Agenda

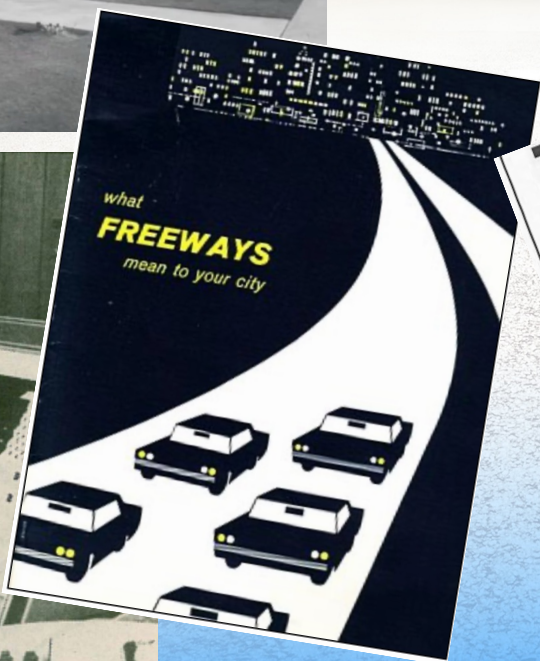Original concepts of ITS & adoption of Signal Systems in the U.S.

ITS Technology evolution from 2000-2025 *Era of the Cloud*

Socio-economic ITS transition, into today's "People First" Equity-based planning with Metrics that Matter

One theme will never change… Safety!

ITS – The Early Years

CONTROLLER DEVELOPS TIMINGS

INFORMATION TO CONTROLLER

MODIFY SIGNALS

DETECTION

what **FREEWAYS** mean to your city

L.A. Gets 'Smart'

Smart Corridor debuts mid-1993

Some political candidates tossed around the term "smart streets" this year as an example of the kind of advanced infrastructure technology that America should be developing.

Once again, Los Angeles County is out in front with a Smart Corridor project that is attracting nationwide industry attention and with a new federal grant for Intelligent Vehicle Highway System (IVHS) technology.

IVHS
Intelligent Vehicle Highway System

ITS Technology Evolution

- Transformation from **IVHS** to National **ITS**
- Use of various **Industry standards** to establish uniformity and compatibility. *A few examples:*

  o NEMA TS1 & TS2 (Environmental, form factor, hardware, operation)
  o NTCIP 1201 & 1202 (Controller database & Comm)
  o Caltrans TEES 2020 (Environmental, form factor, hardware)
  o IEEE 801.x & 1609 (Communications)
  o SAE J2735 V2x (Connected Vehicle Integration)

Saving Lives Through Improved Mobility

ITS Roadway Systems Elements

"Surface transportation in the United States is at a crossroads. The mobility we prize so highly is threatened. Many of the nation's roads are badly clogged. Congestion continues to increase, the conventional approach of the past—building more roads—will not work in many areas of the country, for both financial and environmental reasons.

—Intelligent Vehicle-Highway Systems Strategic Plan, prepared by IVHS America (1992)[25]

ITS Joint Program Strategic Plan

SAFETEA-LU 2005 Renamed from IVHS to ITS.
(Safe Accountable Flexible Efficient Transportation Equity Act)
- Created ITS JPO Program
- Current Strategic Plan period 2020-2025

Intelligent
Transportation
Systems Joint
Program Office

Strategic Plan
2020-2025

U.S. Department of Transportation

WWW.ITS.DOT.GOV/STRATPLAN2020
PUBLICATION DATE: JANUARY, 2020
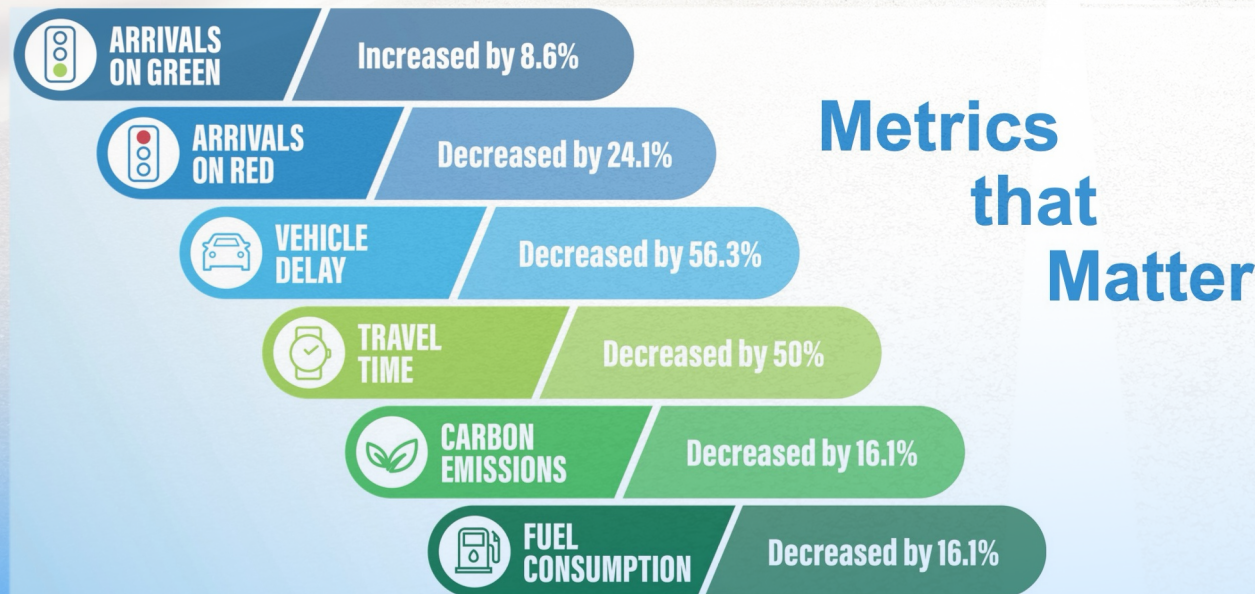PUBLICATION NUMBER: FHWA-JPO-18-746

ITS JPO STRATEGIC RESEARCH AREAS

- Emerging and Enabling Technologies
- Data Access and Exchanges
- Cybersecurity for ITS
- Automation
- Complete Trip – ITS4US
- Accelerating ITS Deployment through:
  - ITS Evaluation
  - ITS Professional Capacity Building
  - ITS Architecture and Standards
  - ITS Communications

2020-2025 ITS Advances in Arterial Mgt.

- Automated Traffic Signal Performance Measures (ATSPM)
  - Originated by Purdue Univ., implemented by Utah DOT
- Transit Signal Priority Optimization
  - Tools to minimize impacts of Priority & Preemption on Coordination
- Vehicle to Controller Infrastructure Communications (V2i)
  - Connected & Autonomous Vehicle 5G Integration

ARRIVALS ON GREEN — Increased by 8.6%

ARRIVALS ON RED — Decreased by 24.1%

VEHICLE DELAY — Decreased by 56.3%

TRAVEL TIME — Decreased by 50%

CARBON EMISSIONS — Decreased by 16.1%

FUEL CONSUMPTION — Decreased by 16.1%

Metrics that Matter

NEXT TRAIN 3 MINUTES

2020-2025 ITS Advances in Arterial Mgt.   (cont.)

- AI-based Video & Radar based Detection Systems
  - Trajectory data for dilemma zone mitigation & pedestrian safety
  - Safety improvements for Vulnerable Road Users (VRU)
- Crowd Source Congestion Data
  - Cellular device travel time tracking via 3rd party live feeds
- Predictive Analytics (Machine learning)
  - Red Light running prediction & mitigation
  - Traffic Controller Pattern Optimization (Real-time Adaptive)
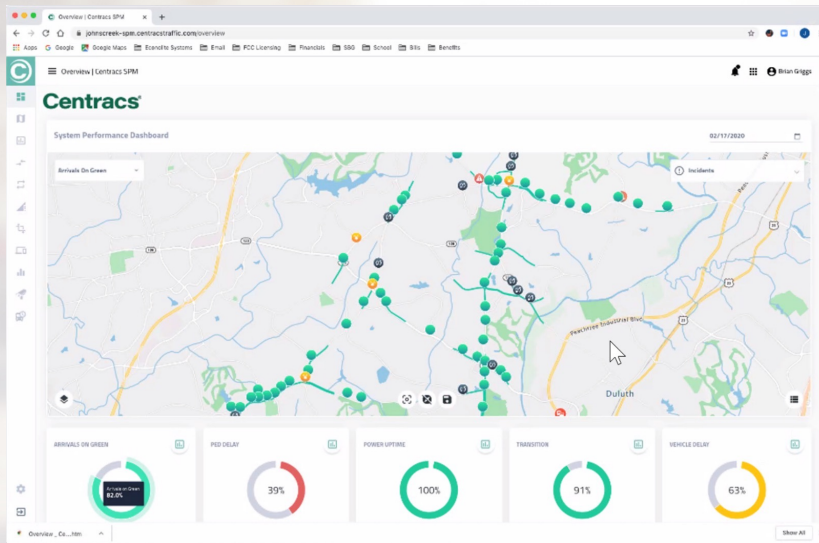- Wrong-Way Freeway Ramp Detection Alert Systems

What Elements make up a Signal System?

- *Key Traffic Control System Components*

  o **Controller** (CPU based ATC, with real-time OS or Linux)

  o **Cabinet** Assembly & Safety Monitor (CMU or MMU)

  o LED Signal **Display** Lamps (Balls, arrows, Ped Countdowns, Bike signals)

  o **Sensors** - Loop, Radar, or Video Detection (Vehicle, Bike, Scooter, Pedestrian)

  o **Priority & Preemption** Operation for Transit and Emergency Vehicles

  o **Network** Communications (Copper, Fiber, Radio, or Cellular Broadband)

  o Battery Backup System (**BBS**) for continuous run time during power loss

  o **CCTV** Camera Monitoring, Pan-Tilt-Zoom (PTZ) Controls

  o **System** Software – Integrates all of the above!

Spoiler Alert: **Most Critical Four Categories – Cabinets, Controller, Systems, Sensors**

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How SPM Hi-Res Data is Compiled

Scanned Controller Enumeration Lookup Table

Timestamp,
Enumeration Code,
Data Parameter

06/27/2013 01:29:51.1	10	8
06/27/2013 01:29:51.1	82	5
06/27/2013 01:29:52.2	1	2
06/27/2013 01:29:52.2	1	6
06/27/2013 01:29:52.3	82	2
06/27/2013 01:29:52.8	82	4
06/27/2013 01:29:52.9	81	4
06/27/2013 01:29:53.3	81	6
06/27/2013 01:29:54.5	81	2
06/27/2013 01:30:02.2	8	2
06/27/2013 01:30:02.2	8	6
06/27/2013 01:30:02.2	33	2
06/27/2013 01:30:02.2	33	6
06/27/2013 01:30:02.2	32	2
06/27/2013 01:30:02.2	32	6
06/27/2013 01:30:06.1	10	2
06/27/2013 01:30:06.1	10	6
06/27/2013 01:30:08.1	1	8
06/27/2013 01:30:13.1	32	8
06/27/2013 01:30:15.8	81	5
06/27/2013 01:30:18.5	82	6
06/27/2013 01:30:27.5	81	6
06/27/2013 01:30:30.4	8	8

Detector 5 ON

Phase 8 GREEN

Detector 5 OFF

1/10th Second
Scan-Rate Resolution

Active Phase Events:

0	Phase On
1	Phase Begin Green
2	Phase Check
3	Phase Min Complete
4	Phase Gap Out
5	Phase Max Out
6	Phase Force Off
7	Phase Green Termination
8	Phase Begin Yellow Clearance
9	Phase End Yellow Clearance
10	Phase Begin Red Clearance
11	Phase End Red Clearance

Detector Events:

81	Detector Off
82	Detector On
83	Detector Restored
84	Detector Fault- Other
85	Detector Fault- Watchdog Fault
86	Detector Fault- Open Loop Fault

Preemption Events:

101	Preempt Advance Warning Input
102	Preempt (Call) Input On
103	Preempt Gate Down Input Receiv
104	Preempt (Call) Input Off
105	Preempt Entry Started

Putting it all together

Signal Optimization

Utilizing:
- Cabinets
- Controllers
- System Software
- Sensors (Detectors)

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Saving Lives Through Improved Mobility

Econolite *Four Pillars*

Cabinets

Econolite's traffic control cabinets are designed and built to future proof the intersection. With the industry's widest variety of cabinet options, and quickest delivery times, agencies can choose from our **Blue Series** line of ready-to-ship cabinets, from **ATCC**, **NEMA**, **33x**, and **hybrid** styles. Additionally, we offer a full breadth of cabinet accessories, from **ZincBlue** UPS, and electronic locks, to artful cabinet wraps for City beautification programs.

Controllers

Econolite's traffic controllers are critical for the overall safety of intersections and to support Connected and Automated Vehicle programs. We offer the **ATC 2070** and **Cobalt**® lines of advanced traffic controllers. Cobalt, powered by the revolutionary **EOS Controller Software**, is the latest in a long history of agency-preferred traffic controllers, known for their focus on safety, efficiency, responsiveness, and ease of use.

Systems

Econolite Systems focuses on delivery of product and service solutions across the entire ITS project spectrum – from software development, system design, integration, field-services, and operations, to public policy, and planning assistance for V2X programs. The interoperable industry leading **Centracs**® **Mobility platform** offers agencies advanced transportation management solutions and has been deployed in over 57,000 intersections worldwide.

Sensors

Econolite provides best-in-class, cross-spectrum sensor solutions for vehicle, bicycle, and pedestrian detection. We know that every agency's detection objectives are unique, and can often be challenging. We offer a sensor solution to address each agency's specific application need. From **Autoscope**® **video**, **EVO RADAR**™, and **AccuSense**® in-ground magnetometers, each technology is designed and developed with simplicity in mind for easy set-up and ease of use.

ECONOLITE

Saving Lives Through Improved Mobility

Cabinets

Traffic control cabinets should be designed and built to future proof the intersection.

- Wide variety of cabinet options, finishes, and delivery times. Anti-graffiti wrap is popular.

- Standard platform to match existing infrastructure
  - NEMA TS1 or TS2
  - Caltrans Model 332 or 334
  - Hybrid 332 & TS2
  - ATC Cabinet Standard (ATCC)

- Cabinet accessories from **ZincBlue** BBS, electronic locks, to artful cabinet wraps for local beautification programs

Controllers

Traffic controllers are critical for the overall safety of intersections, and to support Connected and Automated Vehicle (CAV) programs.

- **ATC 2070** and **Cobalt**® Color Display Advanced Traffic Controllers

- Cobalt, with **EOS Controller Software**, continues a long history of agency-preferred traffic controllers, known for their focus on safety, efficiency, responsiveness, and ease of use

ITS Transportations Metrics that Matter

INTELLIGENT CONTROLLER TECHNOLOGY
for Safer, Smarter Intersections

Cobalt® Advanced Transportation Controllers

Transportation Metrics that Matter

- Reduction in Emissions
- Safety Improvements
- Fuel Savings
- Travel Time Reduction

Systems

The System focuses on delivery of service solutions across the entire ITS project spectrum.

- Software development, system design, integration, field services, and operations, to public policy, and planning assistance for V2X (Connected Vehicles)

- Cloud-based Centracs® Mobility platform provides advanced transportation management tools

- Traffic management that delivers actionable **Metrics that Matter** and operational insights for: rich data analytics, real-time status, events and alerts, signal timing database editor

- Interactive Dashboard can highlight problem areas needing attention immediately upon login.

Systems – Connected Vehicles

V2I technologies, policy, and planning to enable Vehicle-to-Infrastructure (V2I) communications

- **Policy -** Developing CAV system strategies, planning, and operational reports

- **Design, Deployment and Integration -** Utilizing complete multi-modal IP networks, including cabled media, cellular, and private wireless technologies

- **System Planning and Design -** Providing R&D services, educational workshops and forums, test facilities, pilot programs and deployments

- **Installation to Field Maintenance**, ITS solutions planning and design of traffic control systems, including "third party" components

- **Area-wide ITS solutions** planning and design of traffic control systems, operations, and signal maintenance

CAVita

Sensors

Importance of cross-spectrum sensor solutions for vehicle, bicycle, and pedestrian detection.

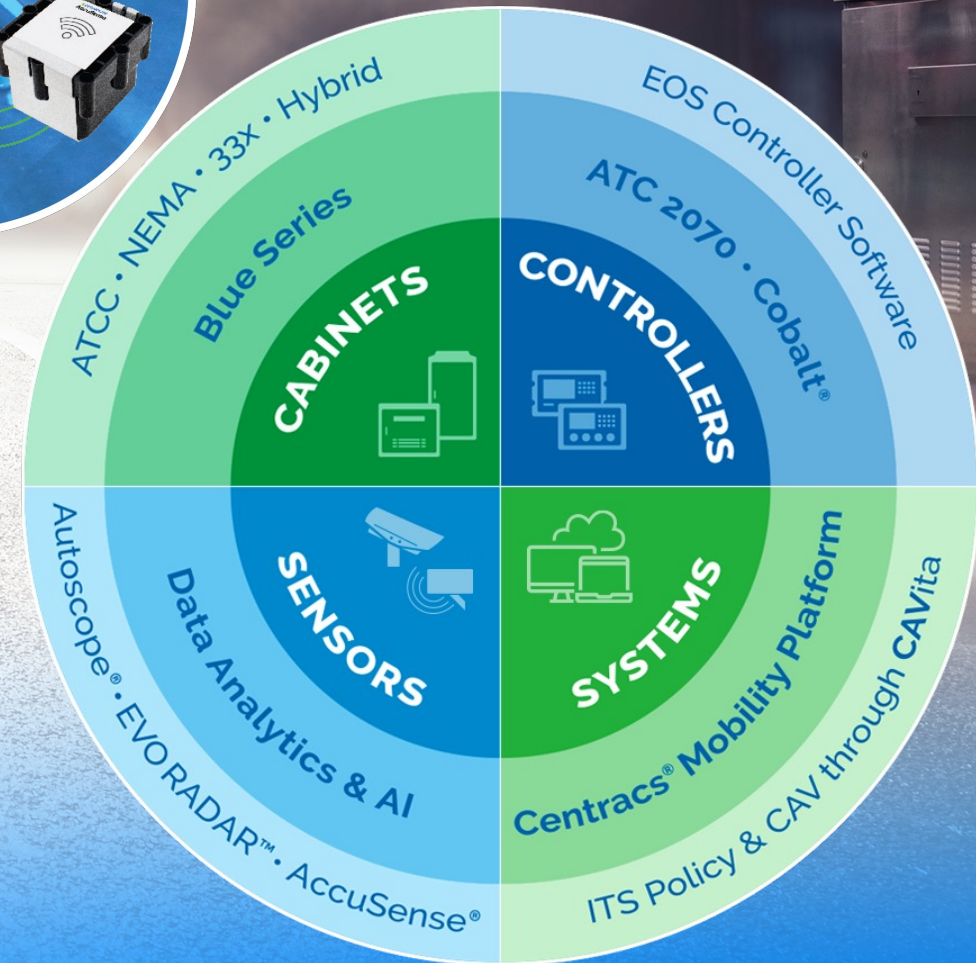- Sensor solutions to address each agency's specific application need:
  - ✓ **EVO RADAR**™
  - ✓ **Autoscope**® video
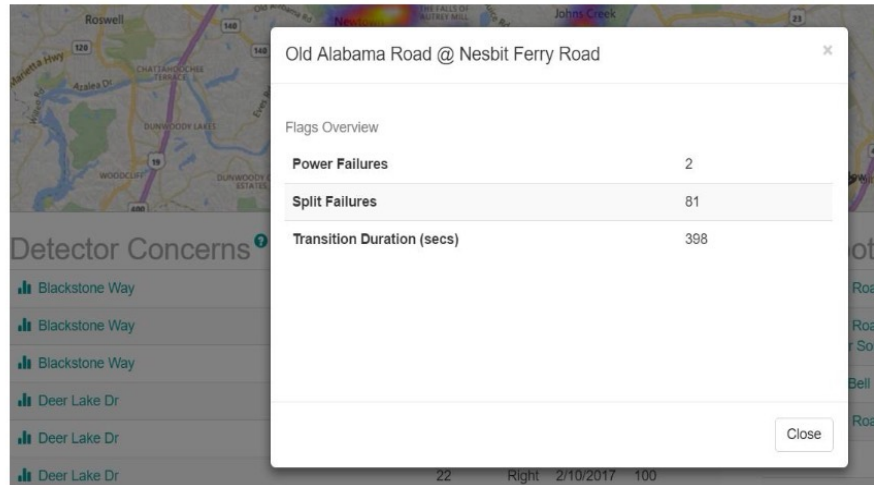 - ✓ **AccuSense**® in-ground magnetometers

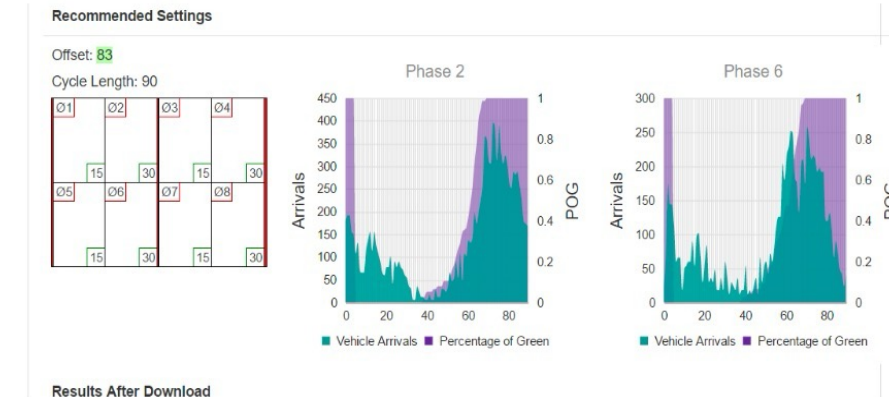# Evolution of Signal Optimization

Reactive

"I had to wait 5 minutes for the light to change!"

Proactive

There are abnormally high spilt failures at Old Alabama and Nesbit Ferry road

Automated Recommendations

Update phase 2&6 split times to 22 seconds and 4&8 to 15 seconds to reduce split failures

ITS Brings Tomorrow's Innovations to today's talented graduates

Questions ?

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