A little history....1998

- Purdue/INDOT continue to collaborate
  --Research Cabinet
- Contact closures terminating in lab
- Opto-Isolated separate cabinets
A little history....2003

• 2003- Purdue/INDOT collaboratively continue to improve the research platform

• Contact closure I/O through TS1 video detection device....All detection and phase data separate cabinets

  2 intersections ~ $1,500,000
The Motivation: Metrics
The Motivation: PFS

- Focus,
- Larger footprint,
- Collaboration
Architecture for Active Management of Geographically Distributed Signal Systems

INTRODUCTION

Significant arterial road networks are a substantial component of the highway transportation network in the United States. The National Transportation Operations Coalition (NTOC) in its 2007 Traffic Signal Report Card noted that, nationally, five to 10 percent of all traffic delay is caused by improper traffic signal timings along major roadways. In 2007, the National Report Card score for overall traffic signal systems operations was 1.3.

Upgraded intersection controllers, communication detection equipment, closed-loop systems, and/or central systems can provide modest improvements. However, there are more significant improvement opportunities for traffic operations and agency manpower efficiency by defining active management practices and implementing alternative traffic signal architectures that go beyond traditional closed-loop and central system models. The following sections document the state of Indiana’s vision and green time to ensure that all movements have sufficient capacity. However, there are clearly other objectives that may or may not enter into consideration, such as pedestrian service, transit priority, and emergency vehicle operations. Although this is an obvious step, agency staff responsible for managing the system will not have clear guidance on how to prioritize competing demands unless there is clear consensus on an agency’s priorities.

2. Collect fundamental signal operations data. Historically, central and closed-loop monitoring systems have displayed near real-time status of phase indications and detectors, but only archived five- or 15-minute flow rates. For any substantive analysis of the signals operation, high-resolution phase indication and detector status must be collected.4, 5

3. Analyze data using theoretically
Pooled Fund Study 1296 Objectives

- Develop a network of transportation agencies to:
  
  - **i) Performance Measures:** develop consensus on operational standards of performance,
  
  - **ii) Central System Architecture for Distributed Wide Area Systems:** define a central management model that can leverage commercial wireless IP offerings that can be competitively outsourced, and
  
  - **iii) Management Concepts and Guidelines:** for using a central system, identify when and where resources are most needed to maximize return on investment.
Pooled Fund Study Products (FHWA, Purdue and Agency Partners)

"Volume 1"
Defining Performance Measures...
Download at: tinyurl.com/signalmoe

"Volume 2"
Business Practices, Use Cases, and Implementation...
Estimated to publish in March 2016

Integration of Performance Measures into Traffic Signal Systems Business Practices
(Forthcoming in 2016)
Observations From the Snow Bunker

Rick Denney
FHWA Resource Center
The Snow Bunker
Observations

• Collaboration
• What’s Important?
• This is a Biggie
• A Tale of Two States
• What Now?
Pooled-Fund Studies

• Are for research
• States kick in their SP&R money to achieve what they could not achieve individually
• States take the lead
• The idea here is to develop tools, and to develop tools that can be implemented cheaply
AASHTO Innovation Initiatives

• Implement good ideas whose time has come
• States take the lead
• The idea here is to implement tools, and find ways to implement them efficiently
The Perfect Marriage

• With the PFS developing tools and the Implementation Initiative planting them around the country, something very special has happened
But What’s Really Important?

• In the past, we have confused performance measures with objectives

• Without objectives, we don’t know what performance means

• Without objectives, we can’t develop strategies for systems and operational approaches in different network and demand contexts
SPM’s Support Objectives (Two Examples)

• If our objective for an uncongested arterial is smooth flow...
  • The PCD and Arrivals On Green tell us if we are achieving it

• If our objective for a congested arterial is maximizing throughput...
  • V/C by phase and cycle tells us how to balance green time to maximize throughput
  • Phase termination identifies congestion
Automated Signal Performance Measures Are The Biggest Thing To Happen In The Signal Industry Since Phased-Based Intersection Control
This is a Biggie

• Signal timing was always an art
  • Gurus stood on the street corner
  • They knew it when they saw it
  • They usually couldn’t explain it

• The science was in modeling and optimizing
  • Models eat volumes, but do we really need volumes?
    *Volume data is expensive, so we only do it every 3 years (if we are lucky!)*
  • Optimizing assumes an objective, but did we just assume they were the right objectives?
Biggie, continued

• SPM’s put the science on the side of observation, rather than modeling
• SPM’s tells us what the optimizer is really doing, with respect to our objectives
• SPM’s illustrate performance, not models
• But how can we afford it?
A Tale of Two States

• Indiana, with a small centralized staff...
  • Uses and develops SPM’s to *daily* monitor arterial systems statewide for good basic service...
  • As a strategy to get the most out of limited staff resources

• Utah, with a directive to be the best in the world...
  • Uses and develops SPM’s to achieve the best possible operation...
  • As a strategy to pursue technology to its limits
We Can Afford It

• Start with our most important arterial
• Build detectors that last
• Use ad-hoc stored data if we have to
• Buy controllers that support it
• Do it as a first step before implementing adaptive control
• Even if we have to do it one intersection at a time, we’ll never have it if we don’t start
We Can’t Afford Not to Do It

• If we *can* know the performance of our signals, we are *obligated* to know it
  • That’s a basic expectation of public service

• It gives us a real and positive story to tell
  • Instead of predicting disaster that never comes when our budgets get cut

• Understanding performance is a principle of providing good basic service
What Now?

• Utah can’t be the Giver of Software forever
• Most agencies struggle to maintain in-house software (Federal agencies, too)
• The next step is a business model
  • Software embedded in signal system products
  • Software offered as a commercial product
  • Use of server offered as a commercial service
• If you buy it, implemented it, spec it, demand it, the business models will come. *This will happen.*
You Know Where I’ll Be
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