

System Architecture and Design

Active Traffic Management Workshop

Merrillville, IN

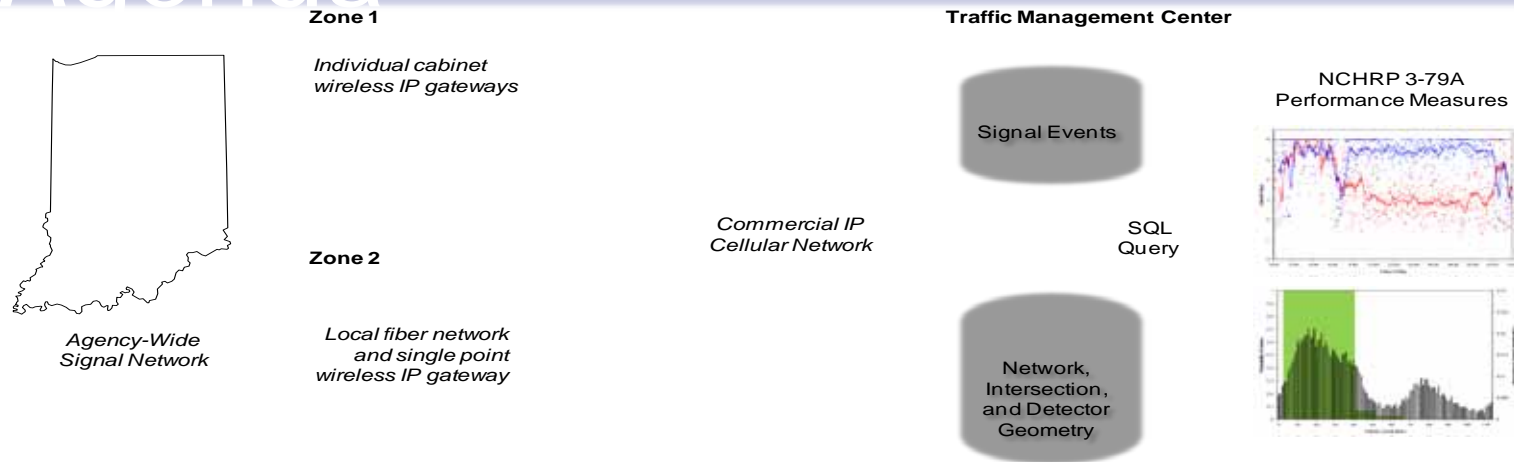
Jim Sturdevant PE

INDOT

Dec 2011



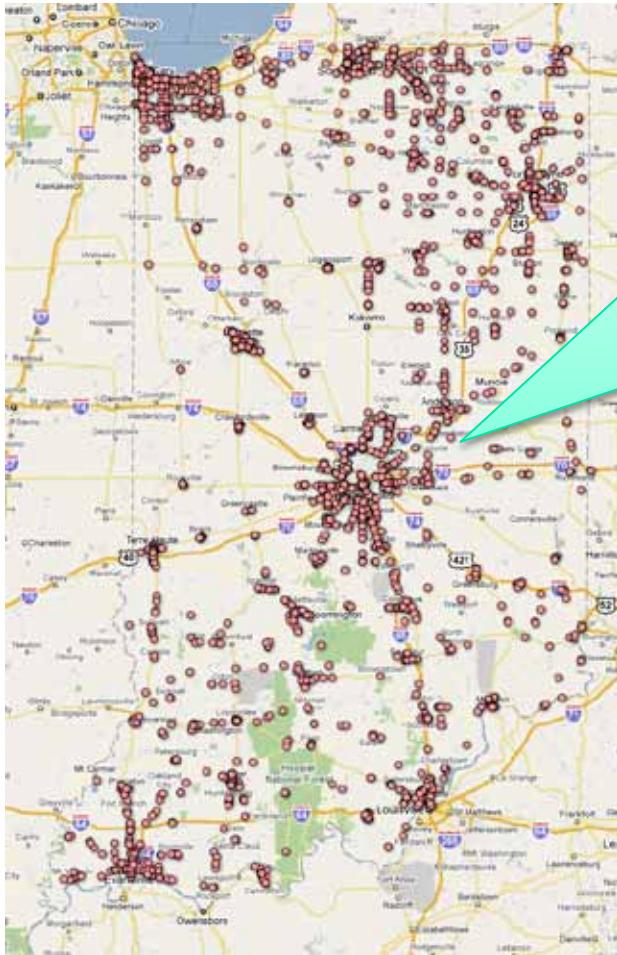
Agenda



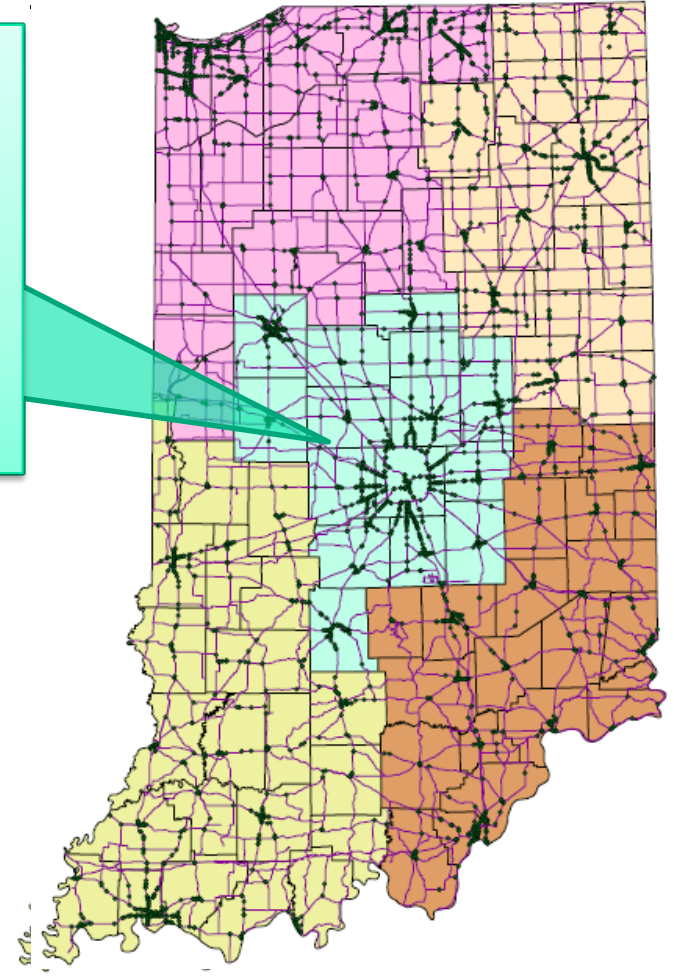
- n Detection needs- Lane by lane and advance
- n Controller features-Event Logging
- n Communication requirements:
- n Down in the weeds: Looking into performance & lessons learned...

Regional/Statewide Signal Management

Geographical/Organizational Challenges



Large geographical areas increase the benefit of remote monitoring and traffic management

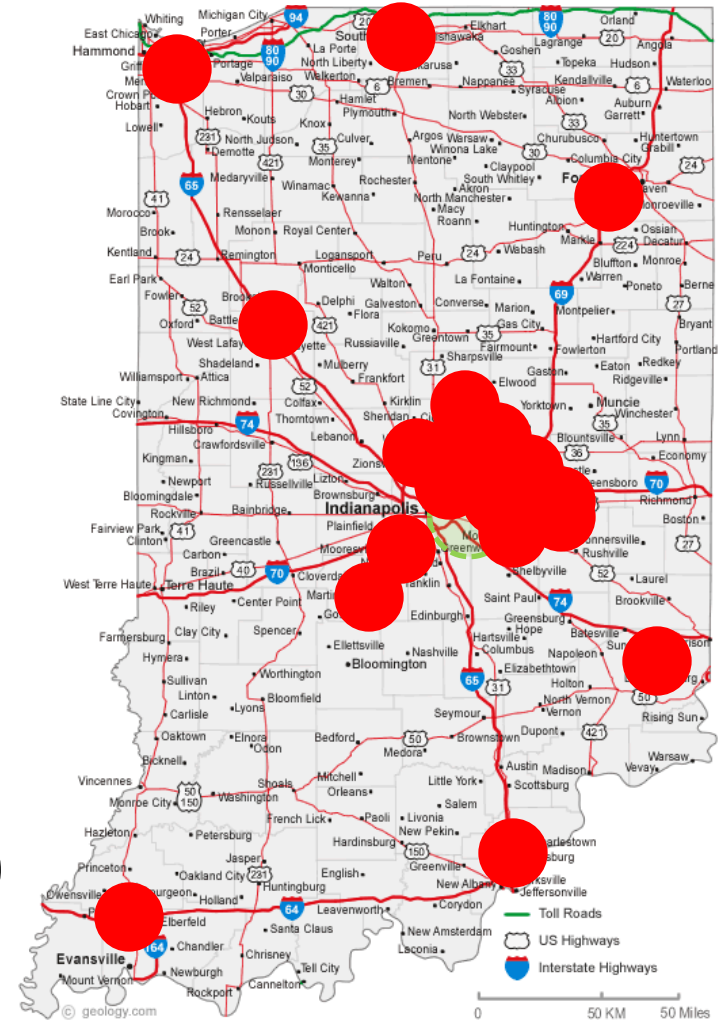


INDOT: ~2,600 signals in 300 systems



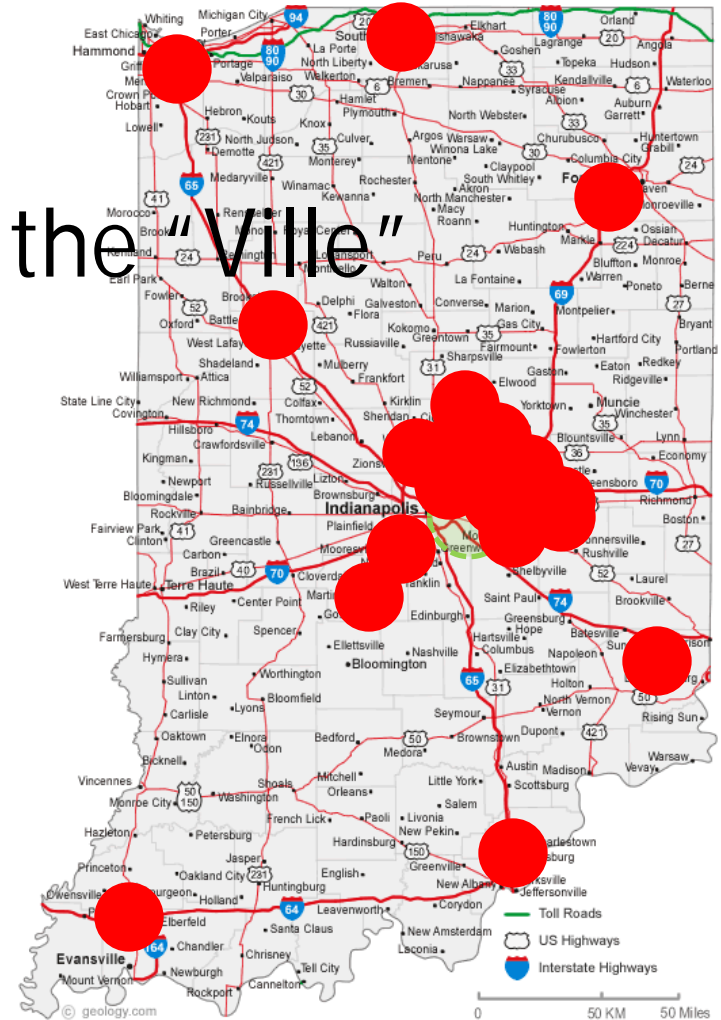
Progress towards Active Signal Management

- n 100 High Resolution Event Data controllers on line
- n ITS Fiber, Commercial Cellular, FHSS Radio, Broadband Radio
- n Peek, Econolite, Seimens (soon)
- n 4.5 Billion Event Data Records (400 million/month)



Progress towards Active Signal Management

- 1 32/37 –Noblesville
 - 2 +1 Pleasant St
 - 4 +2 System --Completing the "Vile"
 - 8 +4 Fishers
 - 16 +8 US31
 - 32 +16 SR37 S
 - 64 +32 Ft Wayne, NW IN
 - 2011 and beyond...
- All new contracts



The other "Ville's" - Merrillville (31)

INDOT Intersection Data Viewer

System list ([Health Page](#))

System:10
C-11: US 36, CR 525 E TO DAN JONES RD

- [US 36 @ CR 525 E \(PRESTWICK\)](#)
- [US 36 @ OLD 36 E ICT](#)
- [US 36 @ CR 625 E](#)
- [US 36 @ AVON KROGERS ENTRANCE](#)
- [US 36 @ SR 267](#)
- [US 36 @ PRODUCTION DR / BEECHWOOD](#)
- [US 36 @ DAN JONES RD](#)
- [US 36 @ AVON MARKETPLACE / SATORI PARKWAY](#)

System:16
C-01: US 36, CR 900 E TO Girls School Road

- [US 36 @ CR 900 E](#)
- [US 36 @ AVON VILLAGE PKWY / WAL-MART](#)
- [US 36 @ Gable Dr.](#)
- [US 36 @ STEEPCASE \(SHILOH CROSSING\)](#)
- [US 36 @ RONALD REGAN](#)

Current Location: US 30(81st Ave.) @ Rhode Island Ave. (NBR=01-045-257)

<< 12/2011 >>

S	M	T	W	H	F	S
				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

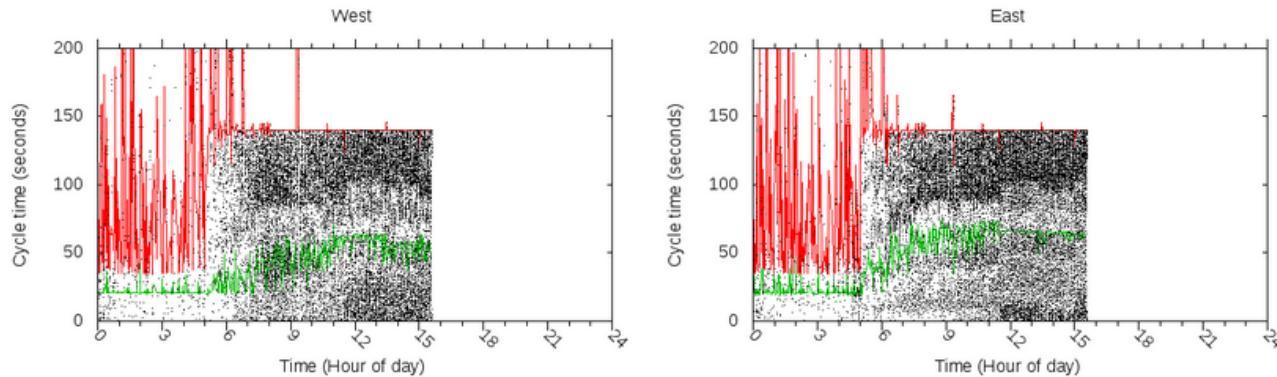
Dec 12 2011 Go

Graph Type:

Files:

- [plot4.sql](#)
- [plot4.dat](#)
- [plot3.sql](#)
- [plot3.dat](#)
- [plot2.sql](#)
- [plot2.dat](#)
- [plot1.sql](#)
- [plot1.p](#)

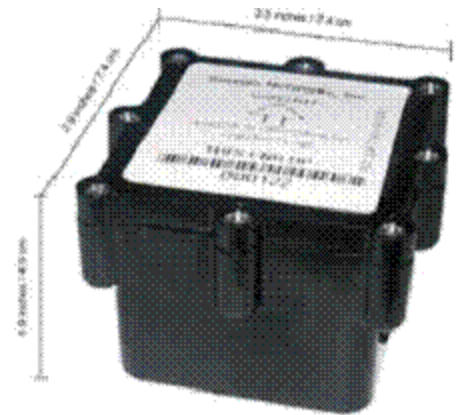
01-045-257 2011-12-12



The other "Ville's" - Louisville (9) Area



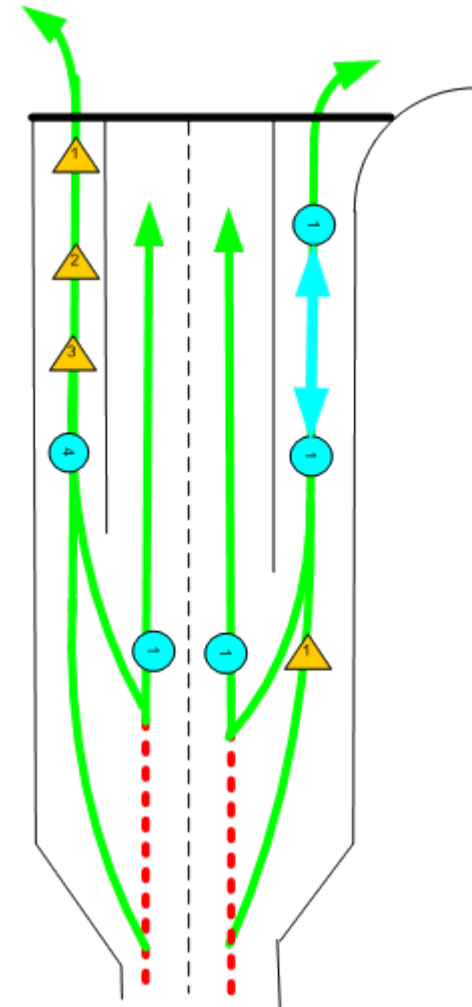
Eyes and Ears- Communications and Detection



Lane by lane, advance, count capable

Loop Tagging Table

Ref#	Loop No	-	Direction	Lane	Phase	-	Loops	C	-	C #	Lead-in and Rack Labels
1	1	-	N	L	5	-	4	C	-	3	1-NL5-4 C-3
2	2	-	N	A	2	-	1	C	-	4	2-NA2-1 C-4
3	5	-	N	B	2	-	1	C	-	7	5-NB2-1 C-7
4	6	-	E	L	7	-	4	C	-	8	6-EL7-4 C-8
5	9	-	E	A	4	-	4	C	-	11	9-EA4-4 C-11
6	10	-	E	B	4	-	4	C	-	12	10-EB4-4 C-12
7	13	-	S	L	1	-	4	C	-	15	13-SL1-4 C-15
8	14	-	S	A	6	-	1	C	-	16	14-SA6-1 C-16
9	17	-	S	B	6	-	1	C	-	19	17-SB6-1 C-19
10	18	-	W	L	3	-	4	C	-	20	18-WL3-4 C-20
11	21	-	W	A	8	-	4	C	-	23	21-WA8-4 C-23
12	22	-	W	B	8	-	4	C	-	24	22-WB8-4 C-24
13	25	-	N	L	5	-	1,2,3				25-NL5-1,2,3
14	26	-	E	L	7	-	1,2,3				26-EL7-1,2,3
15	27	-	E	A	4	-	1,2,3				27-EA4-1,2,3
16	28	-	E	B	4	-	1,2,3				28-EB4-1,2,3
17	29	-	S	L	1	-	1,2,3				29-SL1-1,2,3
18	30	-	W	L	3	-	1,2,3				30-WL3-1,2,3
19	31	-	W	A	8	-	1,2,3				31-WA8-1,2,3
20	32	-	W	B	8	-	1,2,3				32-WB8-1,2,3
21											



Controller Capabilities for event logging



Log Events

Standard Enumerations

100 ms

30 hours storage

Ethernet

FTP Protocol



Translate to CSV



Communications Migration



Communications Security



- n Friends List
- n VPN's
- n Private IPs
- n ...#2 key?



PCD Overview

File Edit View History Bookmarks Tools Help

http://trafficwise.org:86/datamaps_beta/

http://trafficwi.../datamaps_beta/

INDOT Intersection Data Viewer

System list (Health Page)

System:26 SR 14 west of I-69	SR 14 & SCOTT RD. SR 14 & TIMBERLAKE SR 14 & Glencarin Blvd./River Oak Run SR 14 & Hadley Road SR 14 & I-69 SB RAMP
System:7 037@IndyNorth	SR 37 & 126th St SR 37 & 131st St SR 37 & 141st St SR 37 & 146th St
System:11 031@IndyNorth	US 31 (N Meridian St) & 96th St I-465 & US 31 (EB Ramp) I-465 & US 31 (WB Ramp) US 31 & 103rd St US 31 & 106th St US 31 & 116th St US 31 & 126th St

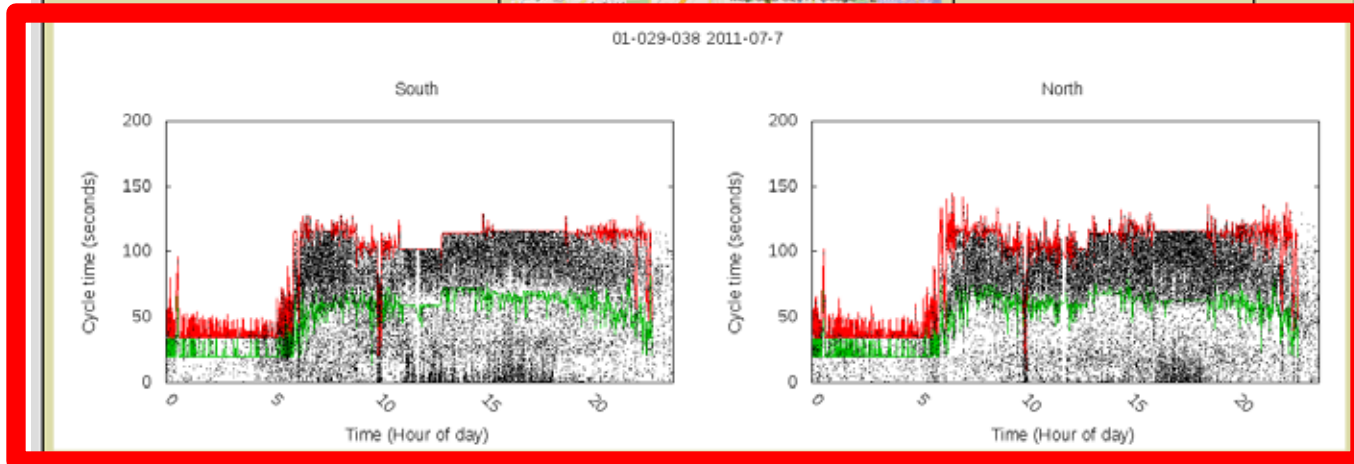
Current Location: SR 37 & 131st St
(NBR=01-029-038)

<< 07/2011 >>

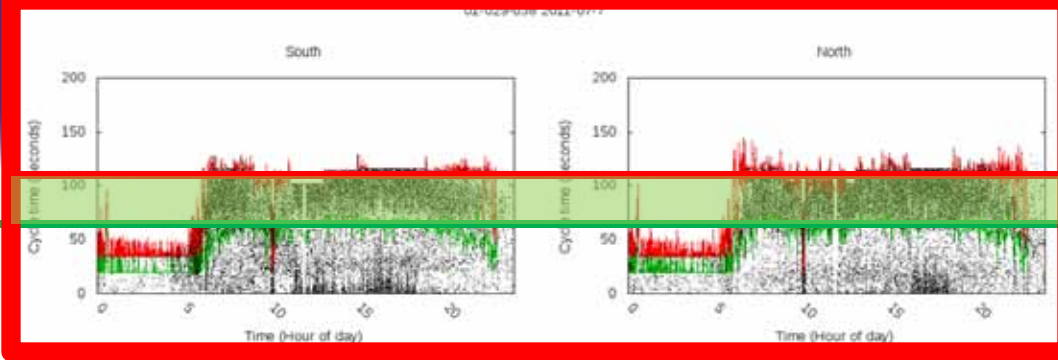
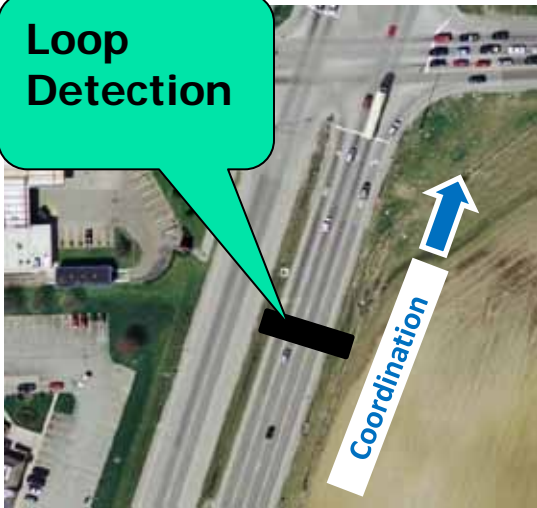
S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Files:
[plot4.sql](#)
[plot4.dat](#)
[plot3.sql](#)
[plot3.dat](#)
[plot2.sql](#)
[plot2.dat](#)
[plot1.sql](#)
[plot1.dat](#)
[plot.p](#)

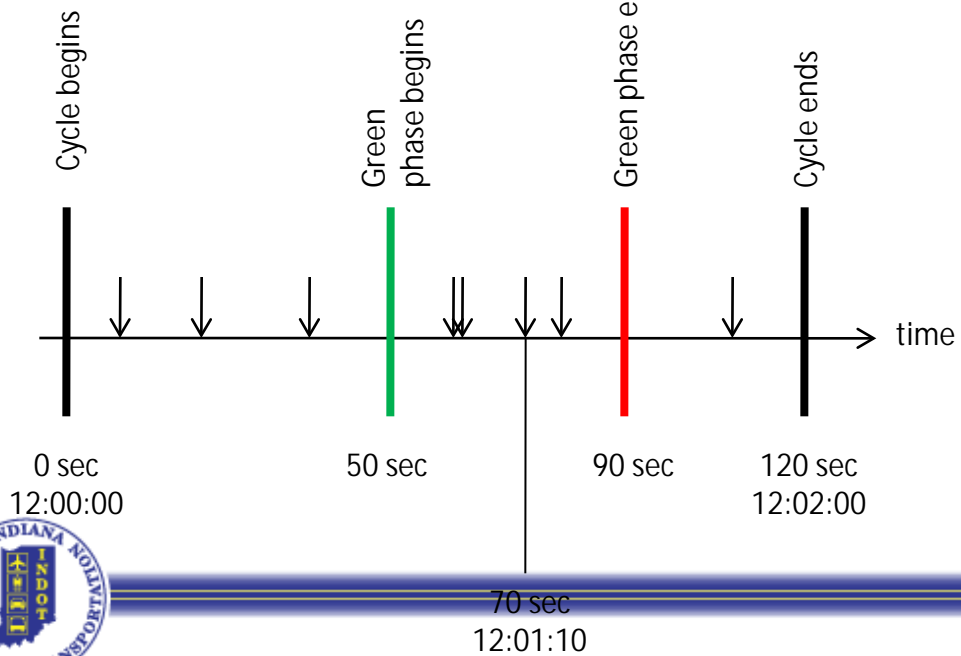
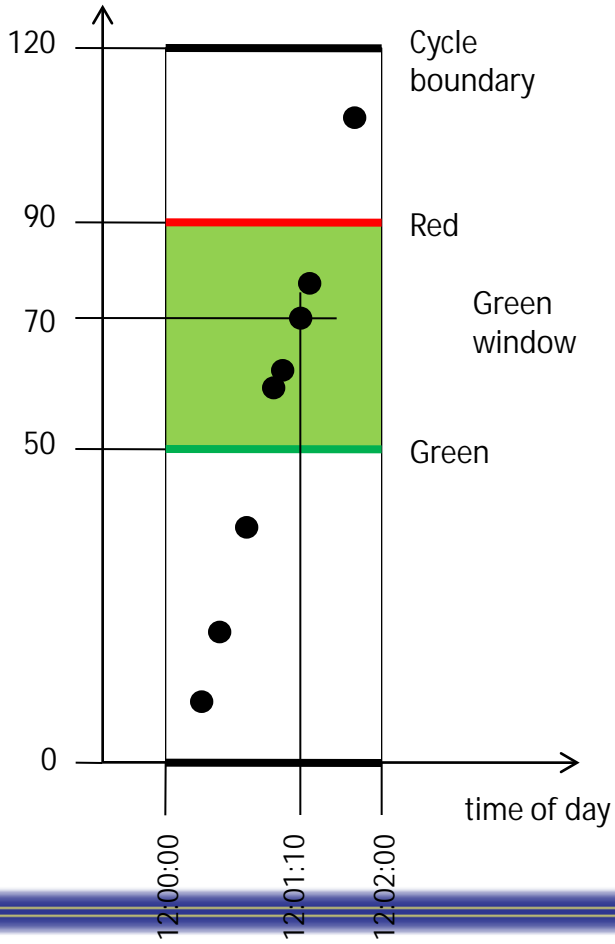
Graph Type: PCD Both Directions

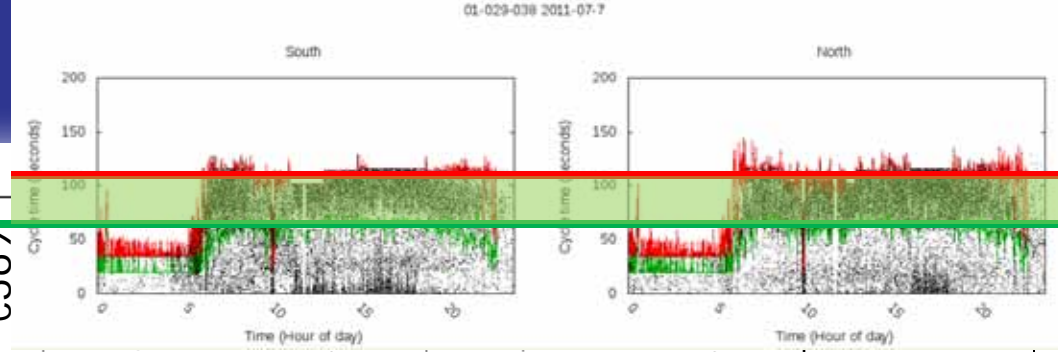
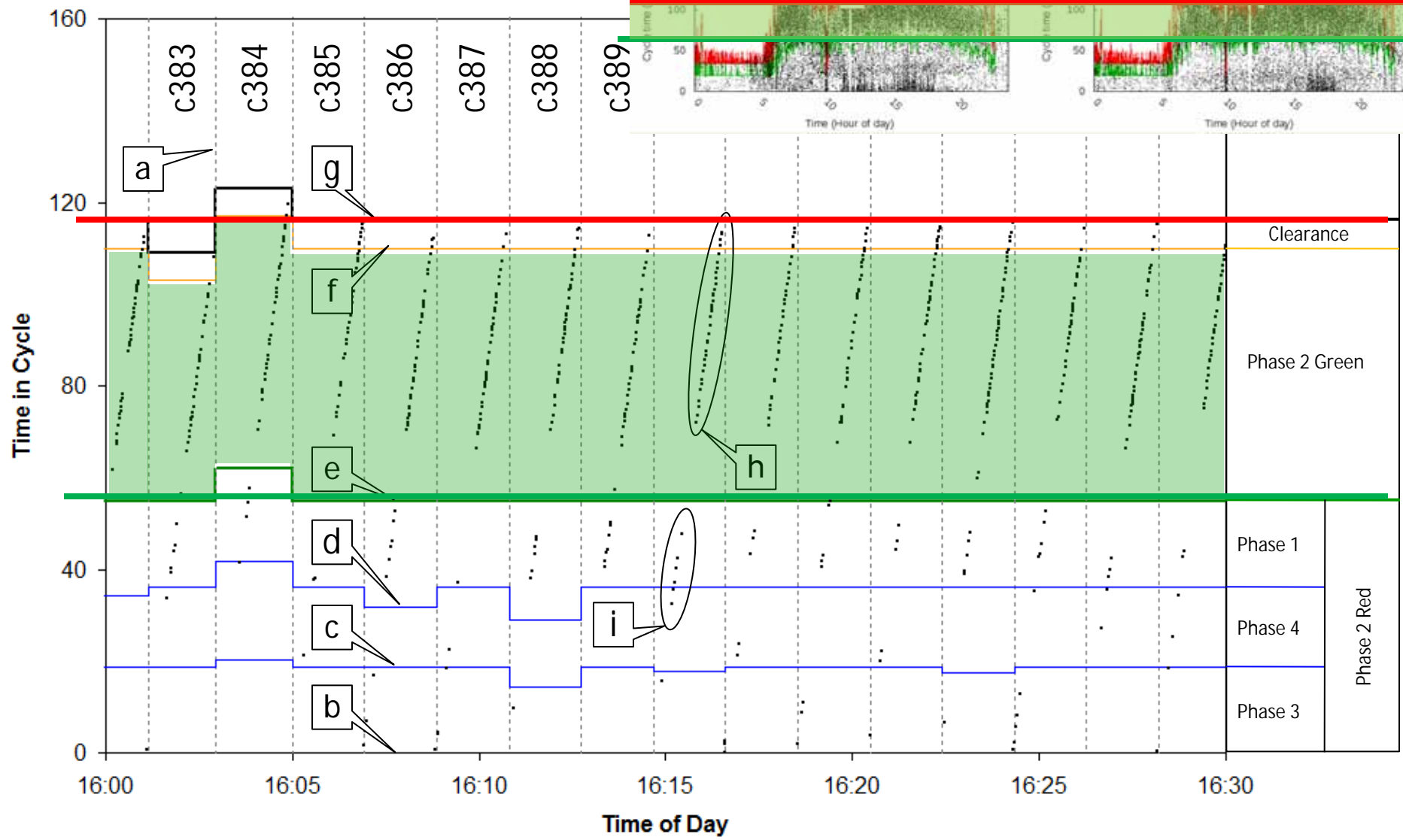


Loop Detection

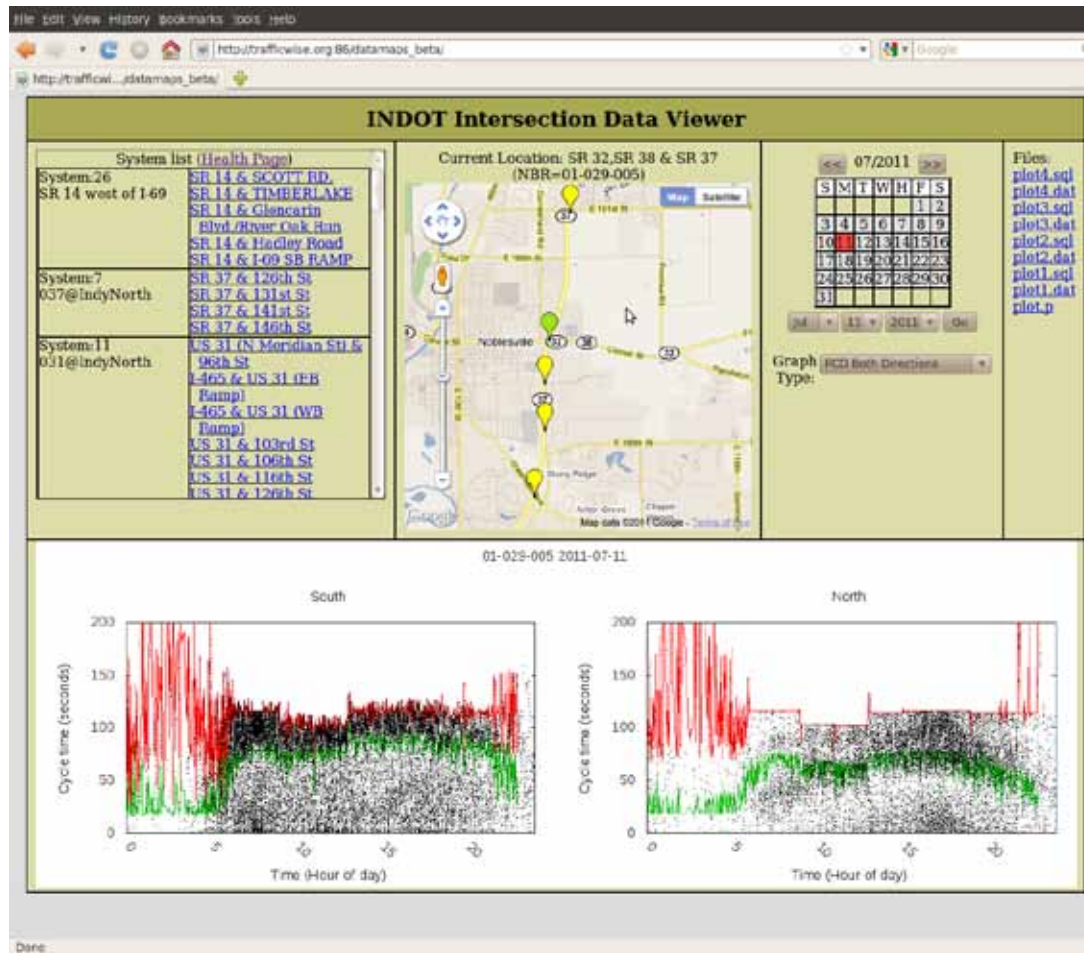


Time in cycle





Original Instrumented Intersection SR37/SR32



Flow Profiles Overview

Applications | Firefox | VirtualBox OSE Manager | 1 WWP/Running | jbrundevirt@idot... | Mozilla Firefox | Mon Apr 25, 4:19 PM

http://flowline.org/602camaps_beta/

INDOT Intersection Data Viewer

System list (Health Page)

System:26	SR 14 & SCOTT RD
SR 14 west of I-69	SR 14 & TIMBERLAKE
	SR 14 & Glencairn
	Ilwaco/Driver Oak Run
	SR 14 & Haribey Road
	SR 14 & I-69 SB RAMP
System:7	SR 37 & 126th St
037@IndyNorth	SR 37 & 131st St
	SR 37 & 141st St
	SR 37 & 146th St
System:11	US 31 (N Meridian Rd &
031@IndyNorth	26th St
	I-465 & US 31 (EB Ramp)
	I-465 & US 31 (WB
	Ramp)
	US 31 & 103rd St
	US 31 & 106th St
	US 31 & 116th St
	US 31 & 126th St
System:31	SR 37 & SR 141

Current Location: SR 37 & 141st St
(NRR=01-029-059)

04/2011

S	M	T	W	T	F	S
					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

Apr. 1 14 2011

Graph Type:

TimeInterval:

BinSize: Submit

LineWidth: Submit

Files: plot4.sql, plot4.dat, plot3.sql, plot3.dat, plot2.sql, plot2.dat, plot1.sql, plot1.dat, plot.p

01-029-059 2011-04-14 (06:00:00.3-09:00:00.2)

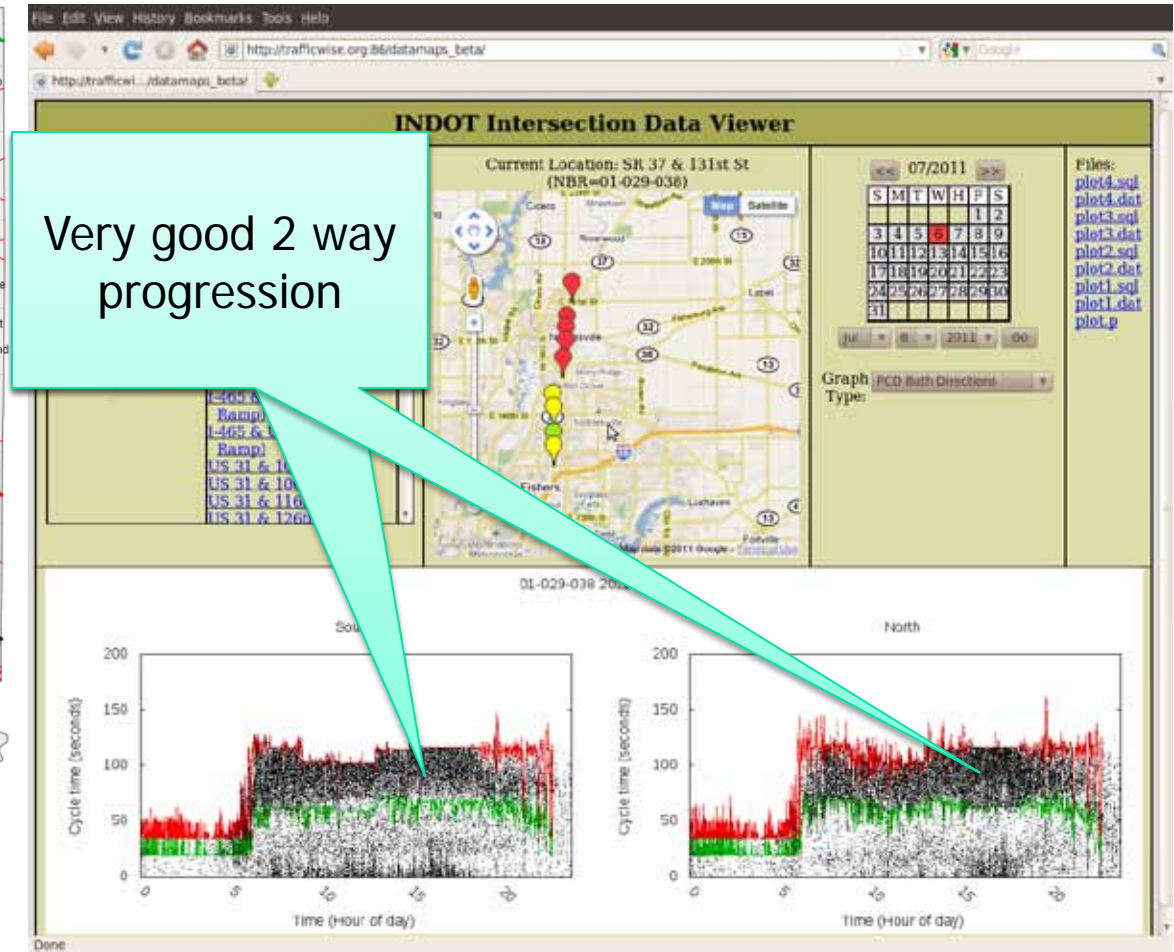
South

North

Done



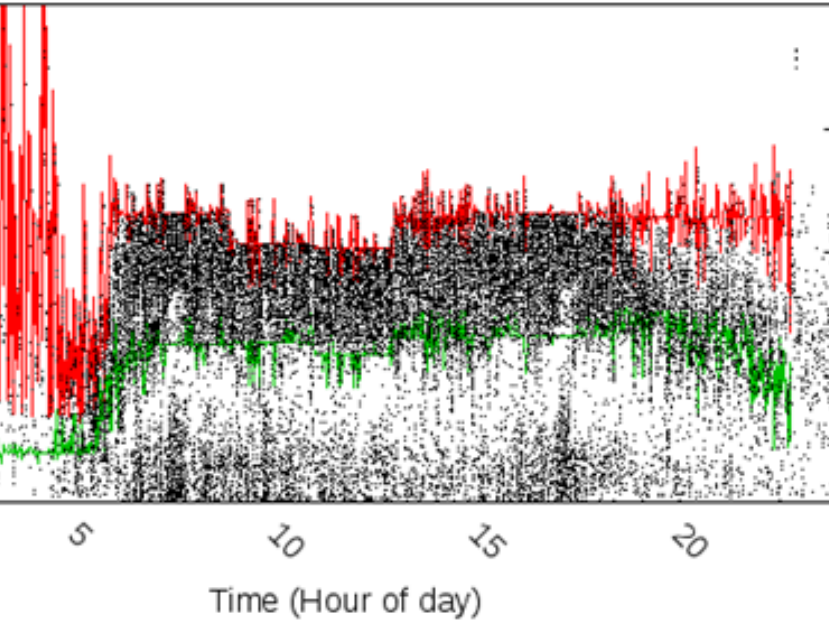
SR37 Fishers/Noblesville- (9)



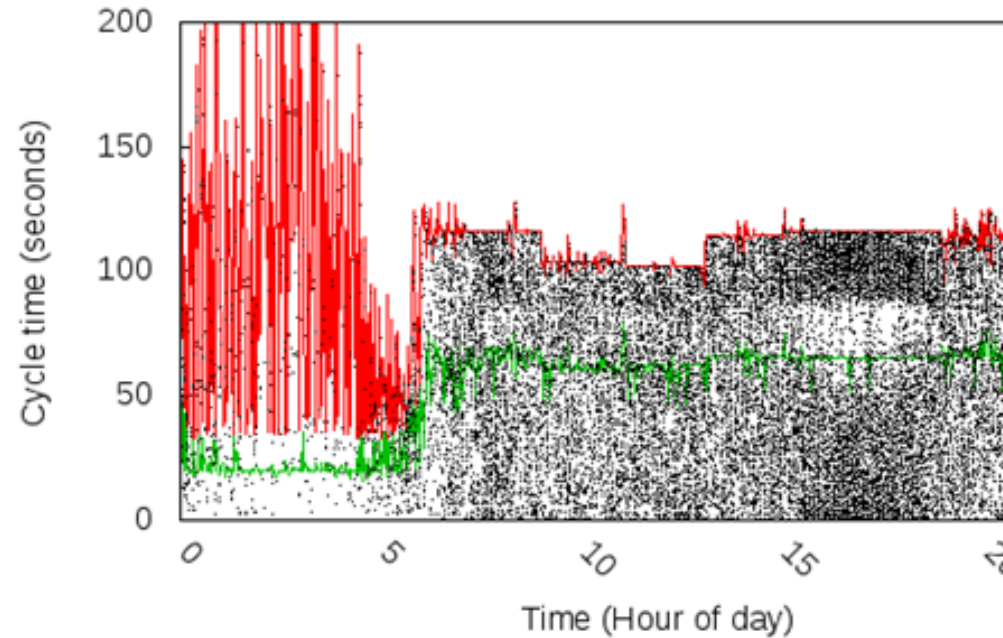
SR-37 & 126th adjacent to I-69

01-029-042 2011-07-6

South

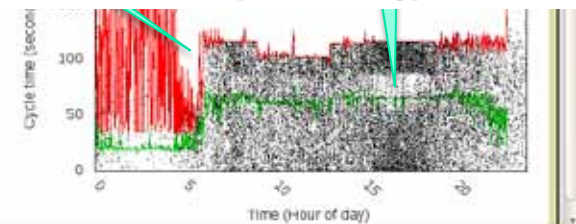
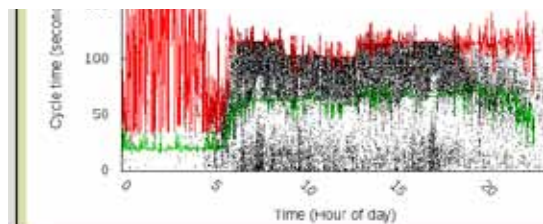


North

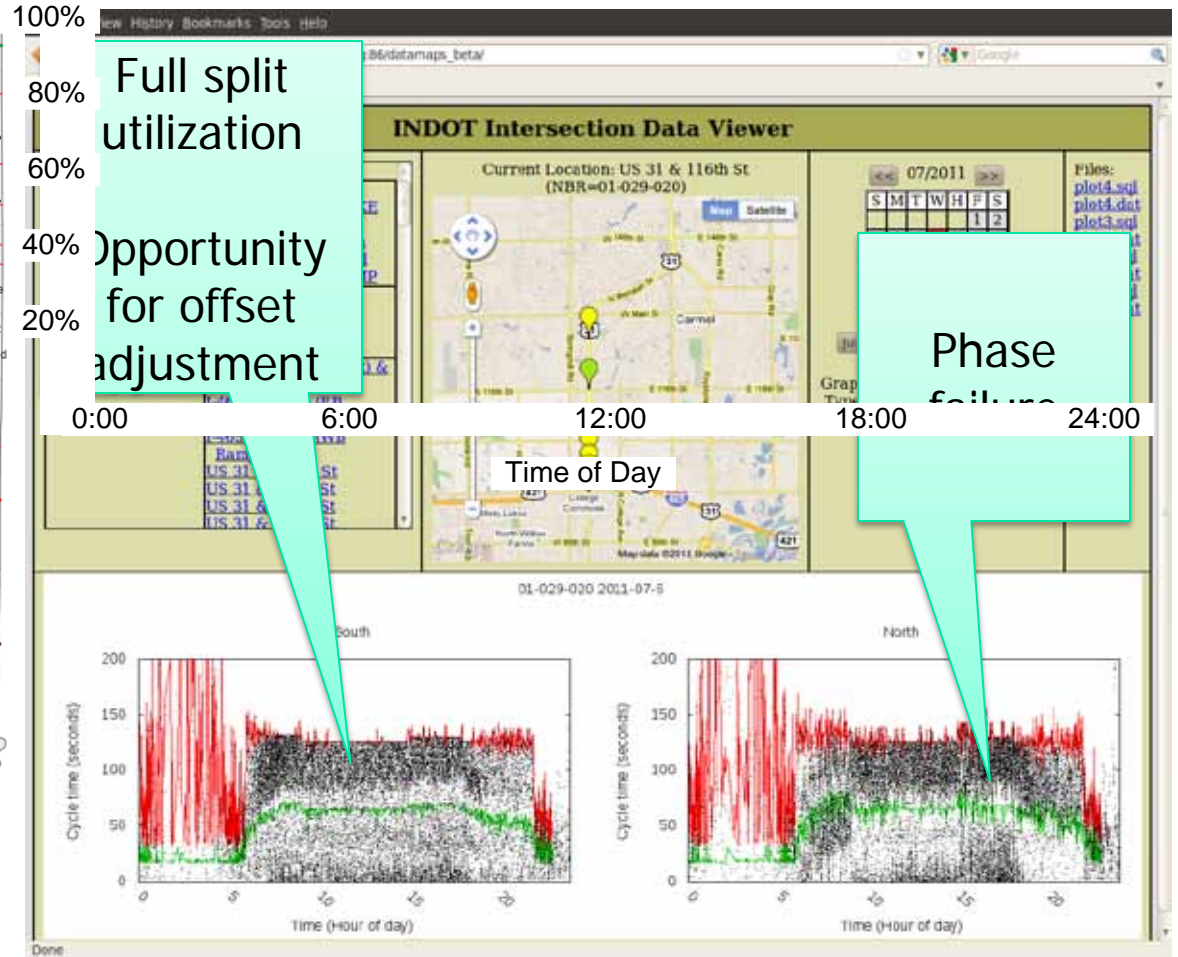
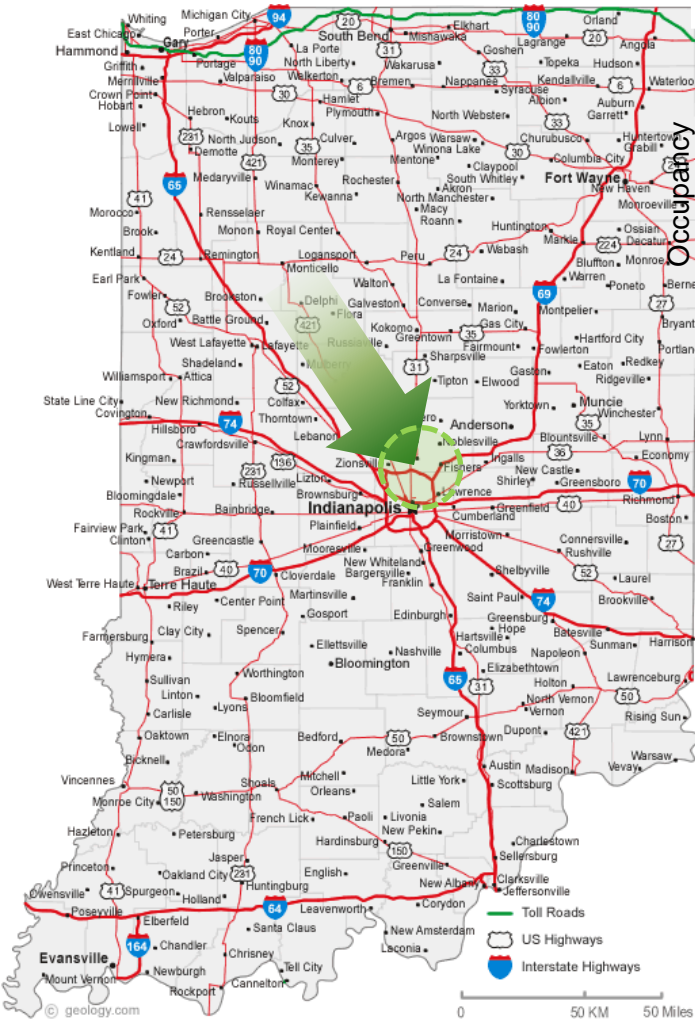


Time (Hour of day)

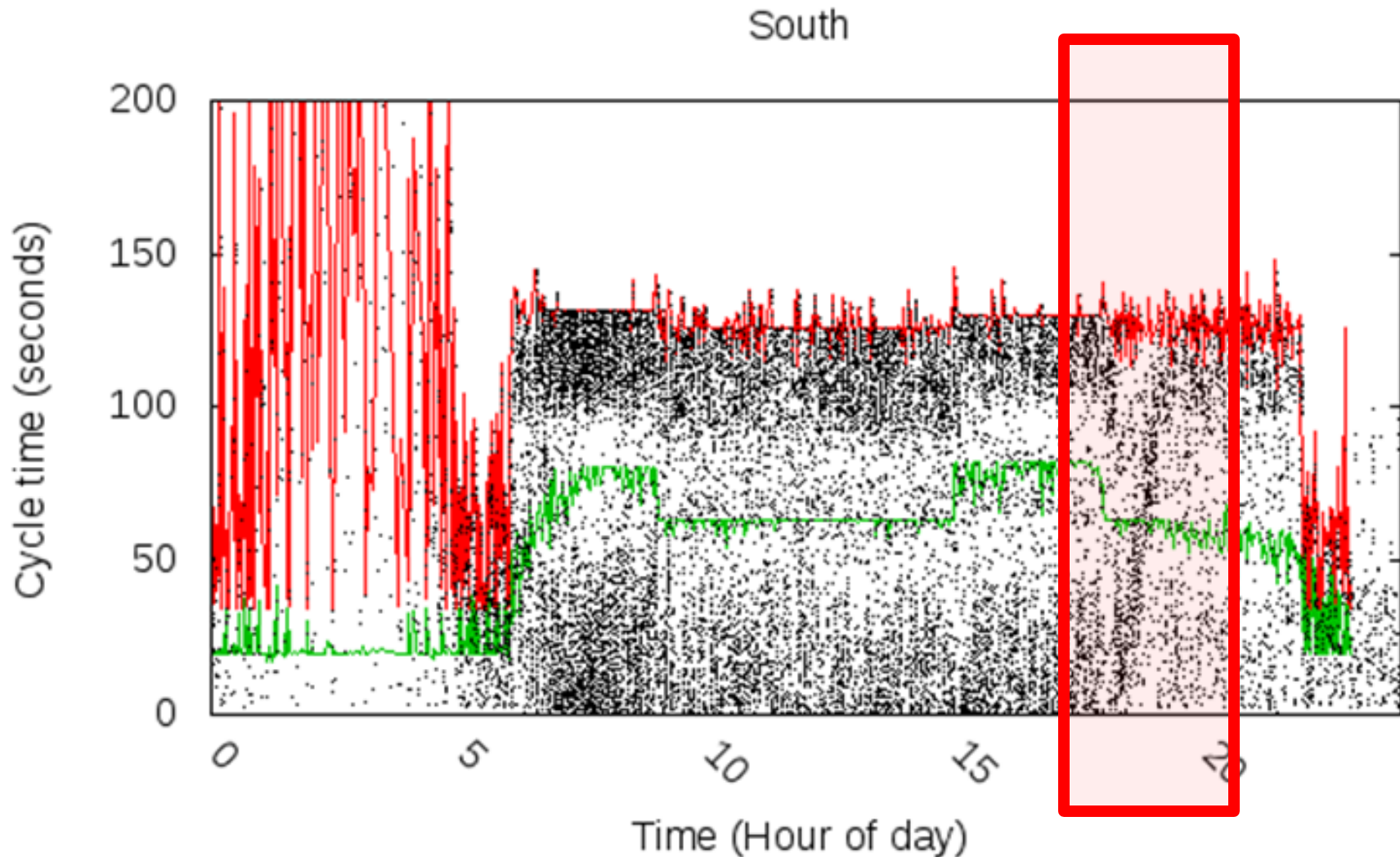
Time (Hour of day)



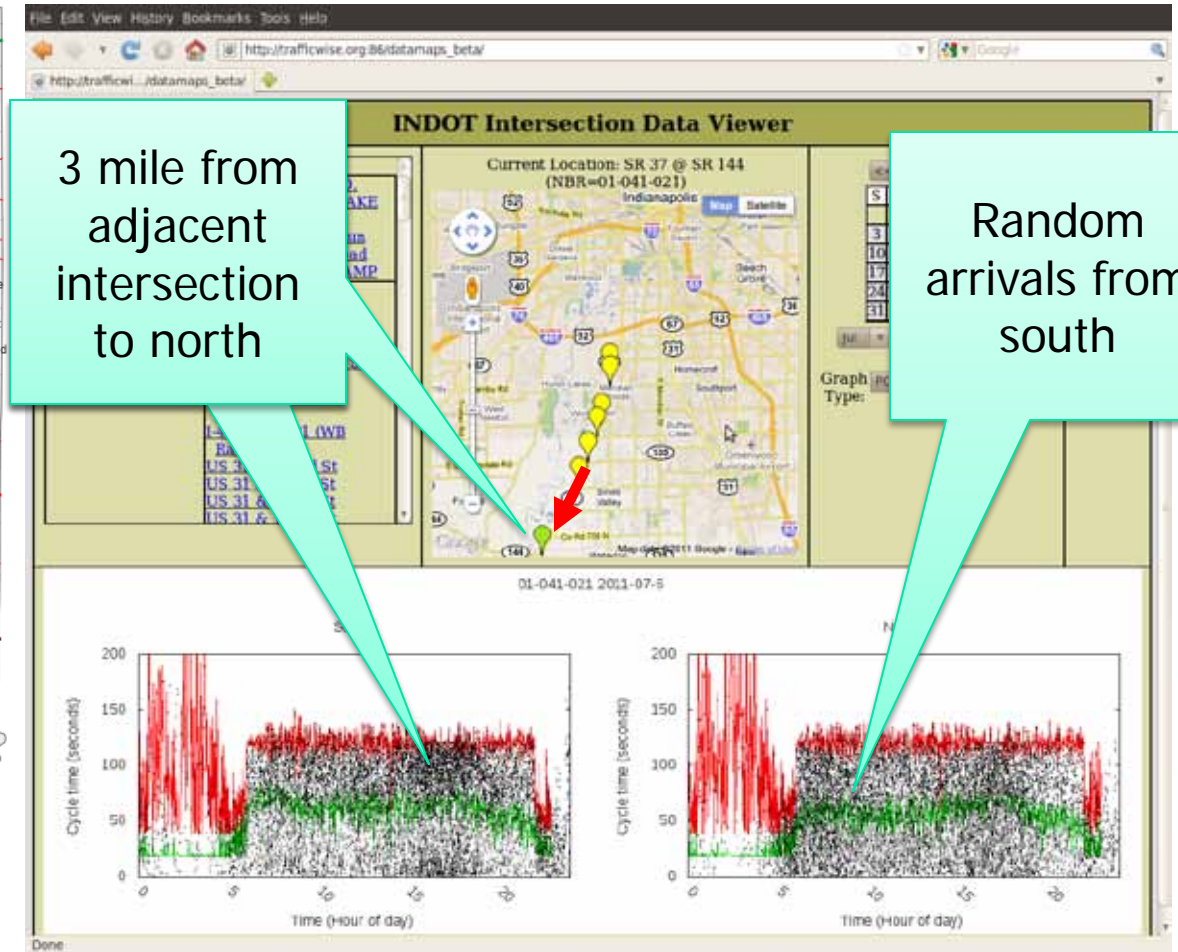
US31 N @ 116th



US 31 @ 126th (8 in system)

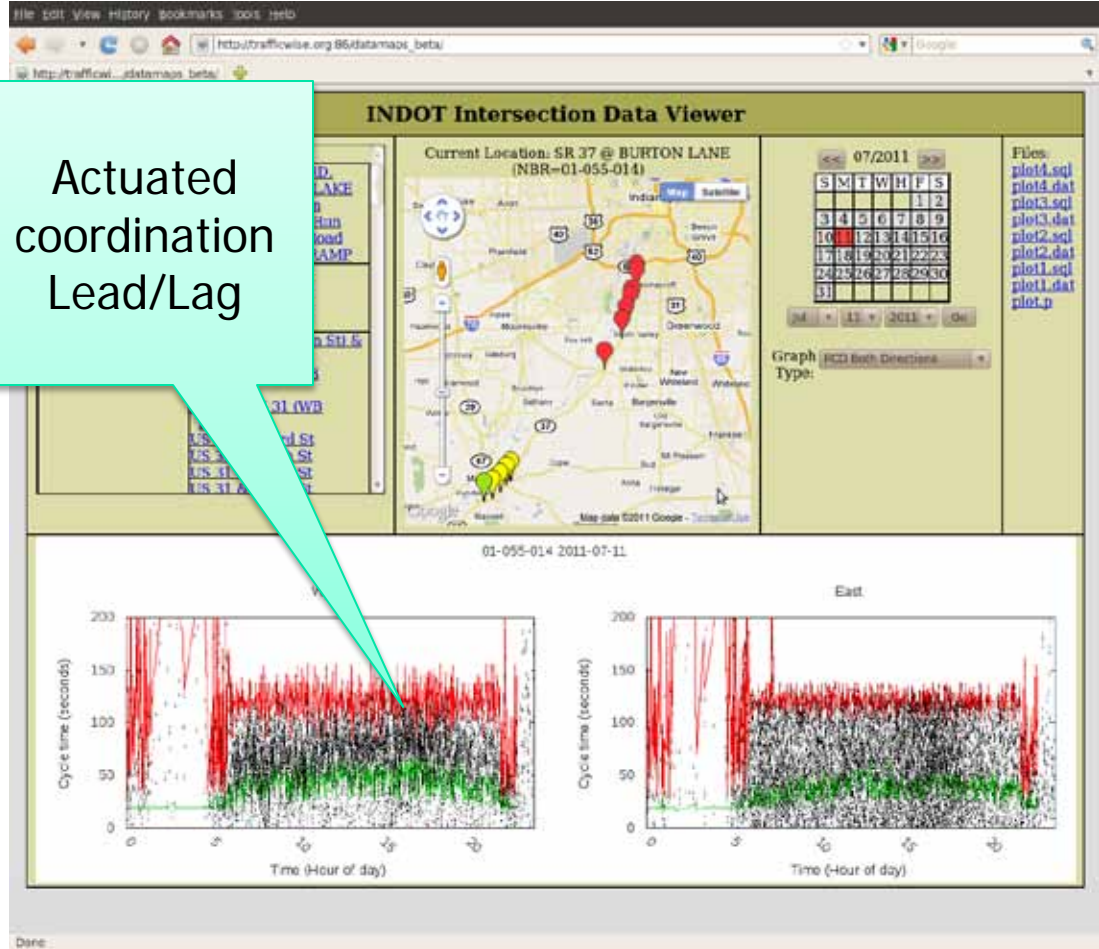


SR 37 South



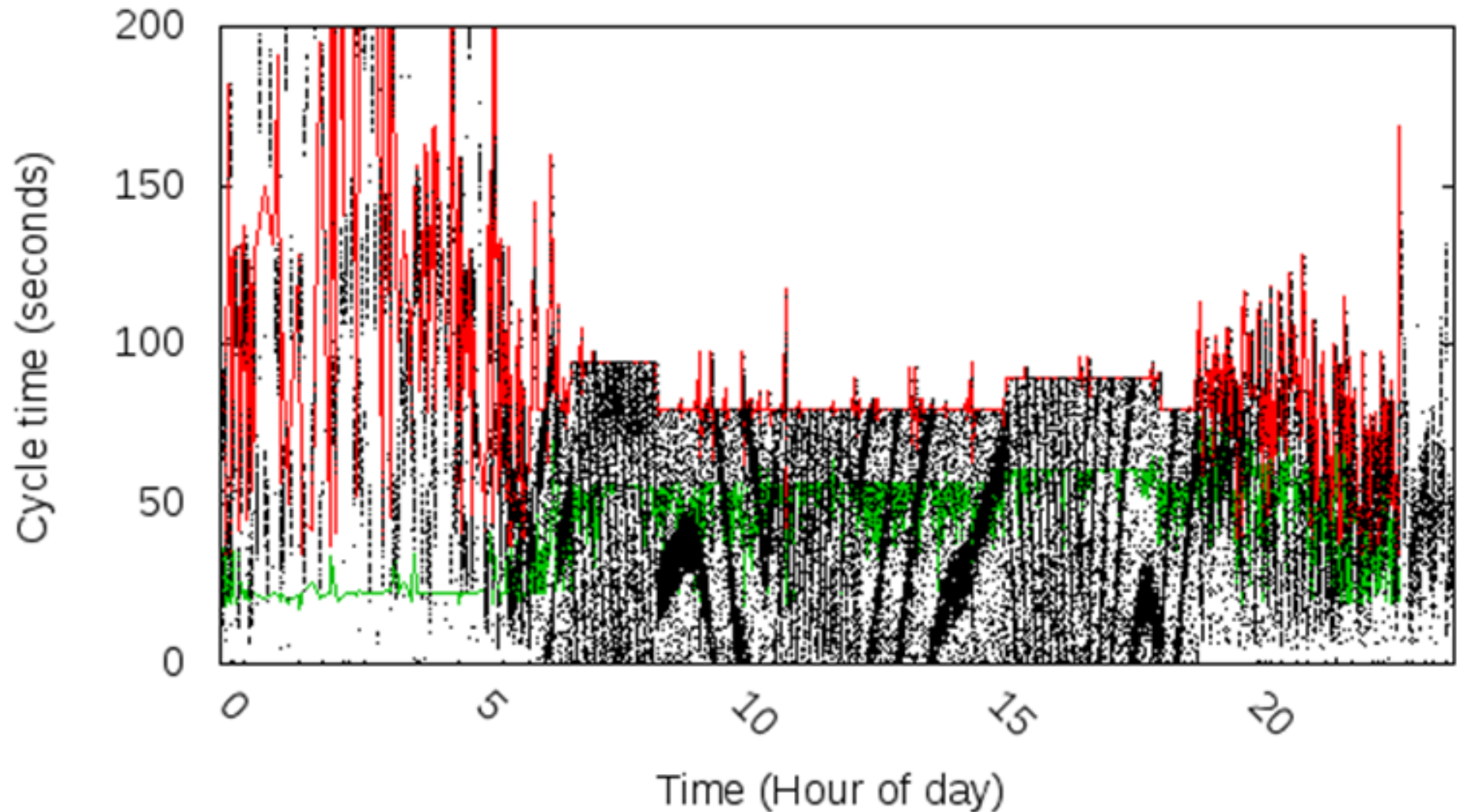
Indy-Bloomington

SR 37- Martinsville



SR 14- Ft Wayne

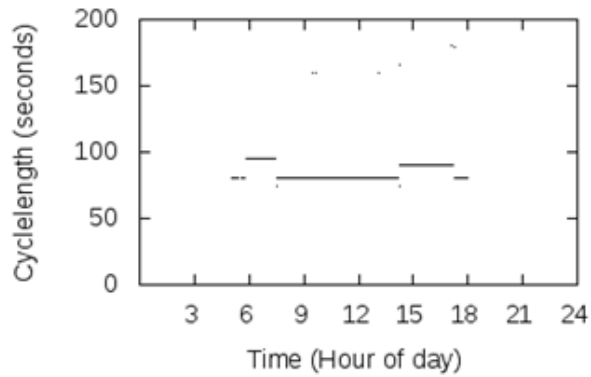
East



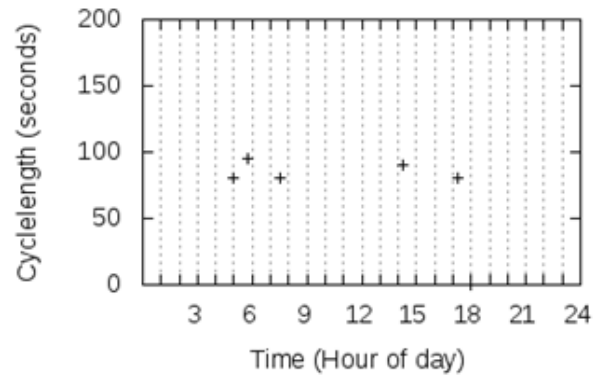
Remote Diagnostics-

Cycle Lengths 01-002-164 2011-07-11

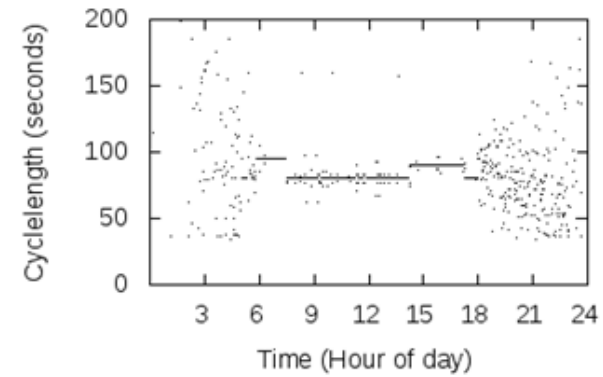
Yeild Point



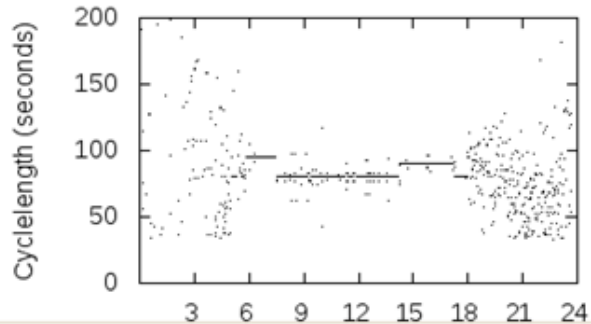
Cycle Length Change



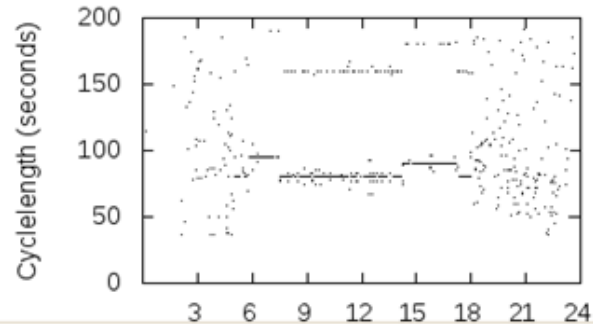
Cycle length Phase 2 termination



Cycle length Phase 6 termination



Bounadry (1256) termination



Pooled Fund Study 1296

Architecture for Active Management of Geographically Distributed Signal Systems



**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. THIS PAPER
DESCRIBES OPPORTUNITIES TO
MODERNIZE TRAFFIC SIGNAL
MANAGEMENT ARCHITECTURES
BY LEVERAGING COMMERCIAL**

INTRODUCTION

Signalized arterials represent 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 a D.

Upgraded intersection controllers, communication, detection equipment, closed loop systems, and/or central systems can provide modest improvements.^{1,2} 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**



Shameless Plug;

Pooled Fund Study 1296 Objectives

- n Develop a network of transportation agencies to:
 - n i) **Performance Measures:** develop consensus on operational standards of performance,
 - n 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
 - n iii) **Management Concepts and Guidelines :** for using a central system, identify when and where resources are most needed to maximize return on investment.

The screenshot shows the Transportation Pooled Fund Program (TPF) website. At the top, there is a login section with fields for 'Username:' and 'Password:', a 'Login' button, and links for 'Forgot your username or password?' and 'What is an authorized user?'. Below this is the TPF logo and the text 'TRANSPORTATION POOLED FUND PROGRAM'. A navigation bar contains links: Home | About TPF | How to Participate | Open Solicitations | Search | Forms | Status Reports | Success Stories | Related Links | Email Alerts. The main content area shows the breadcrumb 'Home > Search Solicitations and Studies > Solicitation Detail View' and the title 'Solicitation Detail View'. The specific solicitation is 'Traffic Signal Systems Operations and Management'. Under 'General Information', the following details are listed: Solicitation Number: 1296; Status: Cleared by FHWA; Date Posted: Jan 22, 2011; Last Updated: Oct 18, 2011; Solicitation Expires: Jan 1, 2012; Partners: CO, GA, MN, NH, TX, WisDOT; Lead Agency: Indiana Department of Transportation. On the right side, there is an orange 'Tools' menu with links to Contacts, FAQs, Glossary, Fund Transfer, Quarterly Webinars, and Archives.



Wrapping up:

- n Communications and Performance Measures Prototyping: Reliability and Scalability (Easy Button?)
- n ~100 controllers by end of year is a start, but only a fraction of the whole.



Questions?



n Thank you!!
n Contact: Jim Sturdevant
jsturdevant@indot.in.gov

