

TS78 - MEASURING PERFORMANCE

12286 Automated Traffic Signal Performance Measures
– A Simplified Alternative Architecture



Mark Taylor, P.E., PTOE
Traffic Signal Operations Engineer
Utah Department of Transportation, USA
marktaylor@utah.gov



Opportunity – UDOT Executive Leaders - 2011

“What would it take for UDOT’s traffic signals to be World-Class?



John Njord



Carlos Braceras

QIT Recommendations (July 2011)

- Require that communications and signal detection be maintained during projects.
- Transition from reactive to proactive signal maintenance by increasing signal maintenance funding.
- **Implement real-time monitoring of system health and quality of operations.**
 - ❖ Automated Traffic Signal Performance Measures (SPM's)

Beginning of SPM's for UDOT

PERFORMANCE MEASURES FOR TRAFFIC SIGNAL SYSTEMS

An Outcome-Oriented Approach

Christopher M. Day, Darcy M. Bullock, Howell Li, Stephen M. Remias, Alexander M. Hainen, Richard S. Freije, Amanda L. Stevens, James R. Sturdevant, and Thomas M. Brennan



PURDUE
UNIVERSITY



ITE Journal, March 2014
feature |

Helping Traffic Engineers Manage Data to Make Better Decisions

Automated Traffic Signal Performance Measures

BY DARCY BULLOCK, P.E., ROB CLAYTON, P.E., PTOE, JAMIE MACKY, P.E., STEVE MISGEN, P.E., PTOE, AMANDA STEVENS, P.E., JIM STURDEVANT, P.E., AND MARK TAYLOR, P.E., PTOE

Improved signal operations with smooth and equitable traffic flow are goals for most traffic engineers; however the limited snapshot-view retiming methods that involve manual data collection, traffic signal modeling, and field fine-tuning are resource intensive and unresponsive to changes in traffic patterns. The National Transportation Operations Coalition's 2012 National Traffic Signal Report Card has led agencies to focus resources on these activities and develop methodologies to examine all the components of traffic signal operations.¹ These data-driven program management plans provide objective methods for identifying shortcomings and encourages coordination with neighboring jurisdictions. In addition, agencies need tools to prioritize activities when resources are constrained.

www.ite.org March 2014 33

SPM's – Requirements & How it Works

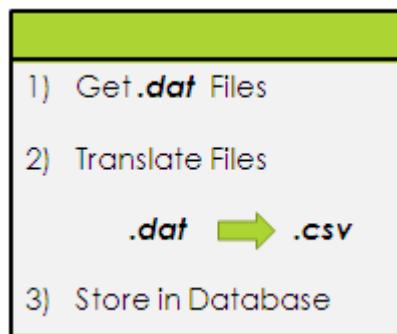


1) High-resolution Controller

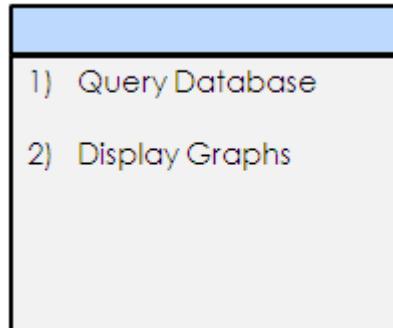
- Econolite Cobalt: Any Version
- Econolite ASC3 NEMA: V. 2.50+ & OS 1.14.03+
- Econolite 2070 with 1C CPU Module: V. 32.50+
- Intelight Maxtime: V. 1.7.0+
- Peek ATC Greenwave 03.05.0528+
- Trafficware 980ATC V. 76.10+
- Siemens M50 Linux & M60 ATC
 - ECOM V. 3.52+
 - NTCIP V. 4.53+



2) Communications



3) Server



4) Website



5) Detection

Can be done independent of a Central System!

September 10, 2014

Metrics & Detection Requirements



Controller high-resolution data only

Purdue Phase Termination
Split Monitor



Advanced Count Detection (~400 ft behind stop bar)

Purdue Coordination Diagram
Executive Summary Reports

Arrivals on Red
Approach Delay

Approach Volume
Link Pivot (future)

Advanced Detection with Speed

Approach Speed

Lane-by-lane Presence Detection

Purdue Split Failure (future)

Lane-by-Lane Count Detection

Turning Movement Counts
Red Light Monitoring (future)

Probe Travel Time Data (GPS or Bluetooth)

Purdue Travel Time Diagram

UDOT's SPM Website – Available to All

UDOT udot.utah.gov

Signal Performance Metrics

AASHTO Innovation Initiative

Charts **Reports** **Log Action Taken** **Links** **FAQ**

-> Signal Metrics

Selected Signal
7063 Bangerter Hwy (SR-154) 5400 South (SR-173)

Signals

Region: All Metric Type: All Filter: Signal Id

Metric Settings

Metric Type

Approach Delay Purdue Phase Termination
 Approach Volume Speed
 Arrivals On Red Split Monitor
 Purdue Coordination Diagram

Consecutive Count

Show Plan Stripes Show Ped Activity
 Upload Current Data

Dates

Start Date: 8/27/2014 12:00

End Date: 8/27/2014 11:59

Reset Date

Sun	Mon	Tue	Wed	Thu	Fri	Sat
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Map

WYOMING

Rock Springs

Great Lakes

Battle Mountain

Boise

Idaho City

Dinosaur N.M.

Uintah and Ouray I.R.

Colorado

Grand Staircase-Escalante N.M.

Ute Mountain

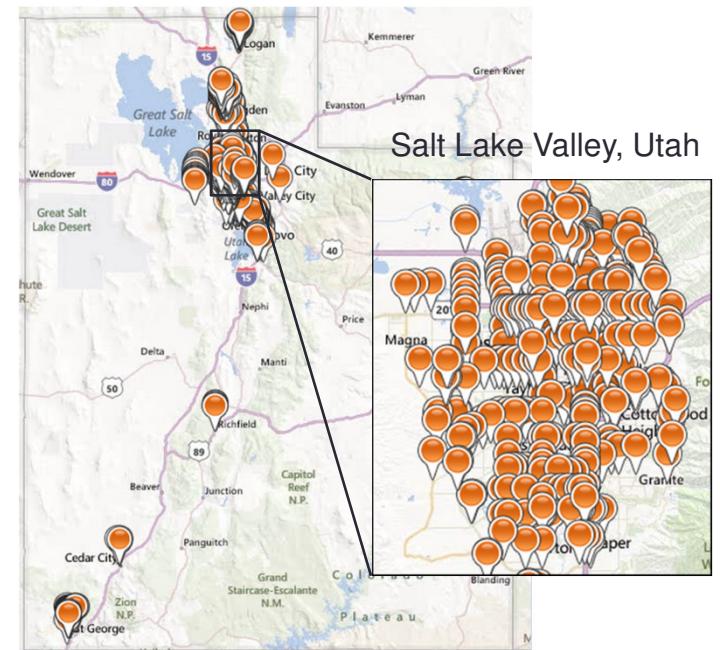
Navajo Indian Reservation

Papago Springs

NEVADA

BRIGHAM CITY

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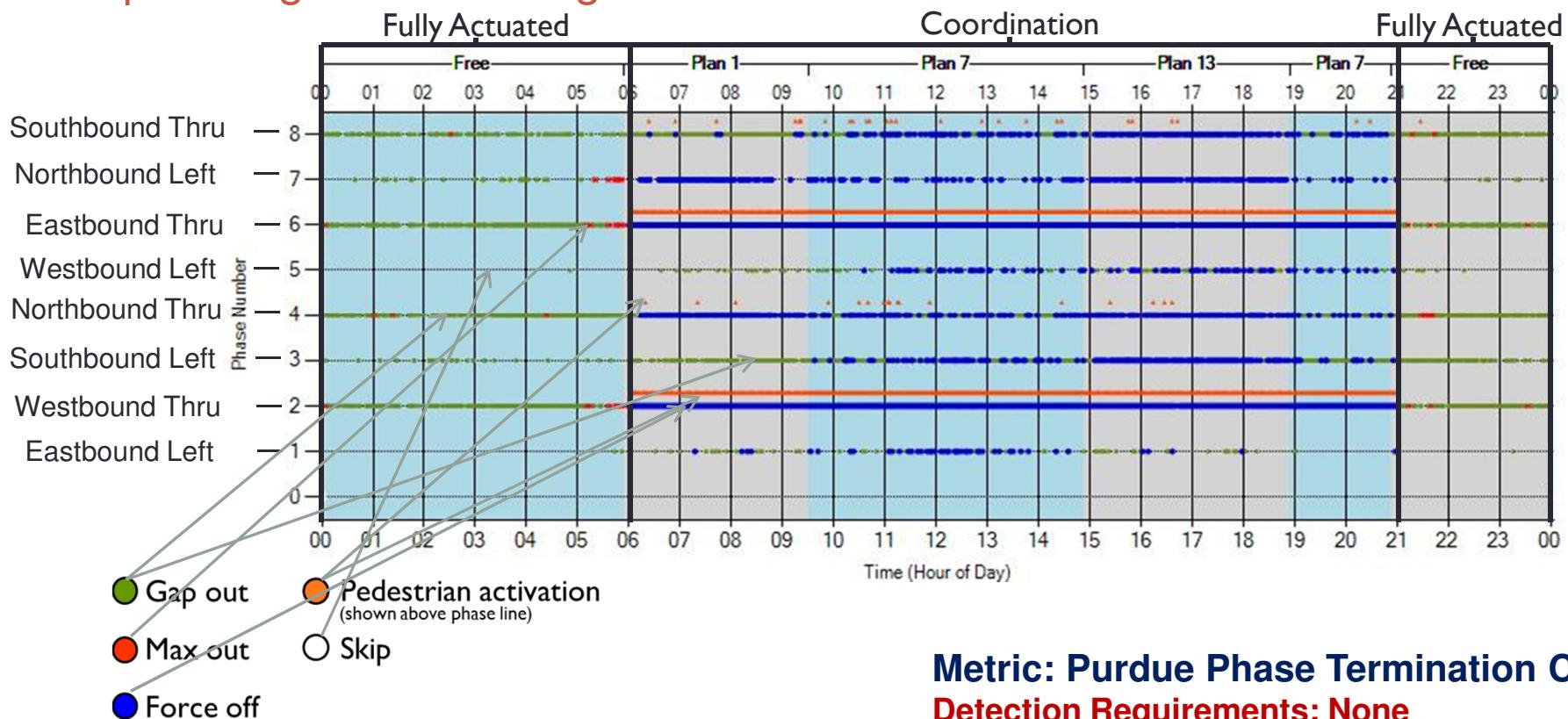


1250 of 1900 Utah Traffic Signals

<http://udottraffic.utah.gov/signalperformancemetrics>

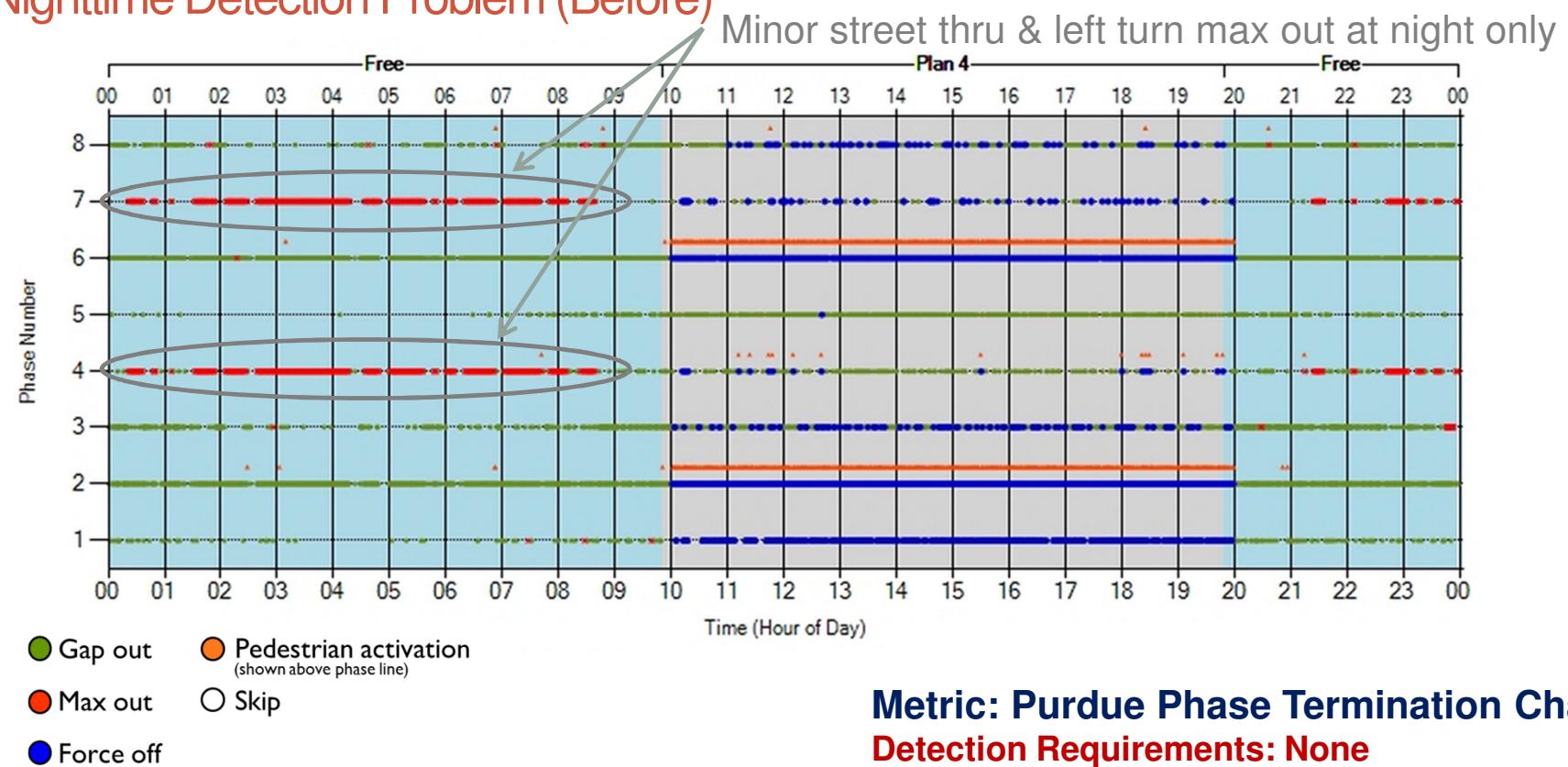
Normal Intersection Example:

8-phase signal with working detection



Maintenance Example:

Nighttime Detection Problem (Before)



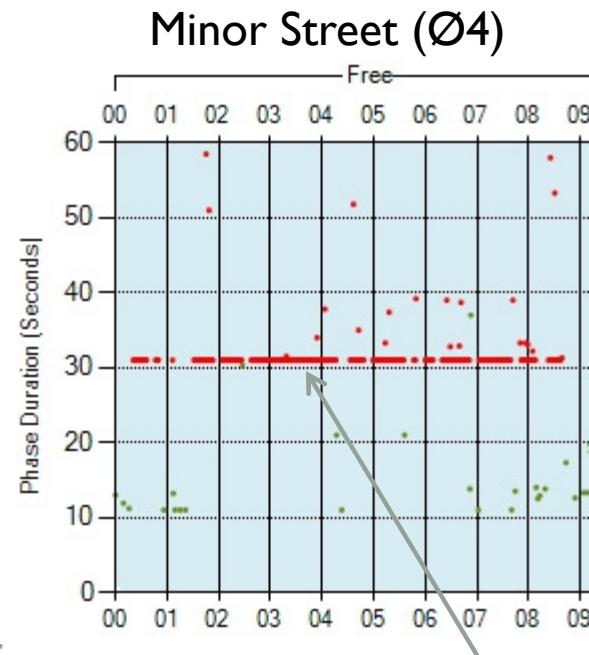
Maintenance Example:

Nighttime Detection Problem (Before)



- Gap out
- Pedestrian activation (shown above phase line)
- Max out
- Force off
- Skip

Major Street sees 20 s of green and 30 s of red

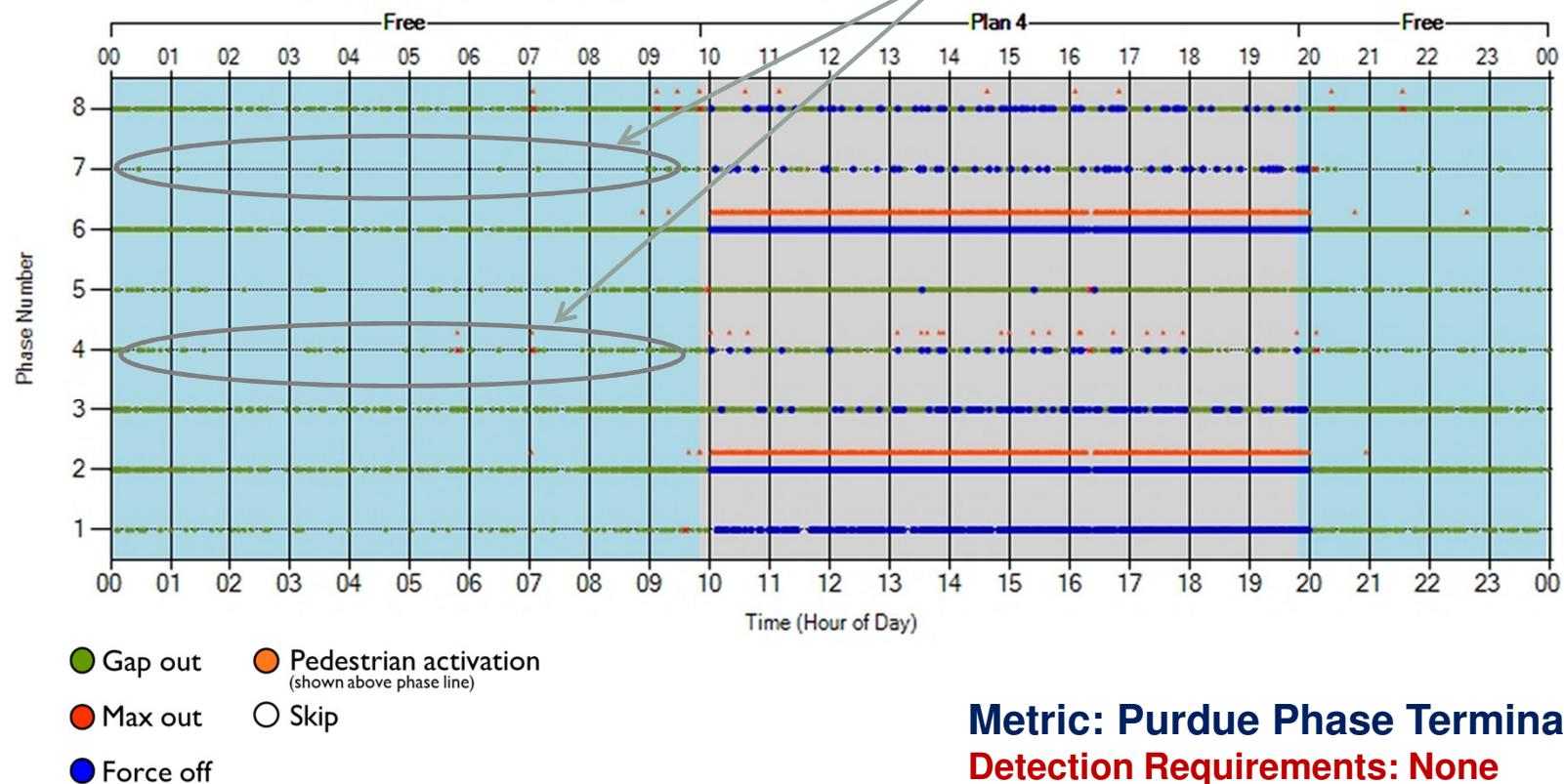


Metric: Split Monitor
Detection Requirements: None

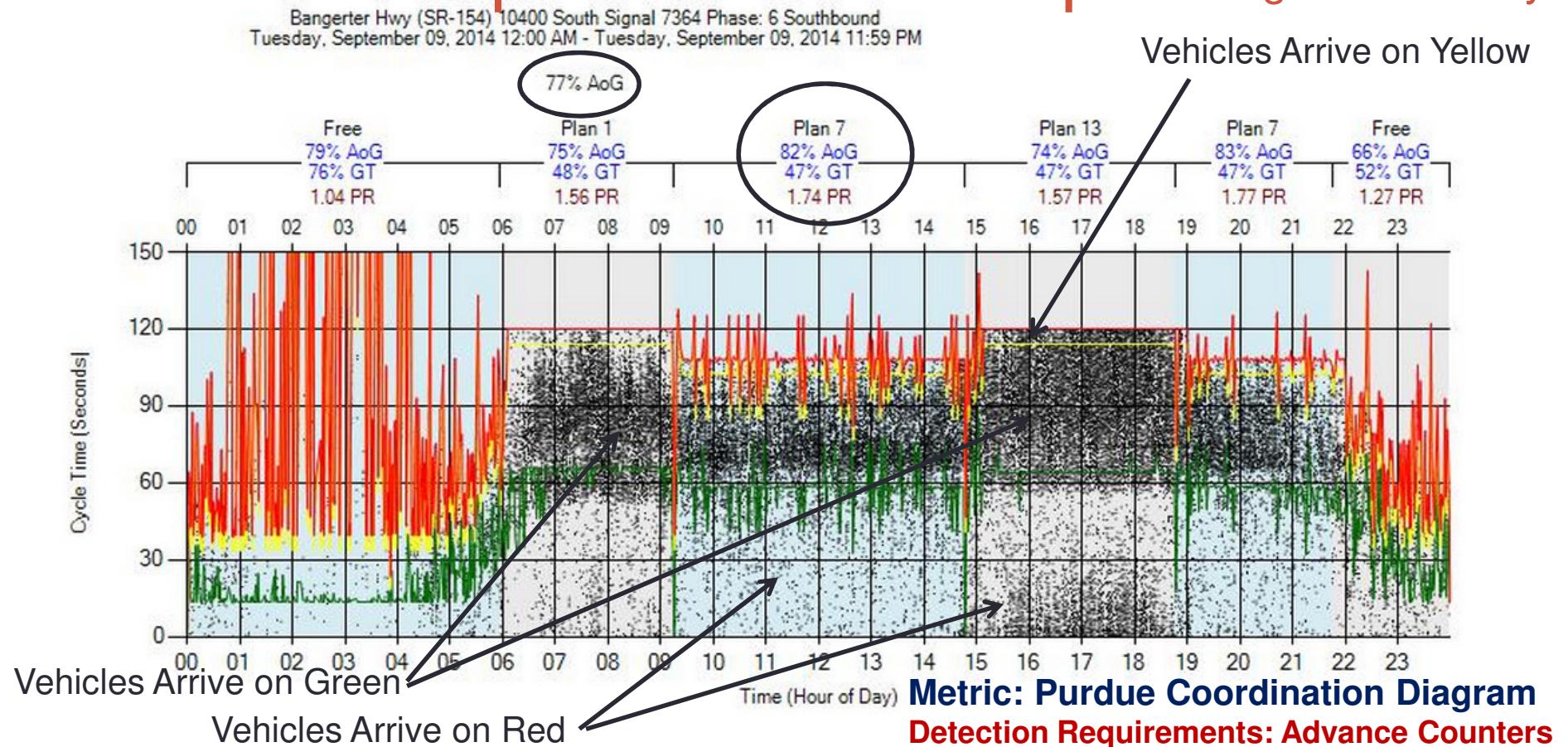
Maintenance Example:

New Detection Technology Installed (After)

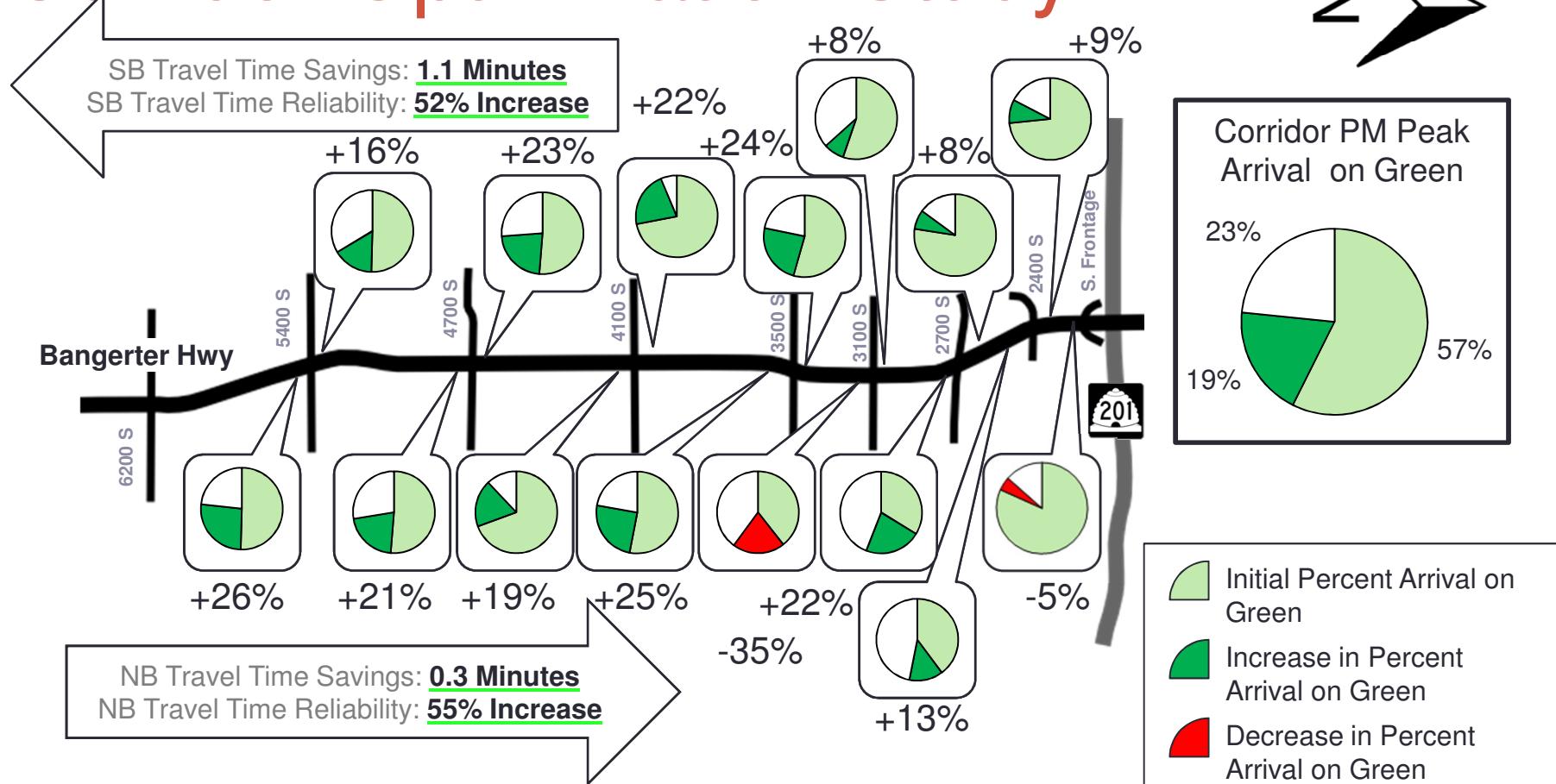
Phases are rarely used at night



Coordination Optimization Example: Progression Quality



Corridor Optimization Study



Executive Reports & Prioritizing:

Statewide Summary 24 hours / day In Utah, USA

Month	Arrival on Red		Volume	Intersections	
Month	Percent	Platoon Ratio	Daily Average Per Approach	Total	Number of Approaches
Aug 2014	30%	1.16	10,740	414	843

- Region, corridor, and intersection summaries also available.
 - Prioritize coordination projects where they're needed the most.
- Software project to breakdown by time-of-day instead of 24/7.
- Engineers could now **directly measure** what previously they could only **estimate and model**.

Metric: Executive Reports

Detection Requirements: Advance Counters

Automated Traffic Signal Performance Measures

AASHTO Innovation Initiative (formally TIG) 2013 Focus Technology

Mission: Investing time and money to accelerate technology adoption by agencies nationwide



Thank You!

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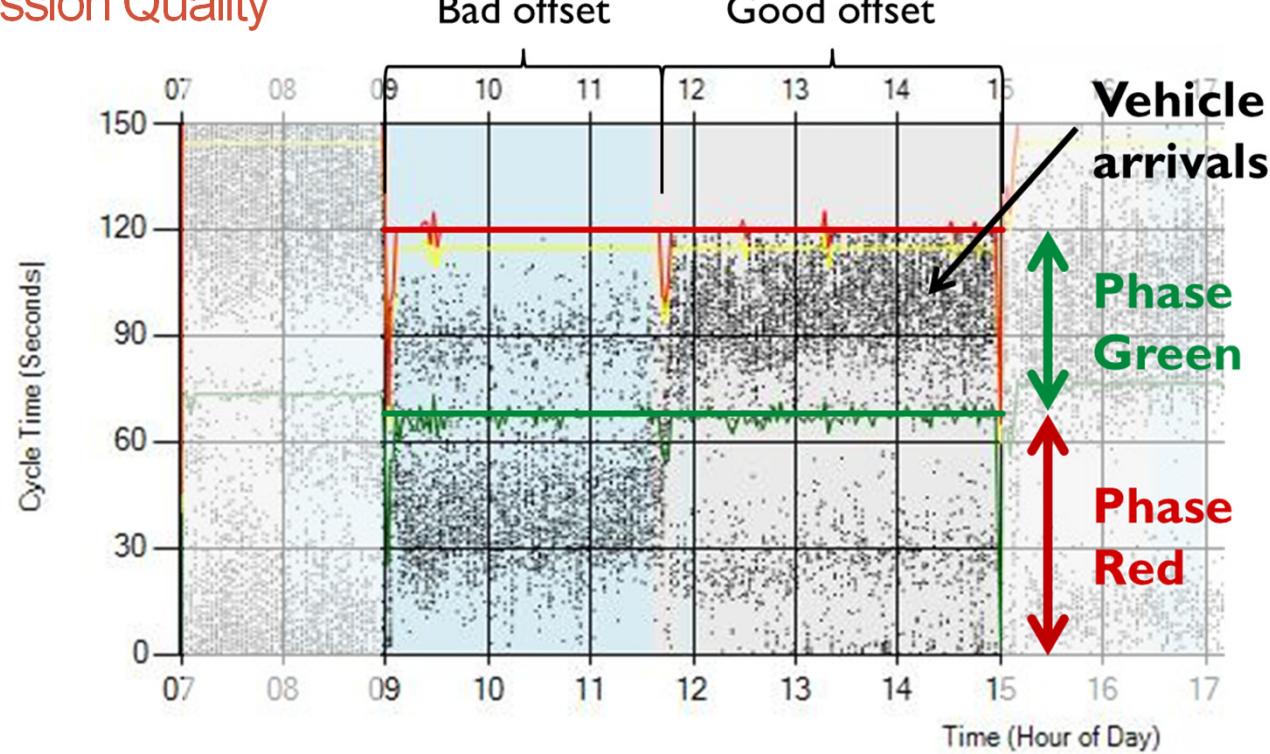
<http://udottraffic.utah.gov/signalperformancemetrics>

Controllers with Indiana Datalogger Enumerations

- Econolite Cobalt: Any Version
- Econolite ASC3 NEMA: V. 2.50+ & OS 1.14.03+
- Econolite 2070 with 1C CPU Module: V. 32.50+
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 - NTCIP V. 4.53+

Coordination Optimization Example:

Progression Quality



Metric: Purdue Coordination Diagram
Detection Requirements: Advance Counters

Operations & Traffic Study Example:

Vehicle Speeds at Intersections

