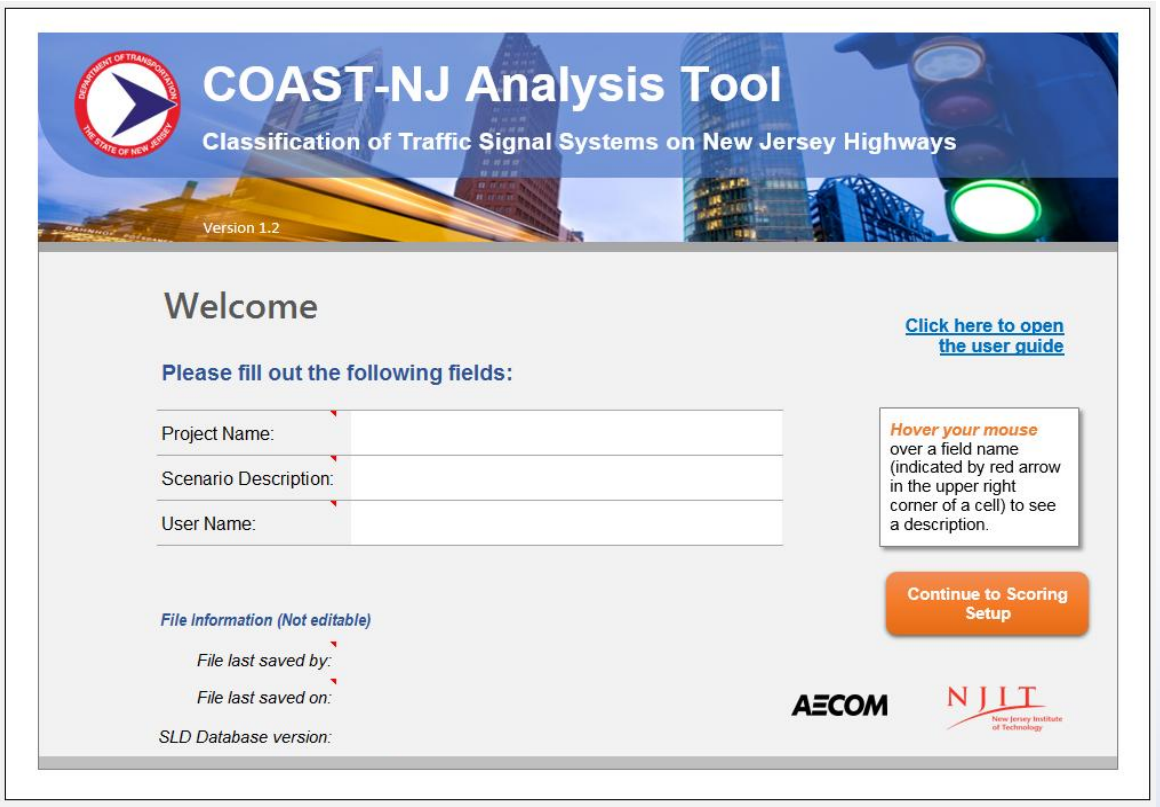
How do we select corridors?

- A quantitative analysis tool that ranks sections of corridors, or zones, based on:
  - Severity of Congestion
  - Variability of Congestion
  - Signal Spacing
  - Traffic Volume

COAST-NJ

What is COAST-NJ?

- Classification of Arterial System Technology on New Jersey Highways
- Developed by New Jersey Institute of Technology (NJIT) & AECOM
- Released for NJDOT use in March of 2017
- "Smart" Excel File with User-Friendly Interface



Main Function of COAST-NJ Analysis Tool

To evaluate NJDOT signalized intersections and intersection zones (signalized sections of arterial roadways) based on a set of evaluation criteria.

- This evaluation is quantitative and provides a set of scores and KPI (key performance indicator) for intersections, zones, and arterial routes.

COAST-NJ Scoring Process

COAST-NJ Encompasses:

2,562 signalized intersections

297 signalized arterial corridors

56 signal systems

- Each individual intersection on the New Jersey state arterials is scored (qualitatively and quantitatively), and accordingly placed into a zone.
  - Intersection Score – Statewide Intersection Analysis Process ("SIAP Score")
  - Corridor Score
  - Traffic Signal Classification Treatment Assignment
- Zone (route segment) score and ranking determines priority level of corridors.
  - Project Prioritization (CTSS and Adaptive)

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Adaptive Signals and Connected Vehicles (CV's)

- Adaptive Signal Construction in NJ:
  - P-77 Signal Cabinet. Larger cabinet to accommodate Adaptive Traffic Signal Control Equipment and future ITS.
  - System Detection. The midblock structures and cabinets to support midblock system detection can be used to support future ITS, such as CV applications.
- Connected Vehicle data can support Adaptive Signal operations by providing vehicle states along the corridor (not just at the intersections) such as position, speed, and acceleration.
  - Connected Vehicles can also provide two-way communication between the vehicle and the traffic signals.

Vehicle to Infrastructure (V2I) Communication

- CV's co
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- Studies
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- This co
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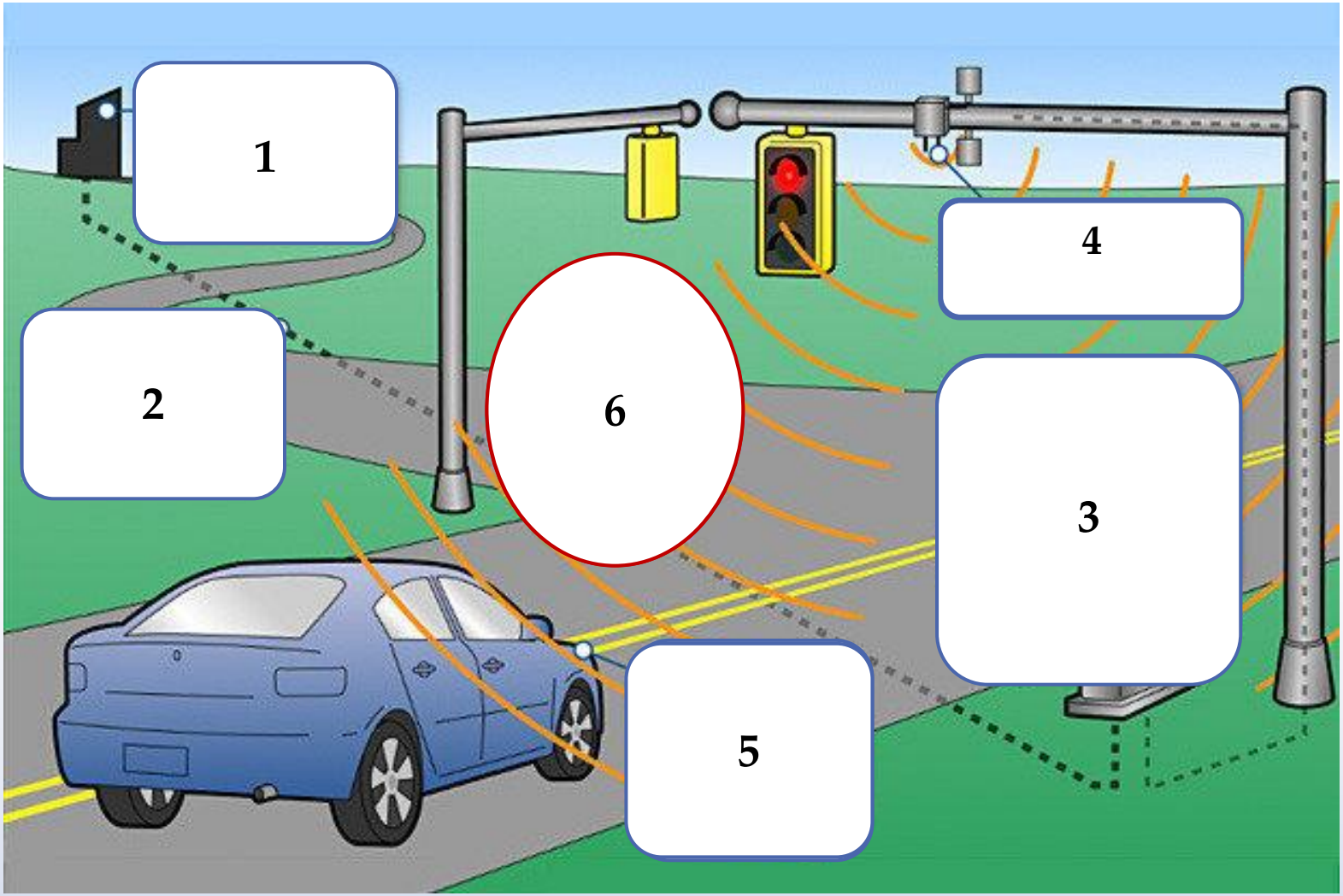
V2I Scenario: Car Approaching a Red Light at a High Speed

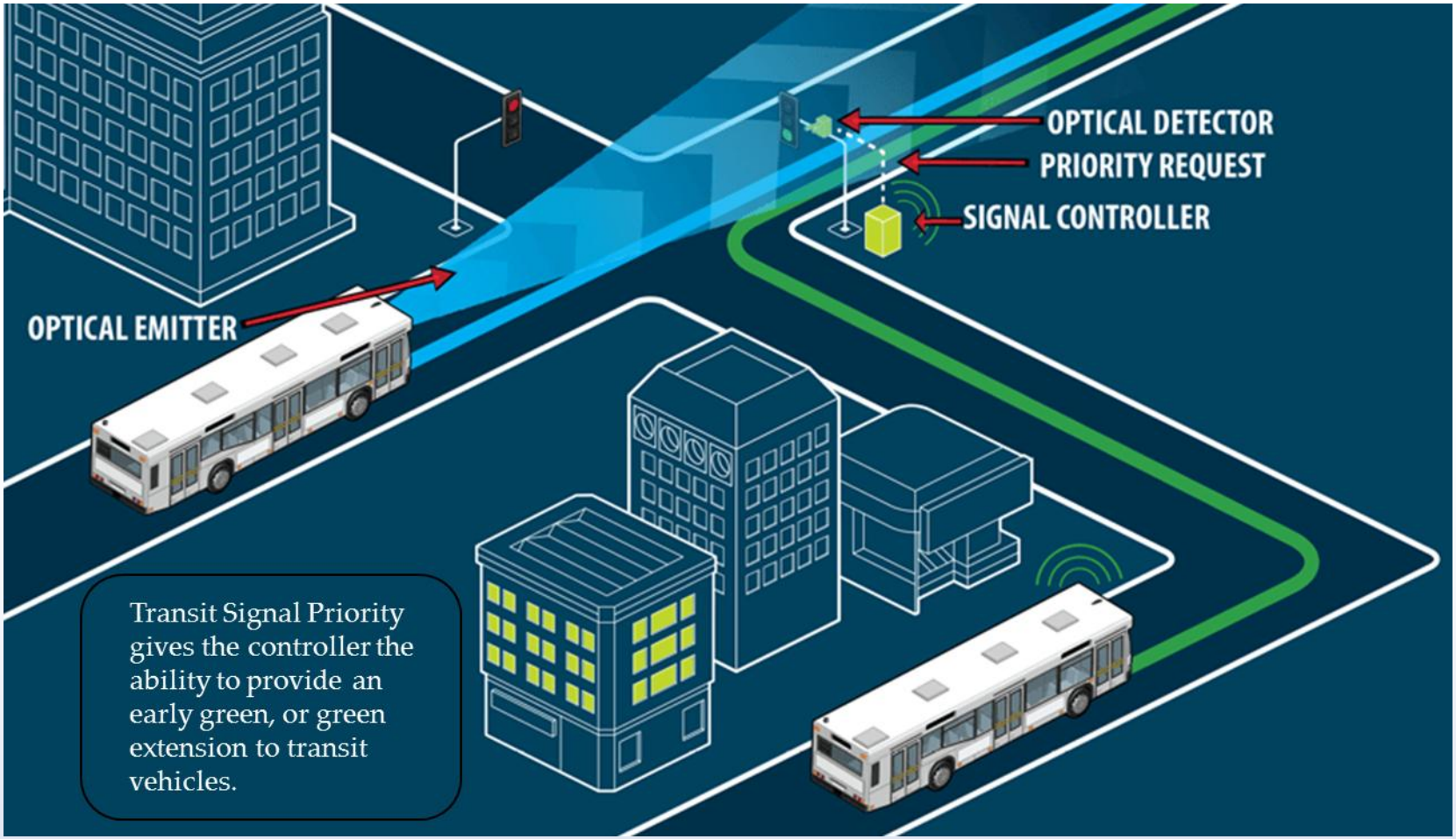


Use of Adaptive Signal Control Technology in Transit Signal Priority (TSP) System

- Transit signal priority (TSP): an operational strategy that facilitates in-service transit vehicles passing through signalized intersections.

- **Adaptive TSP** systems provide priority to transit vehicles, while at the same time trying to minimize negative impacts to other traffic.

Transit Signal Priority



Transit Signal Priority

- Benefits:
  - reduced transit travel times
  - improved schedule adherence
  - improved transit efficiency
  - increased road network efficiency as measured by person throughput
- Requirements:
  - **an adaptive traffic signalized intersection**
  - a detection system aboard transit vehicles
  - a strategy for prioritizing requests


Any
Questions?

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