

A Picture Book Approach to Traffic Signal Management

Darcy Bullock

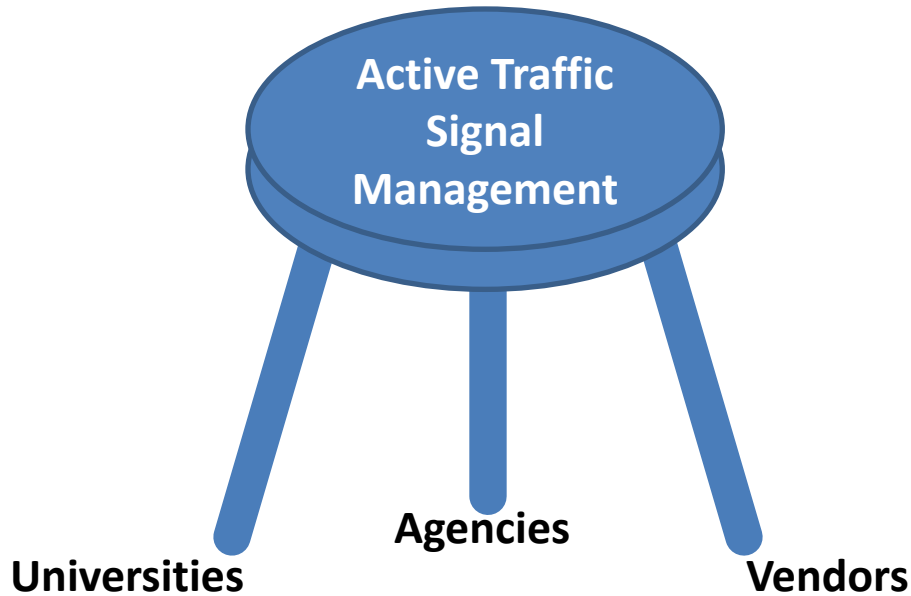
darcy@purdue.edu

Purdue University School of Civil Engineering

Contributor to this talk

- INDOT (Infrastructure Support and Agency Perspective)
 - Jim Sturdevant
 - Jay Wasson
 - Ryan Gallagher
 - Greg Richards
- Purdue University
 - Chris Day
 - Tom Brennan
 - Ross Haseman
 - Alex Hainen
 - Steve Remias
 - Neal Carboneau
 - Darcy Bullock
- Elkhart County
 - Jay Grossman (Elkhart County)
- Marshal University
 - Andrew Nichols
- Econolite (ASC 3 Data Logger)
 - Gary Duncan
 - Eric Raamot
 - Lu Ta
 - Brian Griggs

Emerging Shared Vision



1. Develop infrastructure and procedures to systematically prioritize investing engineering resources
2. Assess that impact

We are in a period where we need to re-introduce concepts so we change how agencies spec. & operate traffic signals and what vendors provide and

Advanced Transportation Information Systems (ATIS) Messages

*What gets measured gets done,
what gets measured and fed back
gets done well,
what gets rewarded gets repeated.*
– John E. Jones



Opportunities to
Push the State of
the Possible

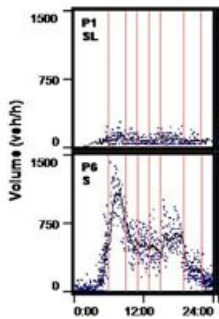
Enormous opportunities to fuse data from

- traffic signal controllers and
- probe data sources

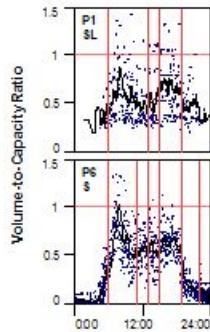
MAP 21

We want to embrace “picture book based performance measures”

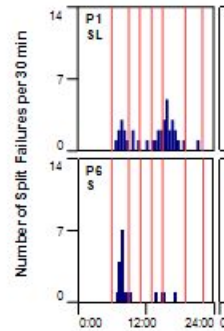
Equivalent Hourly Flow Rate



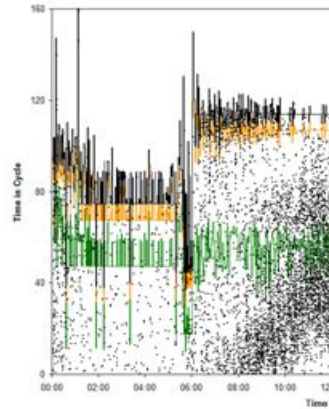
Volume to Capacity Ratio



Split Failures Per Half Hour

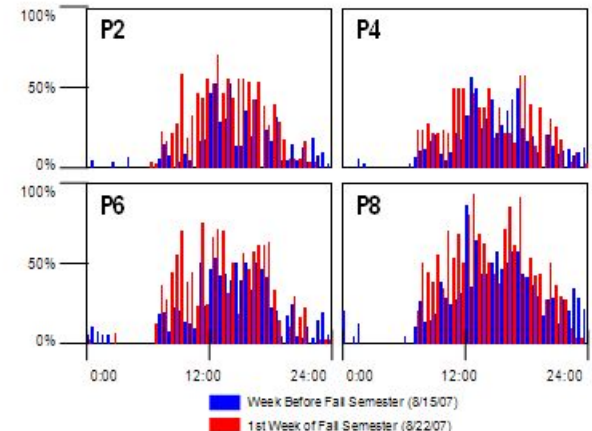


Purdue Coordination Diagram (PCD)

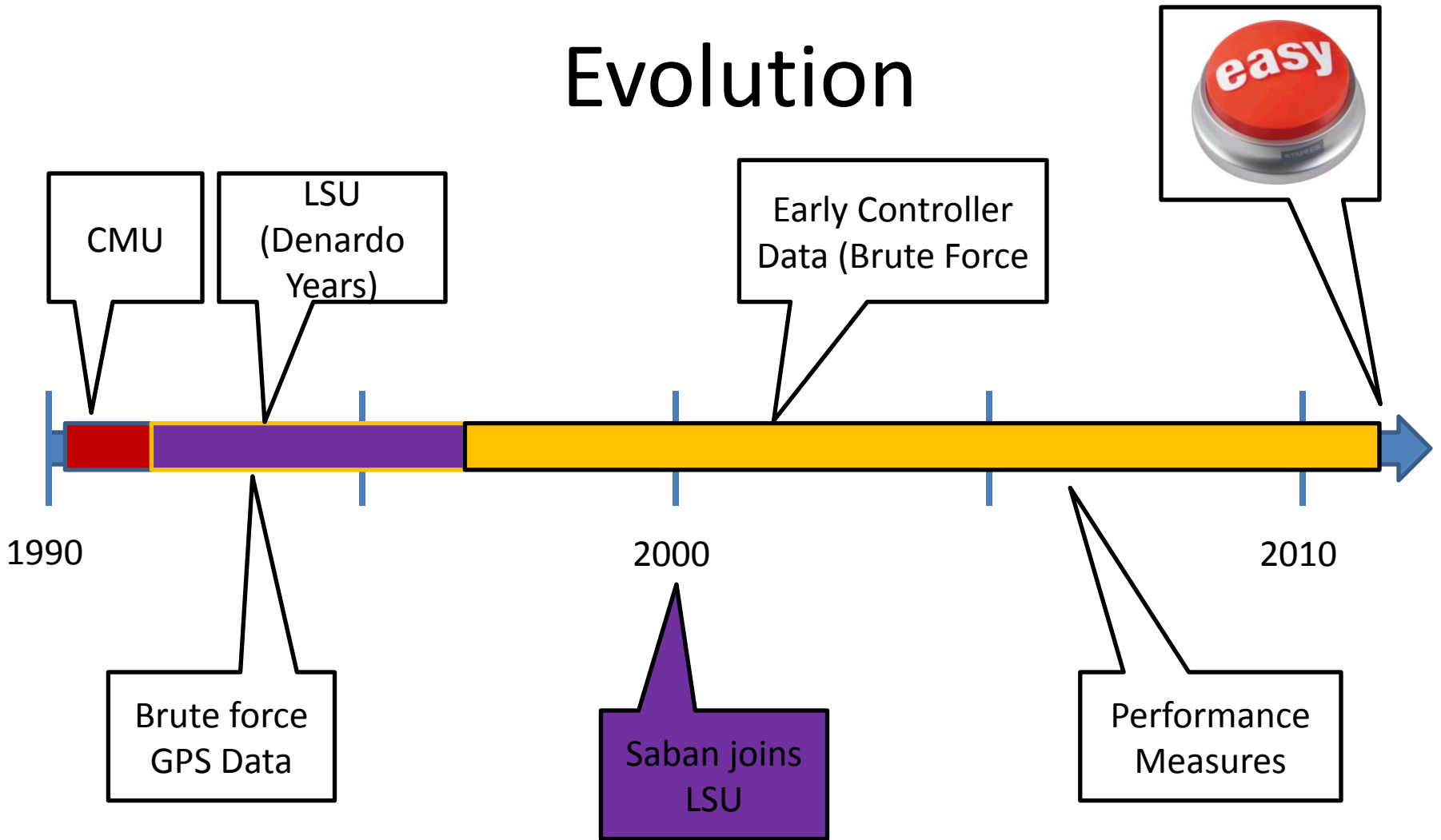


Opportunity for
MAP 21
Leadership

Percentage of Phases with Peds



Evolution



October 2006 State of the practice

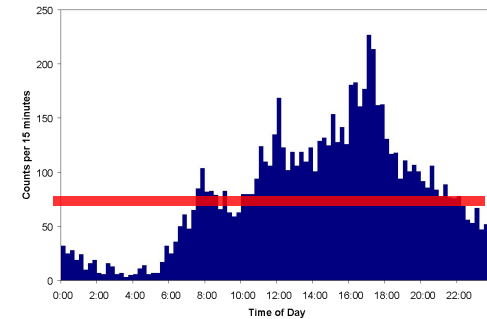




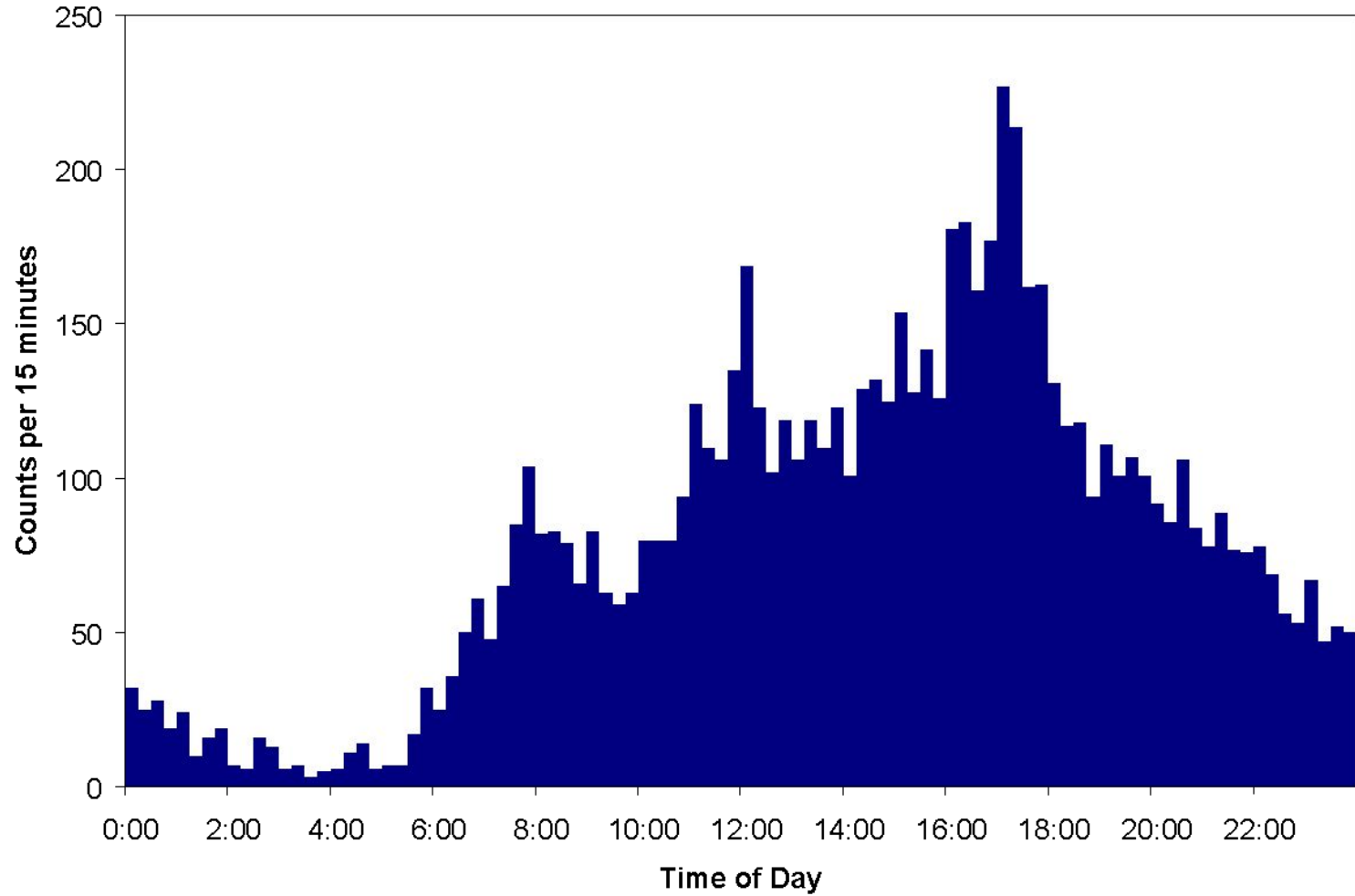
“If one wants to be outstanding in there field, one must first spend some time standing in the field” *Bill Kloose*

True or False

On Average, we have no capacity problems at any signalized intersection?



15-Minute Counts (Phase "n")




Opportunity

How can we use controller and probe data to quantify what we can see and assess if we can improve.



Outline

- Signal Management/ Challenges
- Data Sources
 - Controller
 - Probe Vehicles
- Fundamentals
- Data ->Information to assess fundamentals
- Results
- Q&A..Dialog



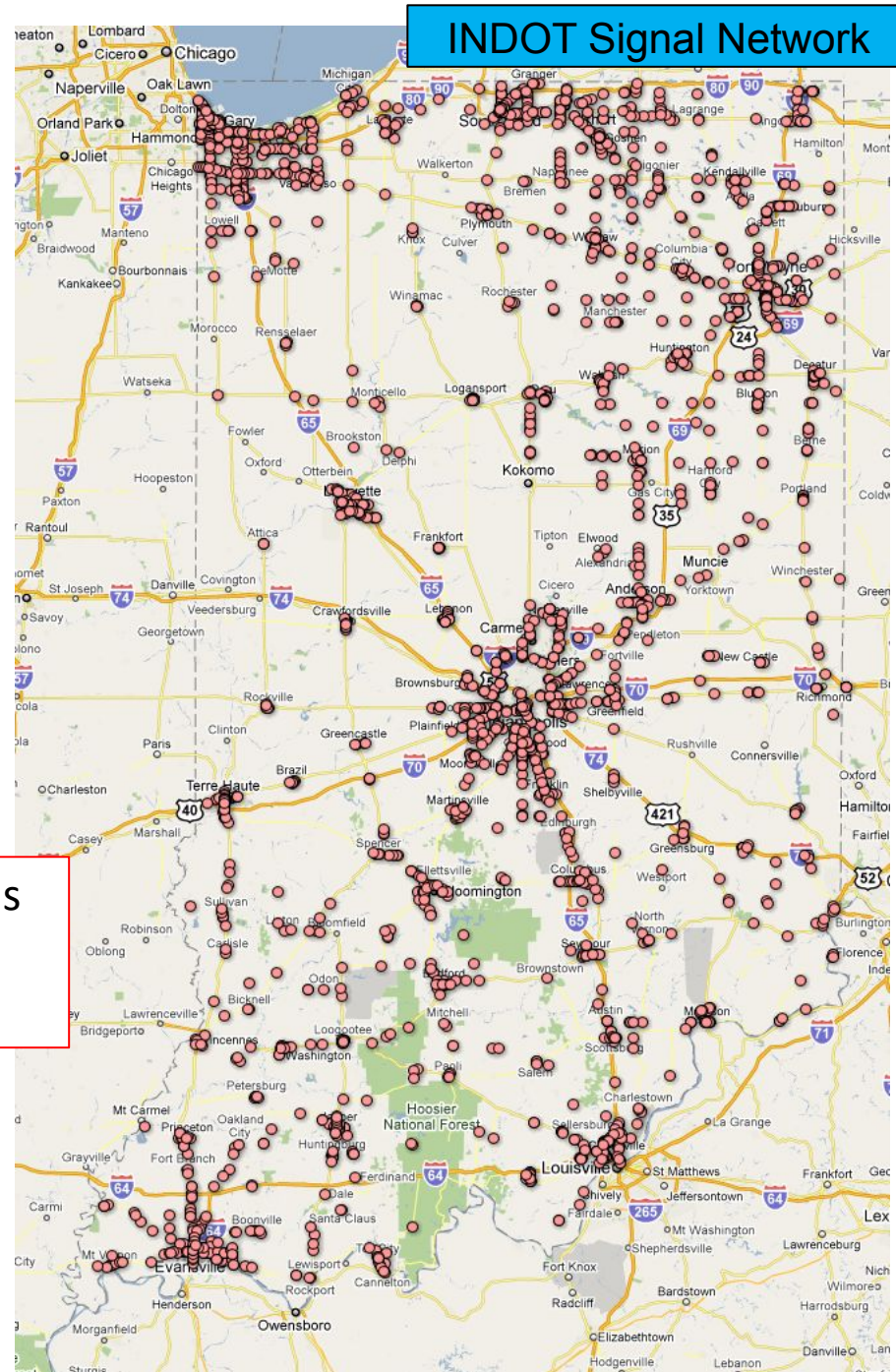
Don't wait
until the End

Question

- Where (and when) are the opportunities to improve signal operations?

INDOT: 2,600 signals in 300 systems
Nationwide: 350,000 signals
Globally: who knows?

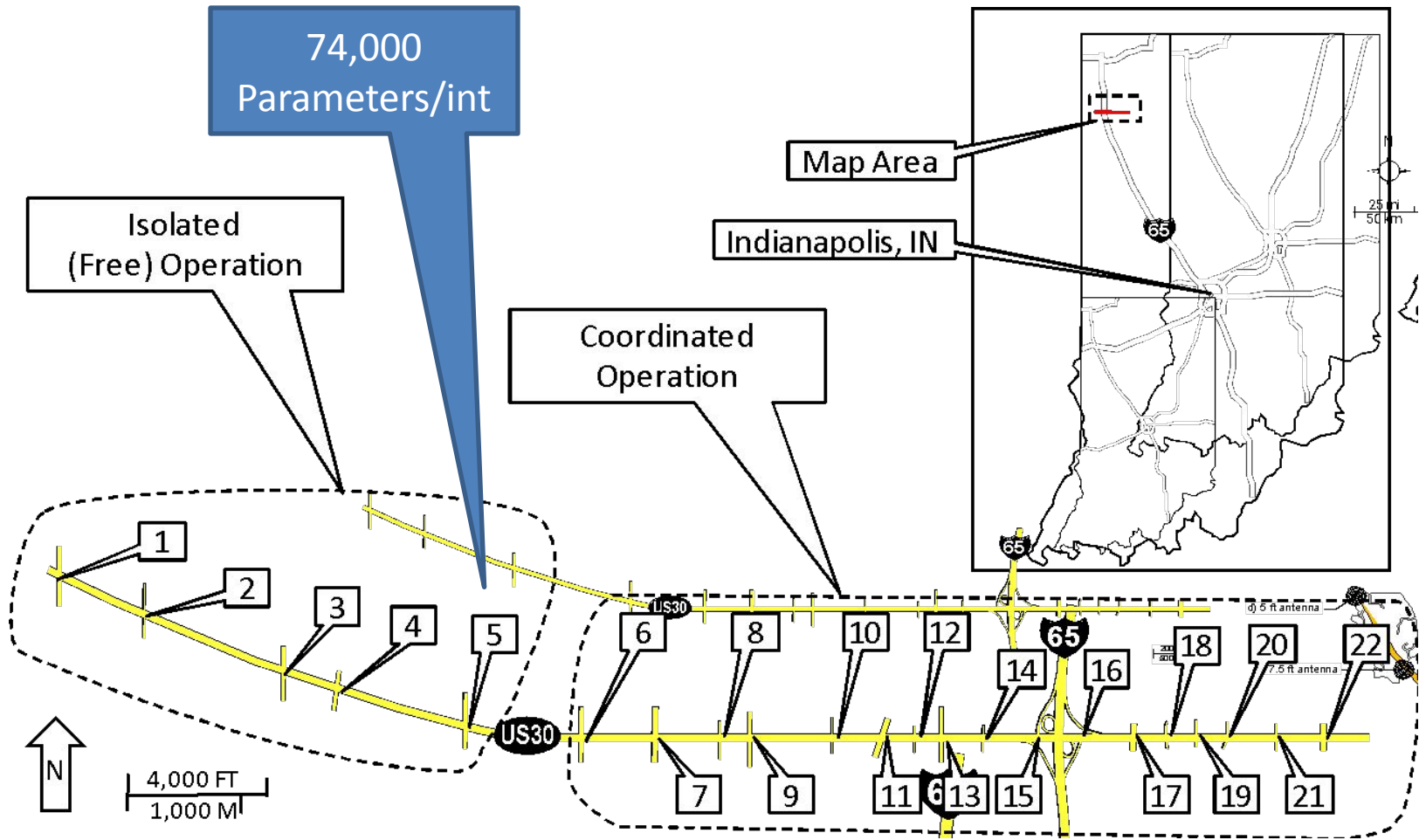
INDOT Signal Network



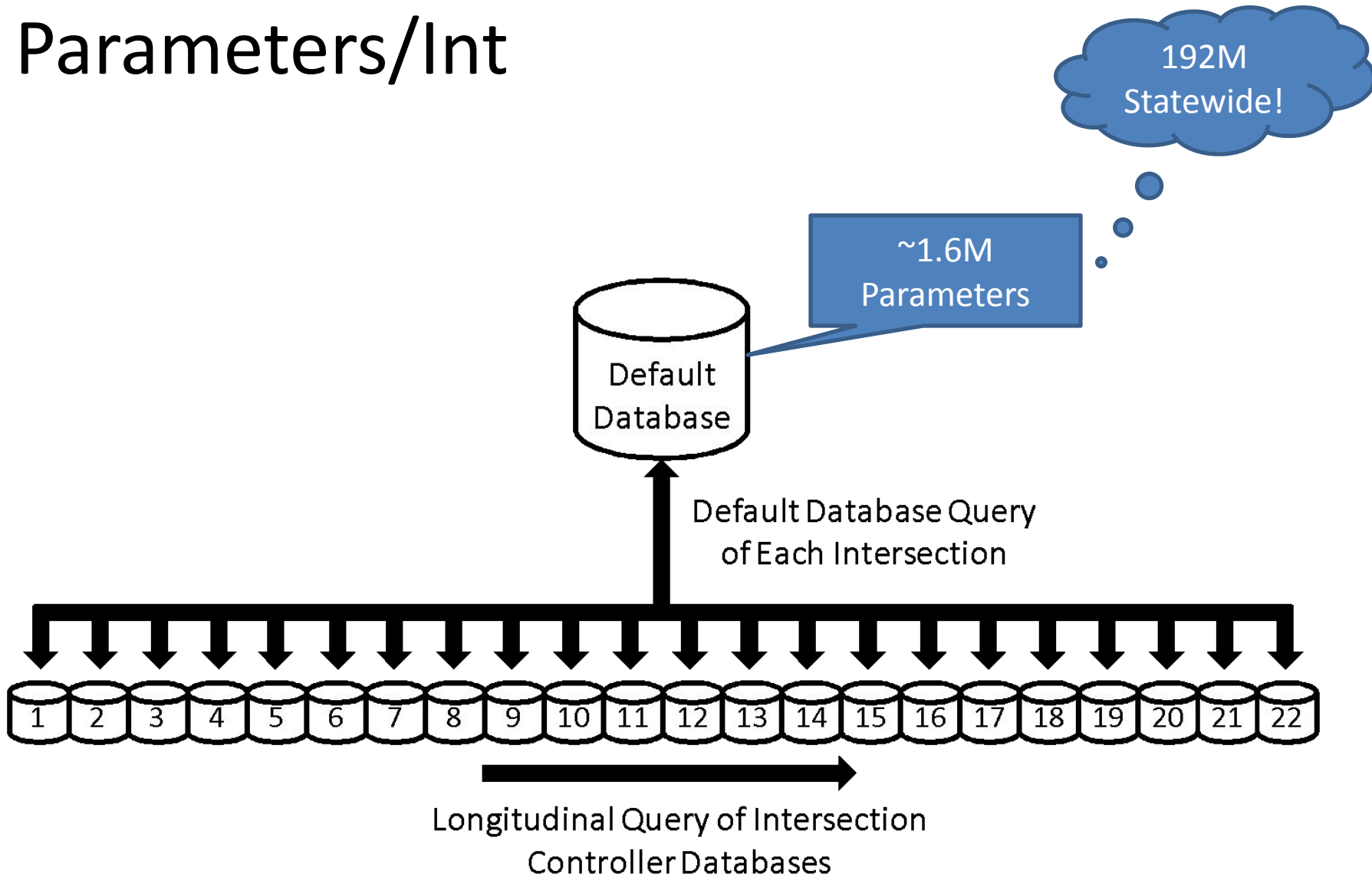


~311,000 Traffic Signals... We need systematic procedures for identifying operational problems...and fixing them using controller and probe data.

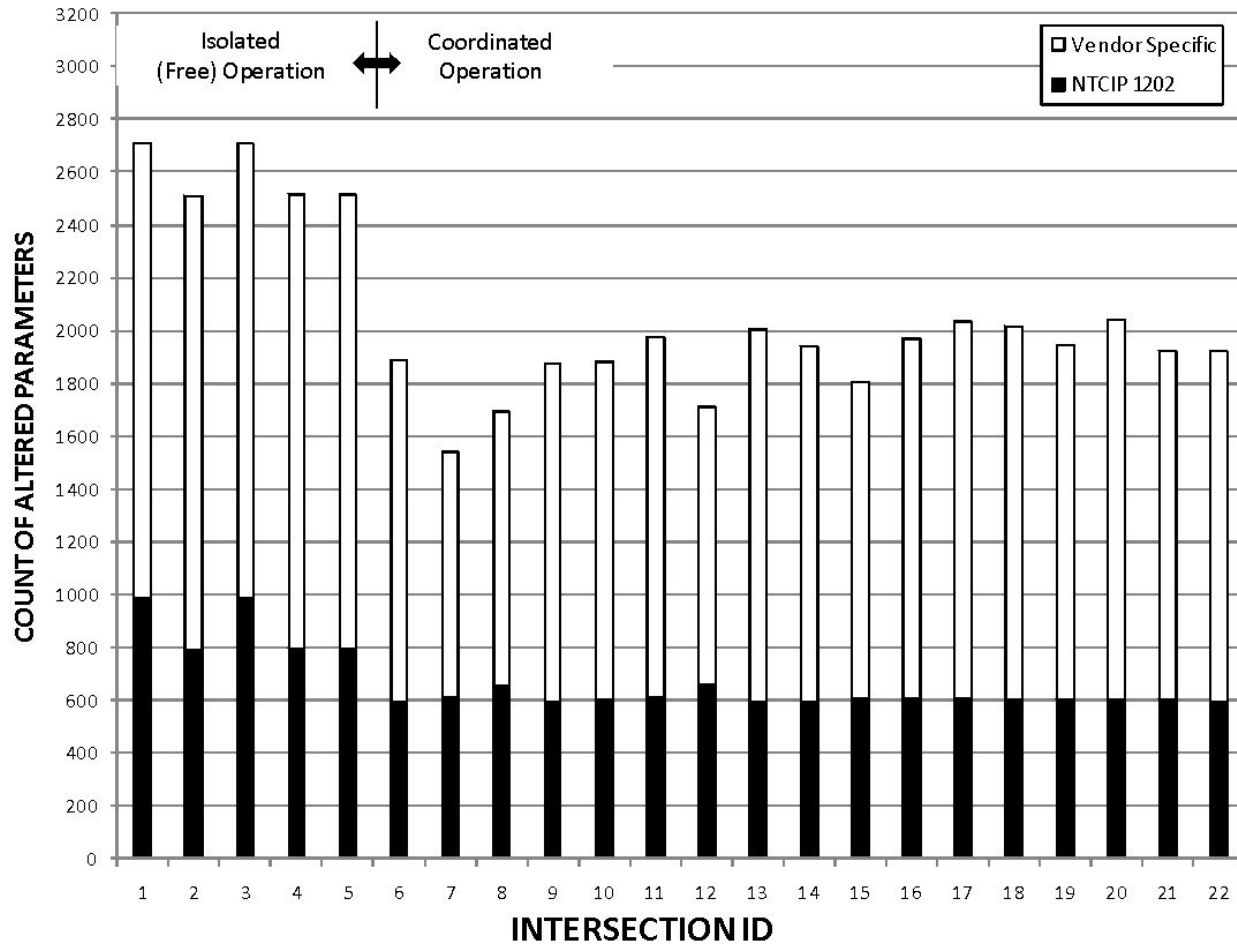
Typical Corridor (22 Intersections)



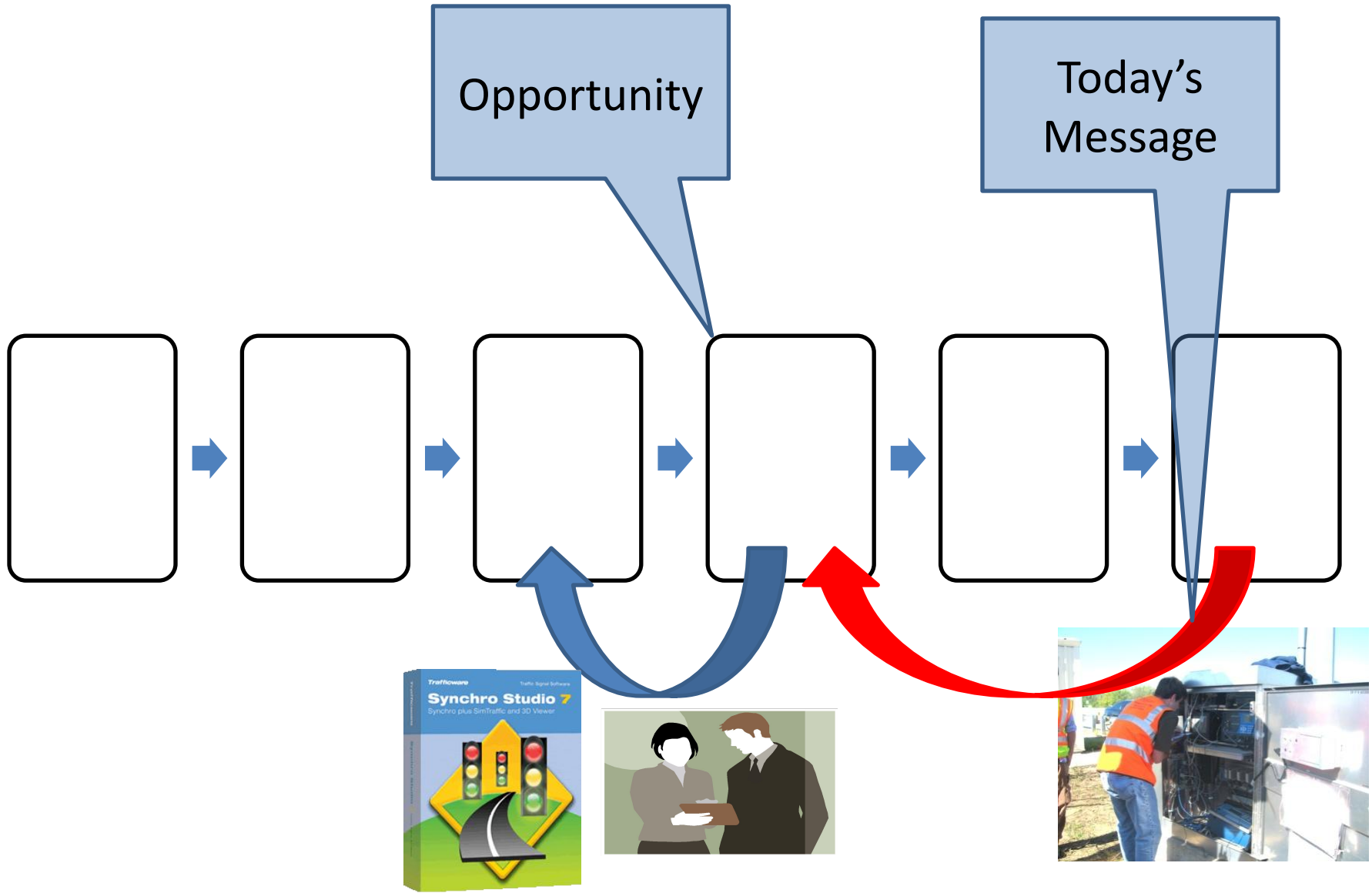
~74,000 Configurable Parameters/Int



So how many do we really use?



Traffic Signal Timing Process



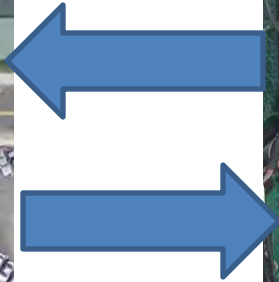
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Historical data collection (~1,000:1) averages out all of the information

~500,000
Events/day

Typical less than 500
average values/day
sent to Traffic
Management Centers
(and those are rarely
archived)



High Resolution Data

Econolite ASC 3 with Indiana
Data Logger Enabled (FTP
Transfer of hourly time
stamped events)



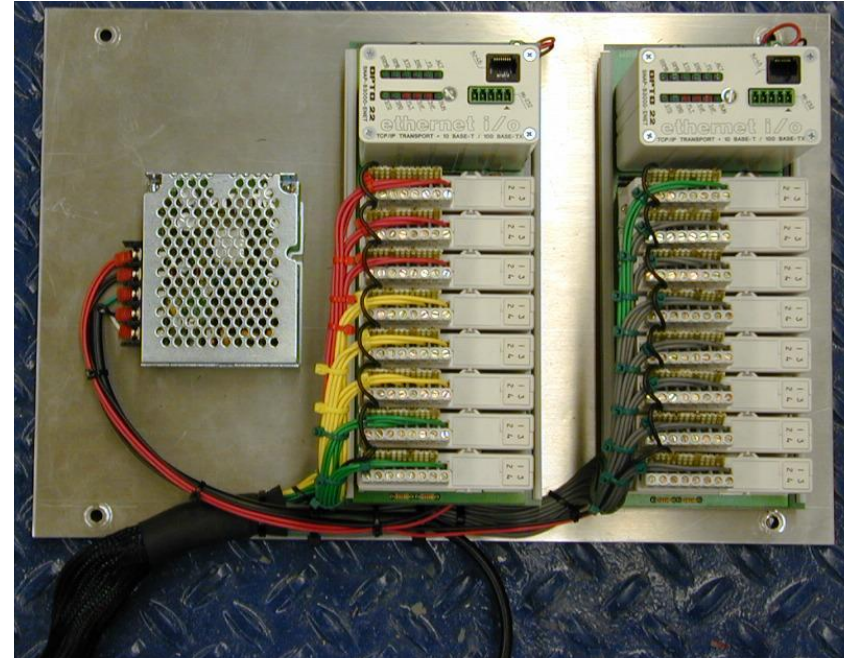
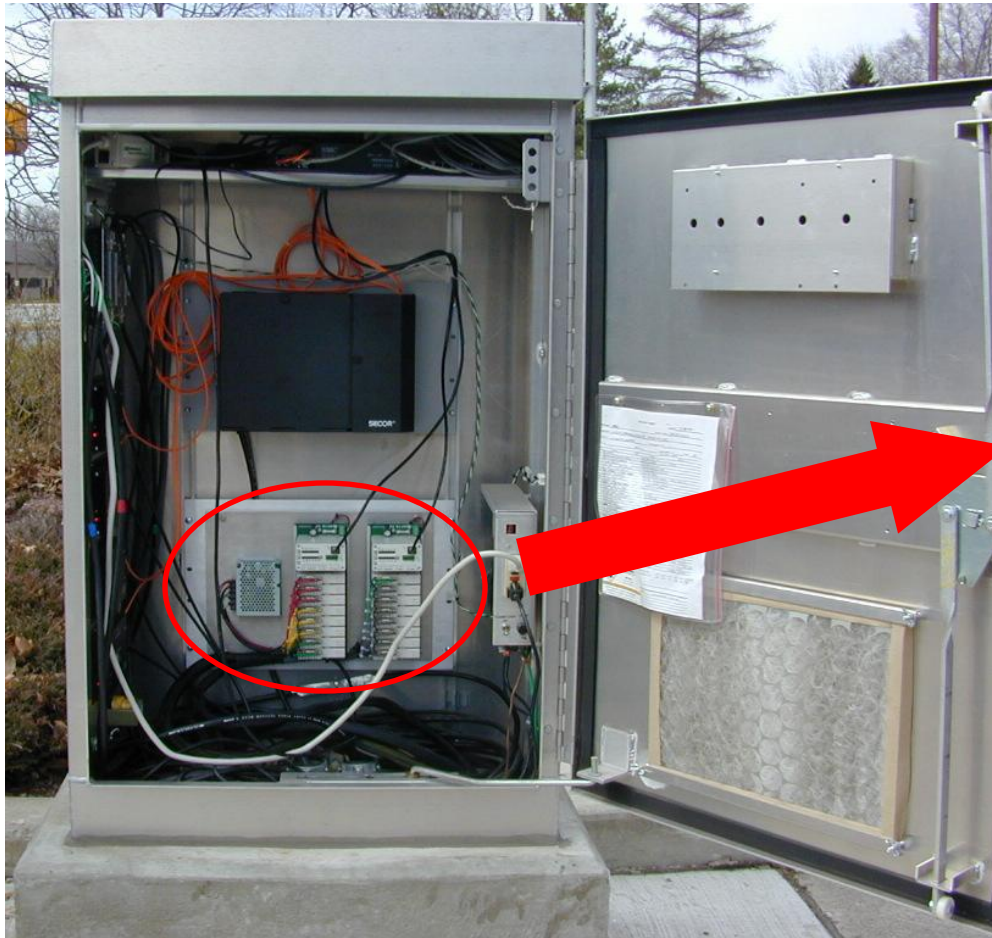
Ethernet Switch

Multi-scale

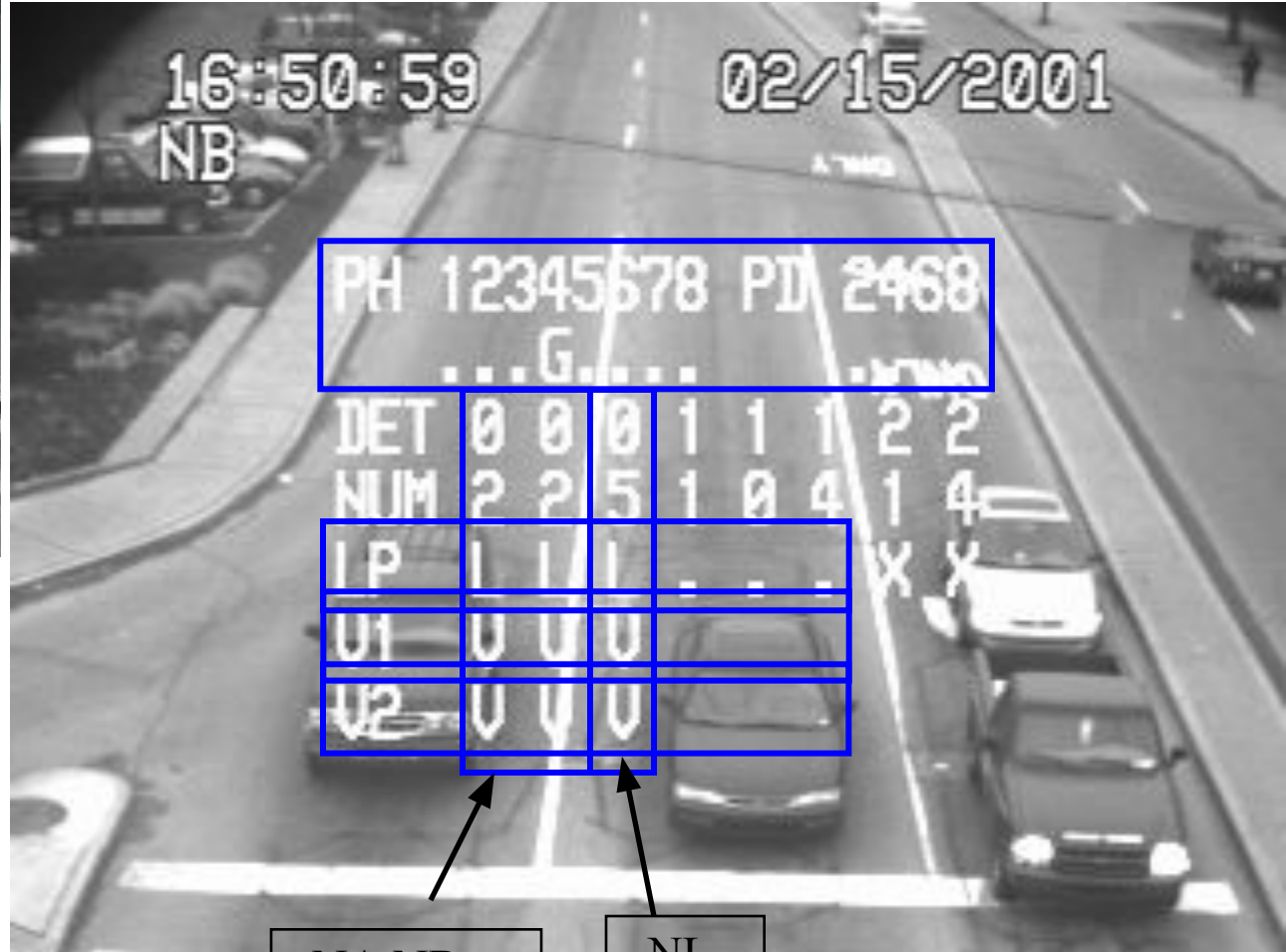
Performance Measure Concepts

- Travel Time is an important performance measure for both arterials and freeways
- Travel Time data can identify transportation links with performance challenges
- High resolution traffic signal controller data is needed to identify corrective actions

Signal Event Monitoring



Video Detection Evaluation



- Phase Indication
- ILD Status
- VID1 Status
- VID2 Status

• Example

Recent References

Multimodal with
vehicle, shuttle,
and ped. modes

- Day, C.M., R.J. Haseman, H. Premachandra, T.M. Brennan, J.S. Wasson, J.R. Sturdevant, and D.M. Bullock, “Visualization and Assessment of **Arterial Progression** Quality Using High Resolution Signal Event Data and Measured Travel Time,” Transportation Research Board Paper ID:10-0039, January 2010.
- Bullock, D.M., R.J. Haseman, J.S. Wasson, and R. Spitler, “Anonymous Bluetooth Probes for **Airport Security Line Service** Time Measurement: The Indianapolis Pilot Deployment,” Transportation Research Board Paper ID:10-1438, January 2010.
- Haseman, R.J., J.S. Wasson, and D.M. Bullock, “Real Time Measurement of **Work Zone Travel Time Delay** and Evaluation Metrics,” Transportation Research Board Paper ID:10-1442, January 2010.
- Day, C.M., J.R. Sturdevant, and D.M. Bullock, “**Outcome Oriented Performance Measures for Signalized Arterial Capacity Management**,” Transportation Research Board Paper ID:10-0008, January 2010.
- Smaglik E.J., A. Sharma, D.M. Bullock, J.R. Sturdevant, and G. Duncan, “**Event-Based Data** Collection for Generating Actuated Controller Performance Measures,” Transportation Research Record, #2035, TRB, National Research Council, Washington, DC, pp.97-106, 2007.

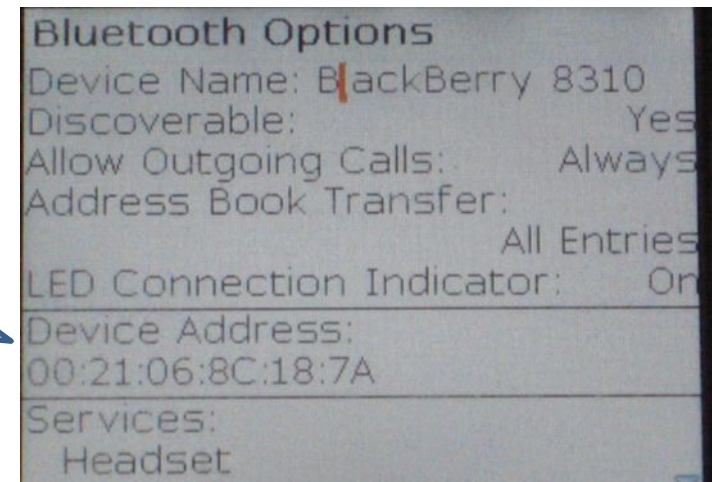
Terminology

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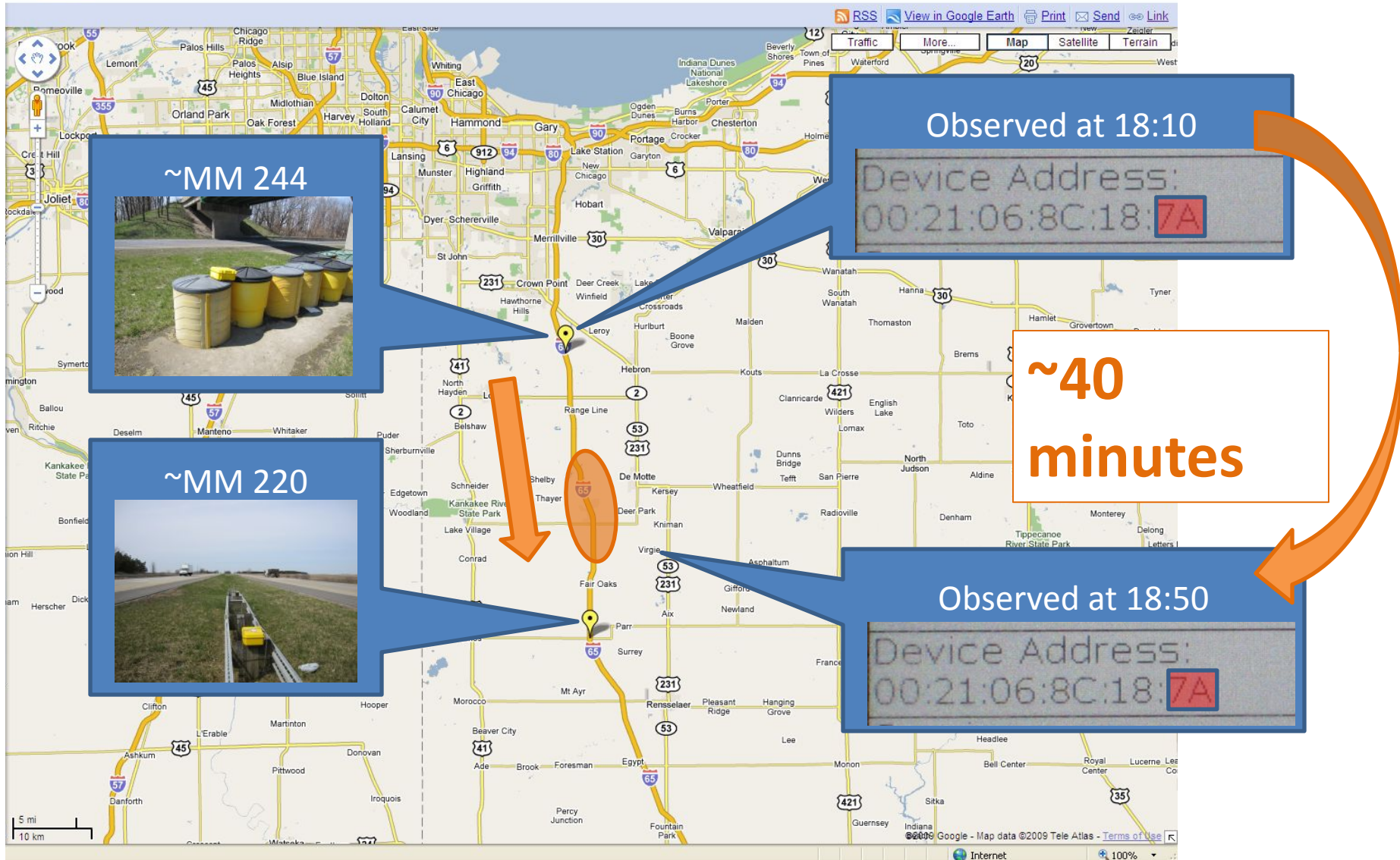
Concept

- **Bluetooth:** a wireless protocol utilizing short-range communications technology facilitating data transmission over short distances from fixed and/or mobile devices
- **MAC Address:** a 48 bit (>28 trillion) unique address assigned to a device by its manufacturer.



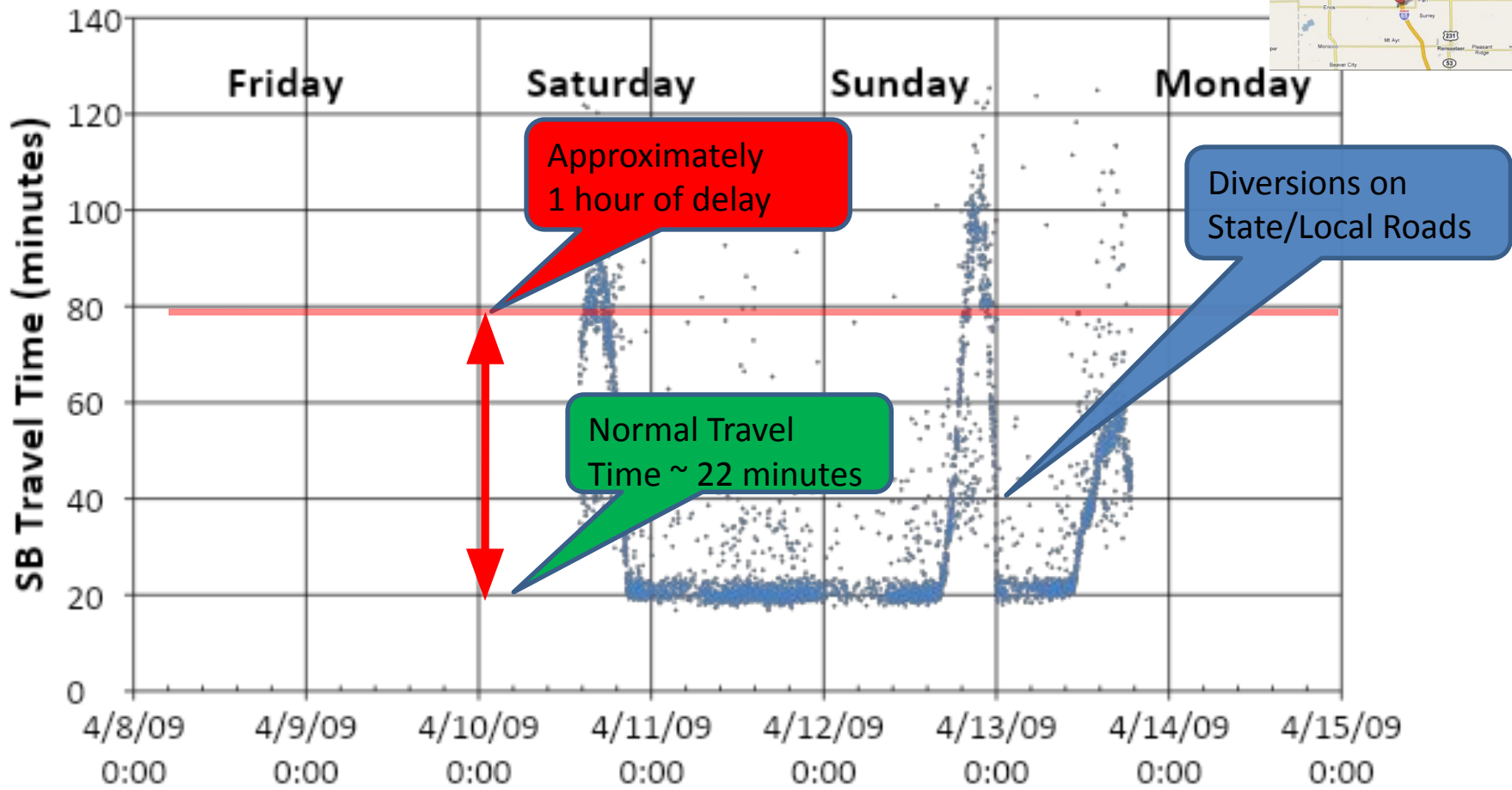
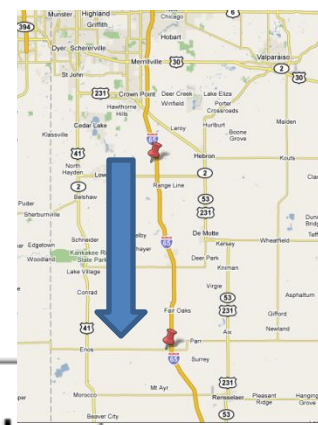
Easter Weekend: Southbound

Example 40 min travel time sample

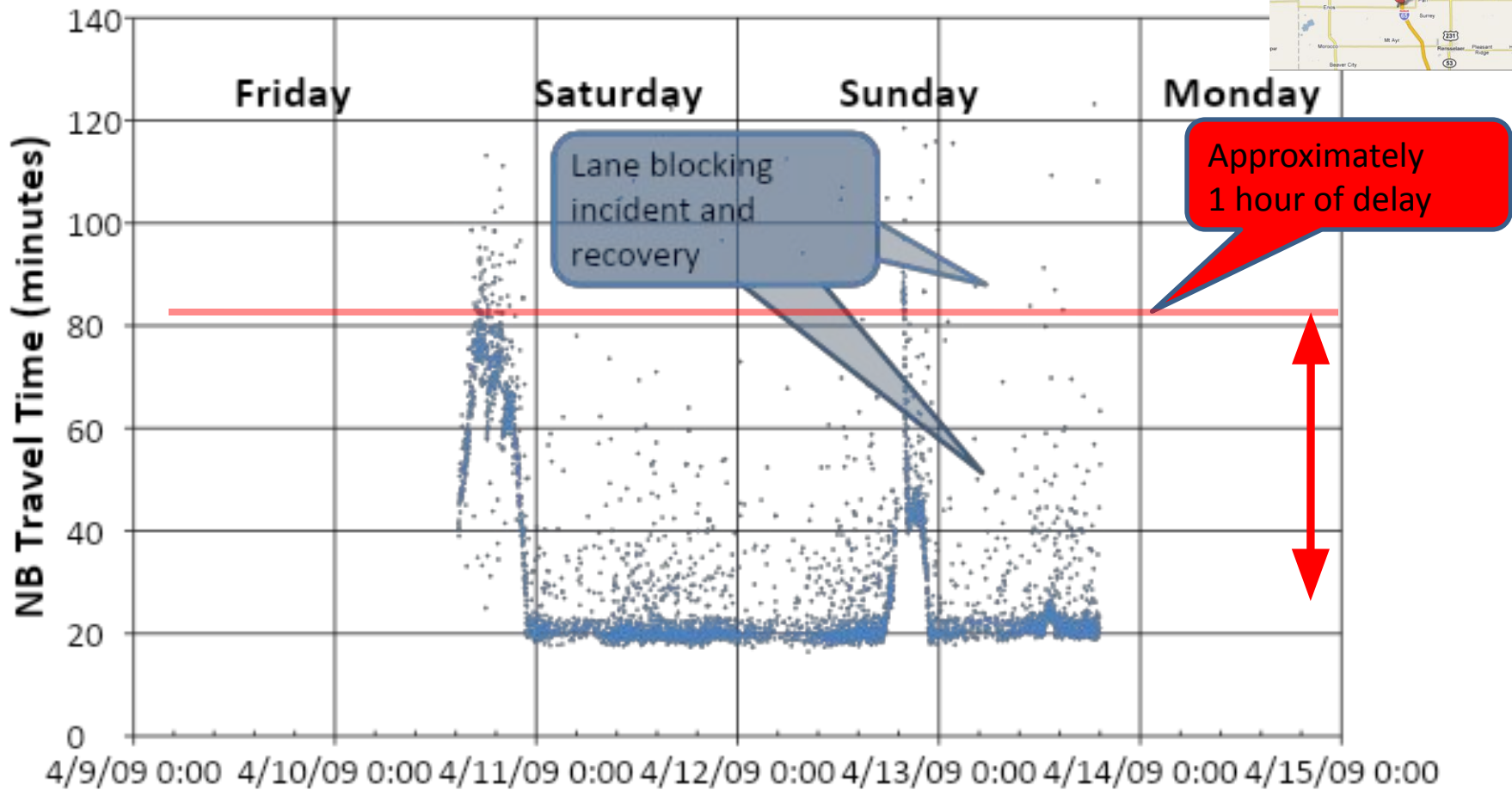
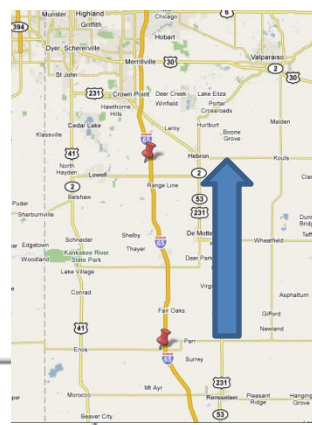


Easter Weekend

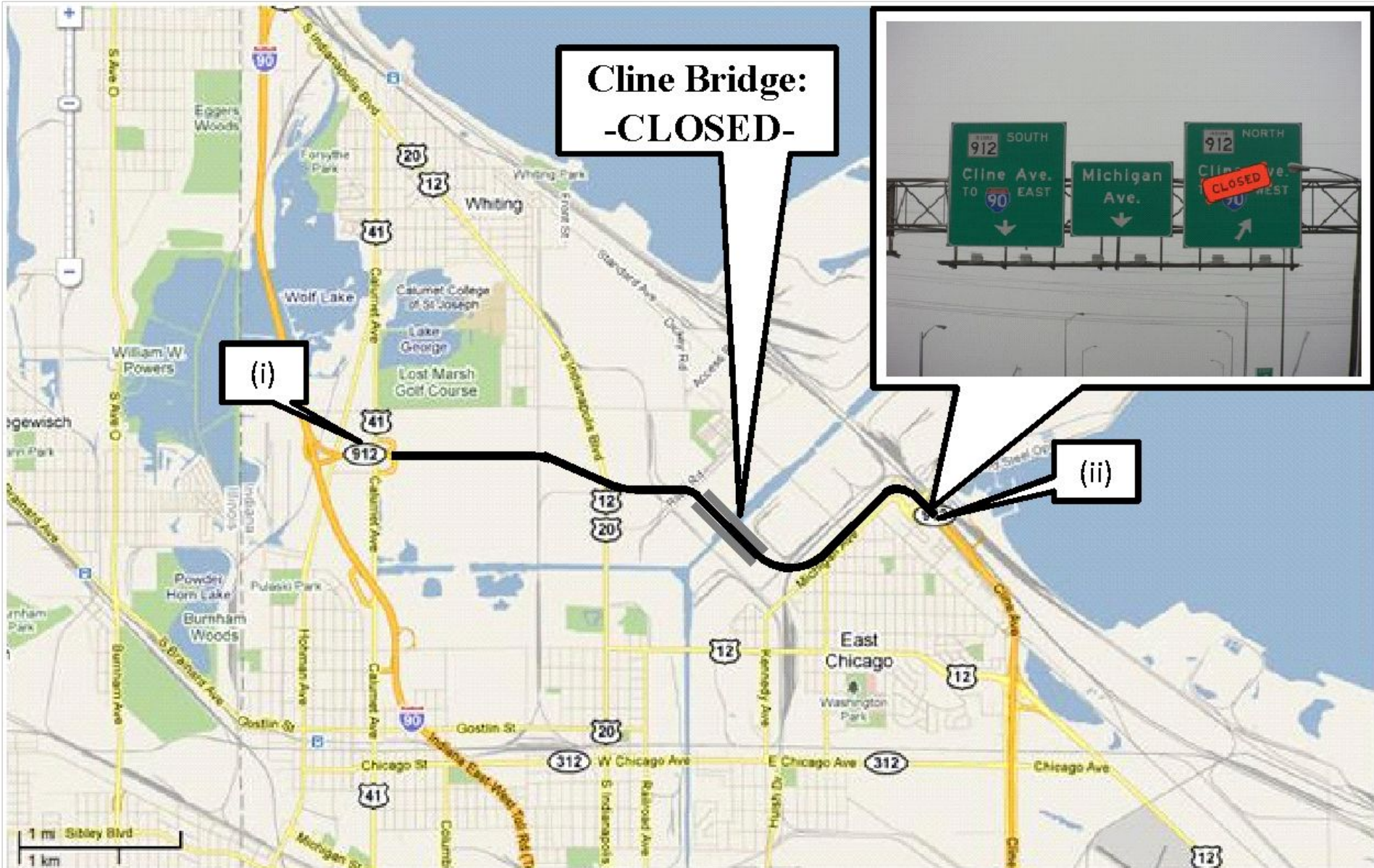
Southbound Travel Time (~24 miles)



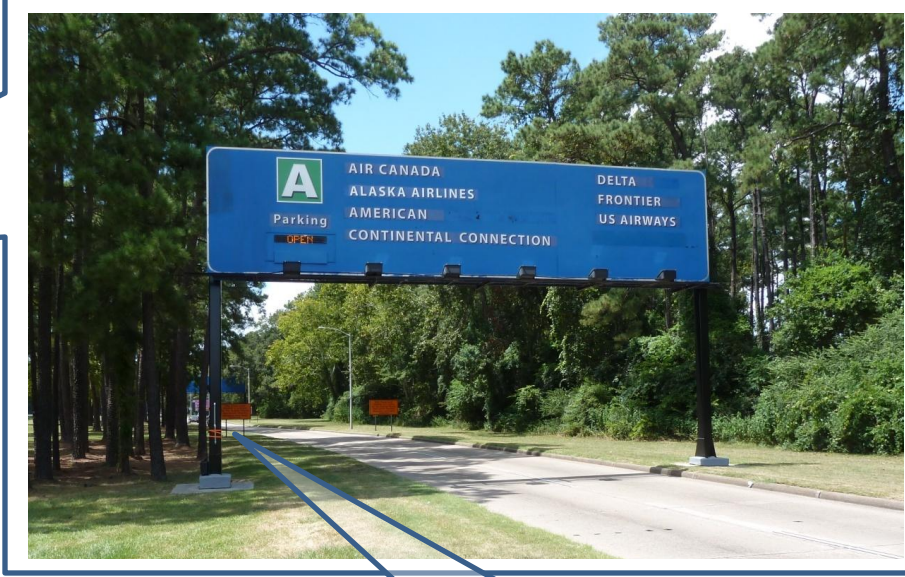
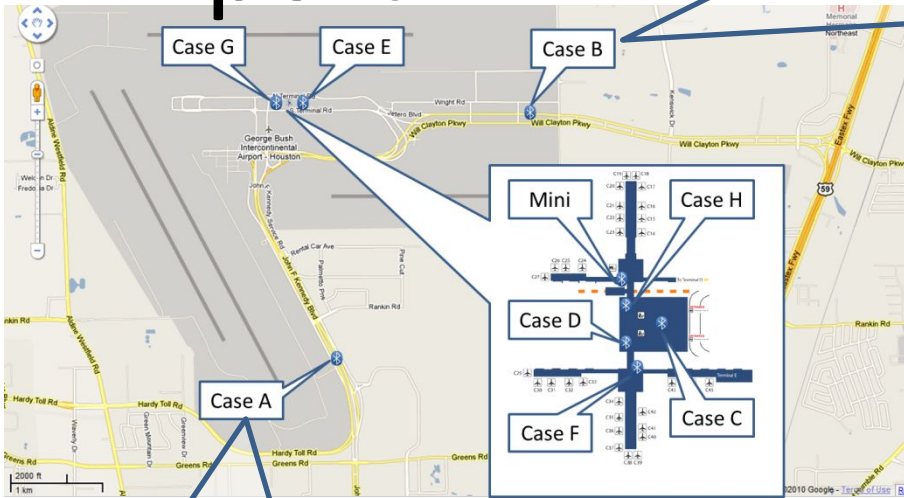
Easter Weekend Northbound Travel Time (~24 miles)



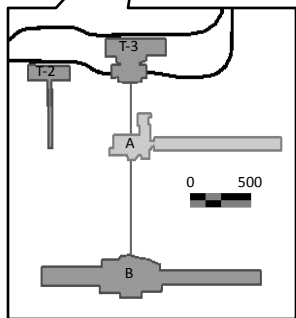
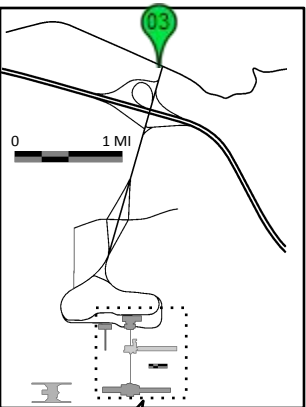
Gary, IN



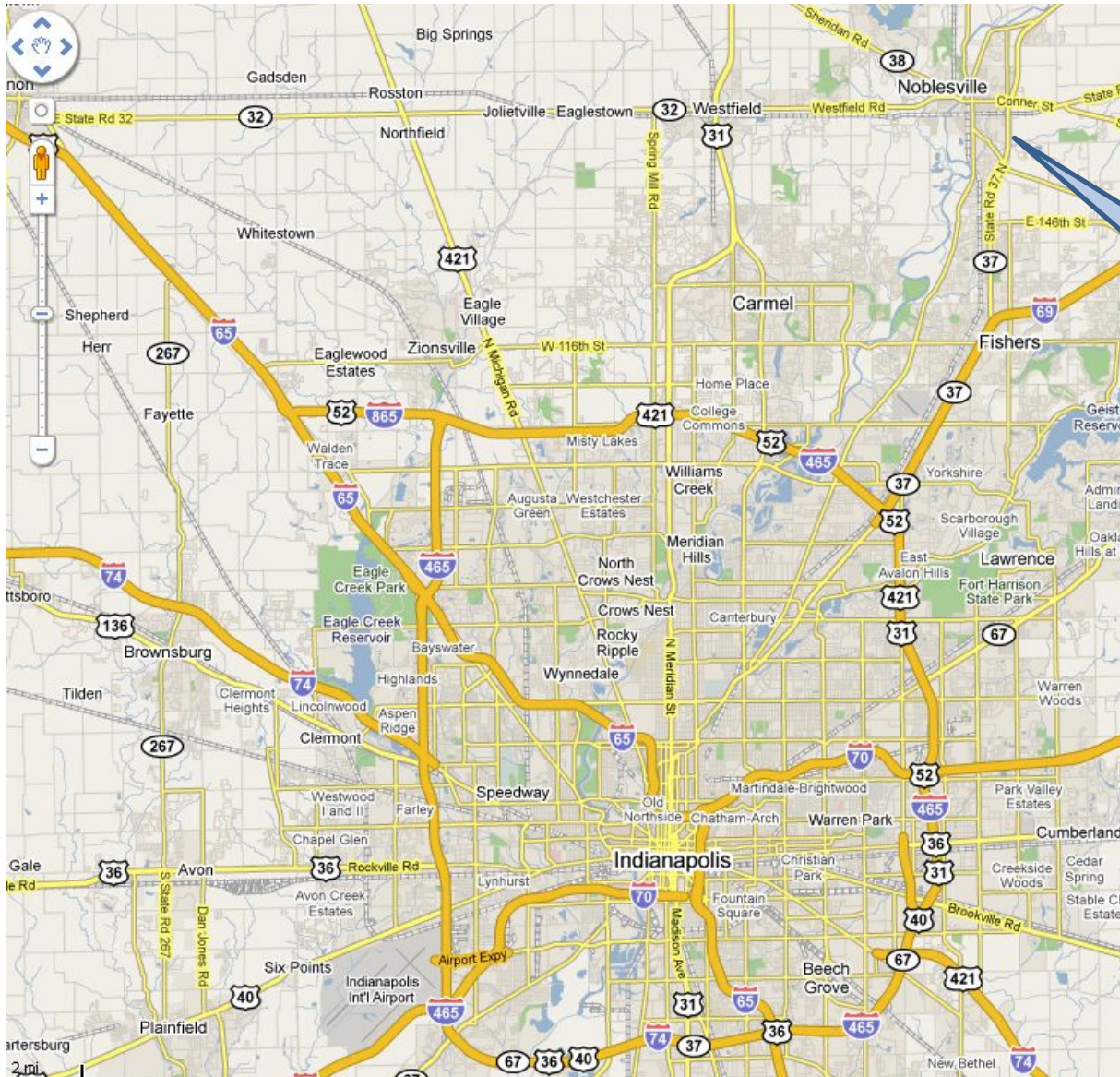
Houston, TX Airport



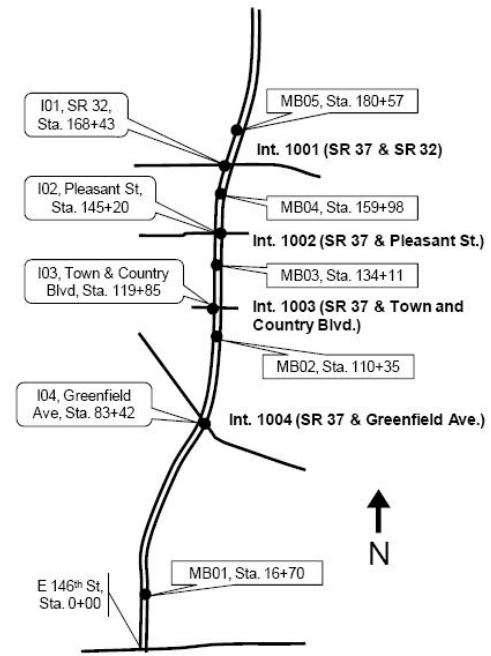
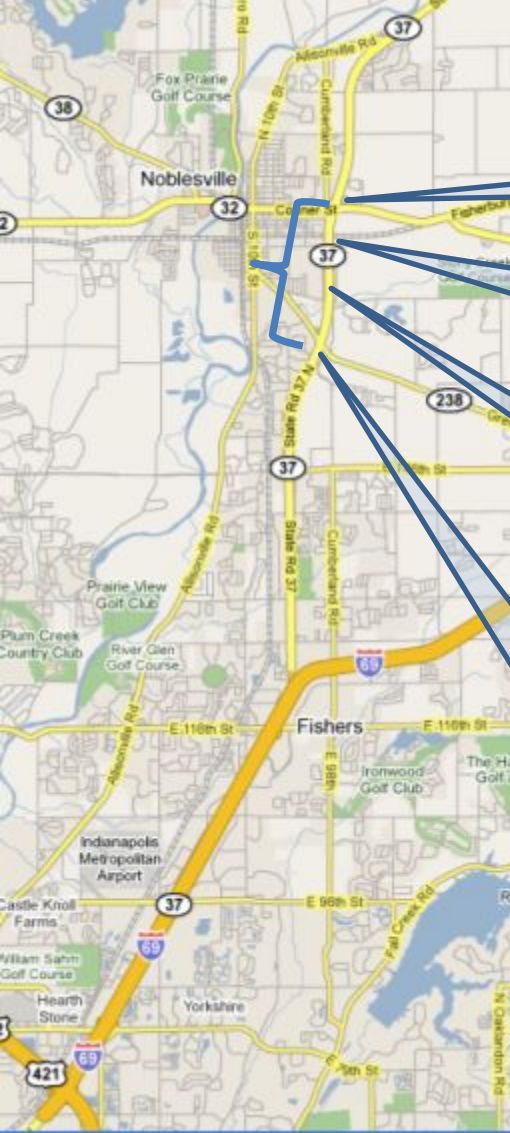
Cincinnati, OH Airport



Indianapolis, IN



SR 32 Instrumented Arterial from SR 238 to SR 37



SR 32 @ SR 238

Bluetooth
Antenna

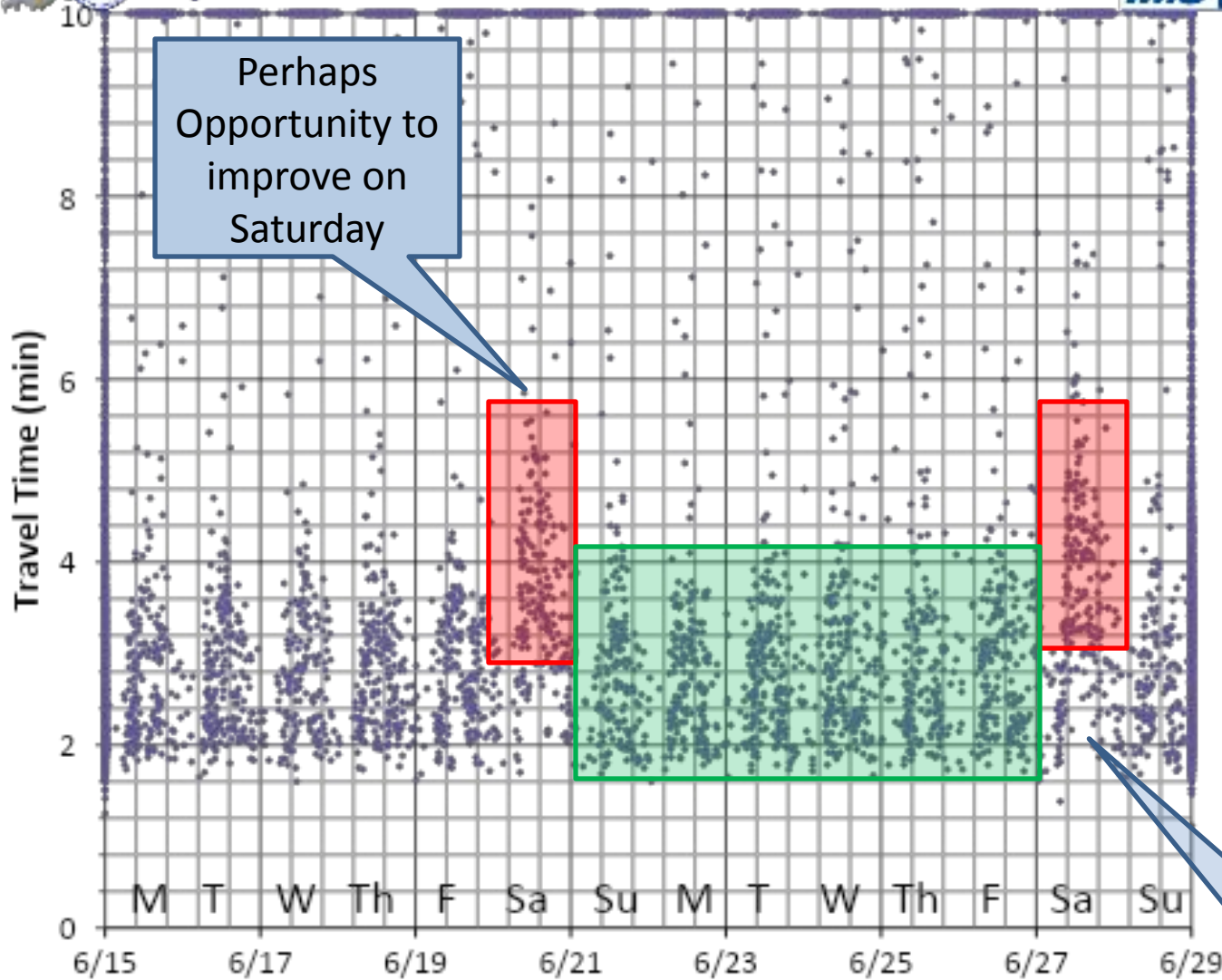
Econolite ASC 3
with Indiana Data
Logger Enabled



Ethernet Switch

Bluetooth Data
Logger

SR-37 Travel Times



Perhaps Opportunity to improve on Saturday

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Highway Capacity Manual Delay Equation

$$d = d_1(PF) + d_2 + d_3$$

Oversaturation
(Split Failures)

$$d_{1,\phi,a} = \frac{0.5C \left(1 - \frac{g_{\phi,a}}{C_a}\right)^2}{1 - \left[\min(1, X_{\phi,a}) \frac{g_{\phi,a}}{C_a} \right]}$$

$$PF_{\phi,a} = \frac{1 - P_{\phi,a}}{\left(1 - \frac{g_{\phi,a}}{C}\right)} f_{PA}$$

1

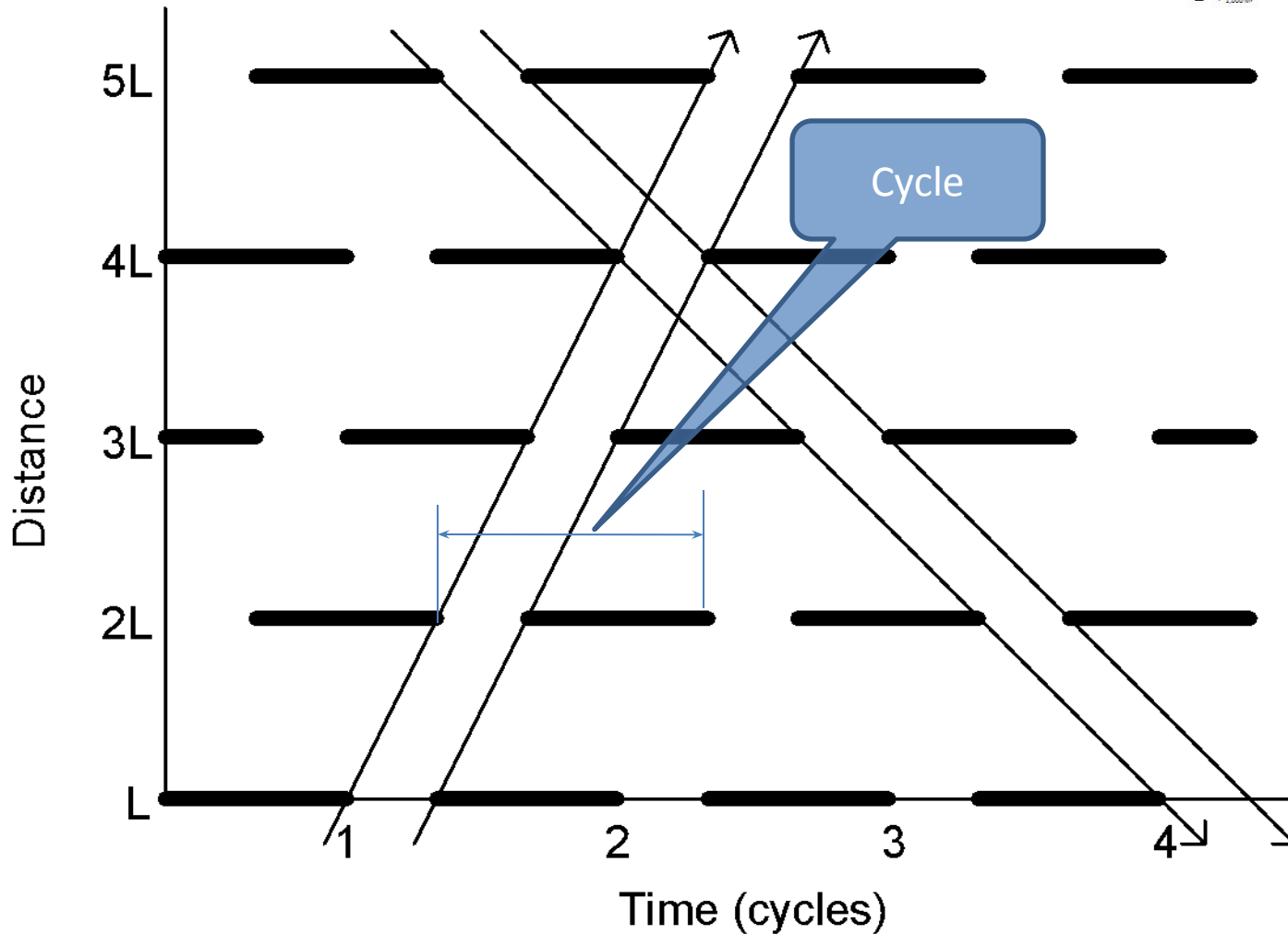
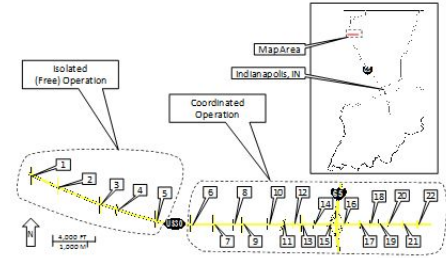
Capacity Utilization
(Volume-to-Capacity Ratio)

Quality of Progression
(Percent on Green)

2

Coordination: Split, **Cycle**, Offset

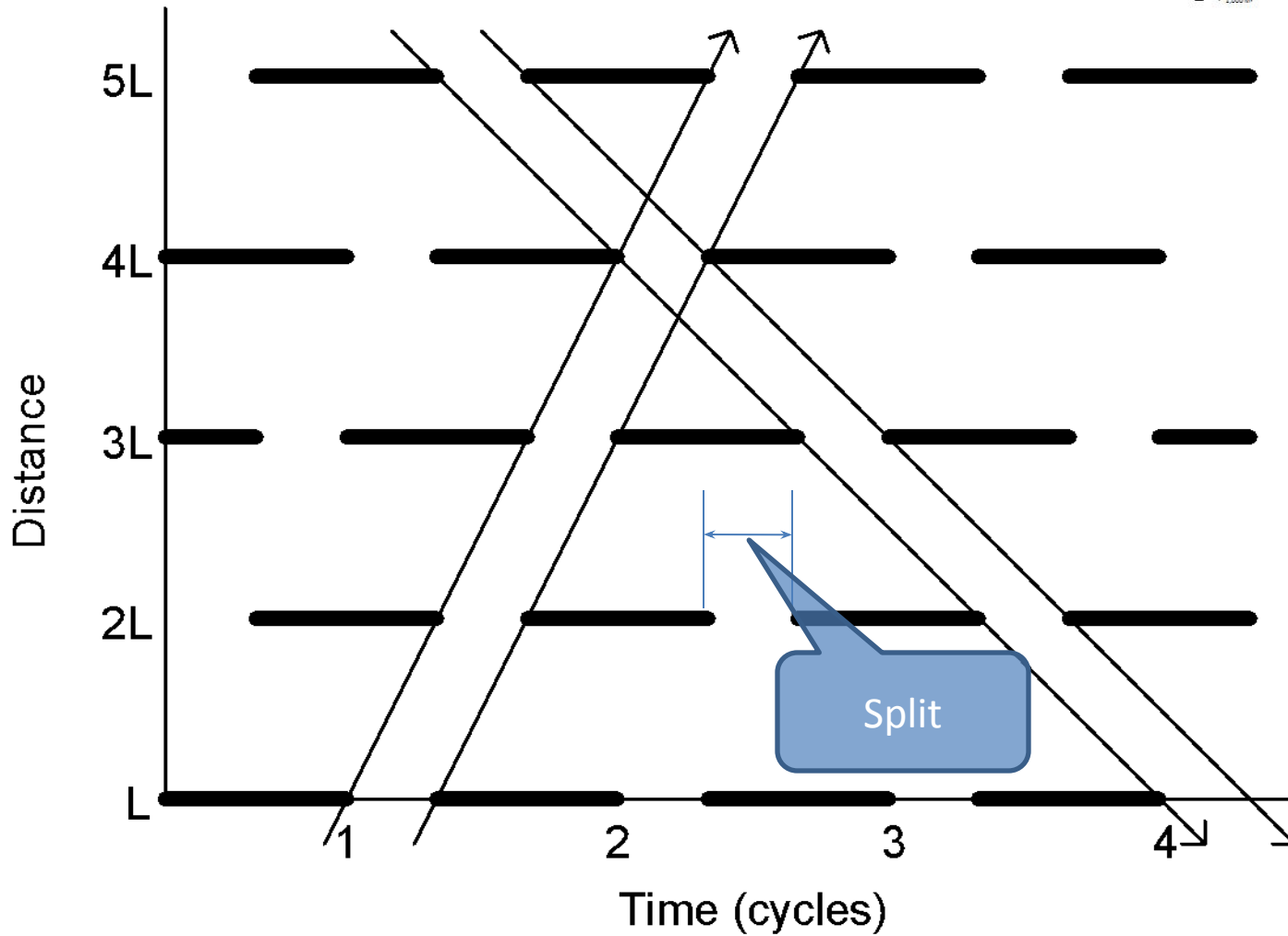
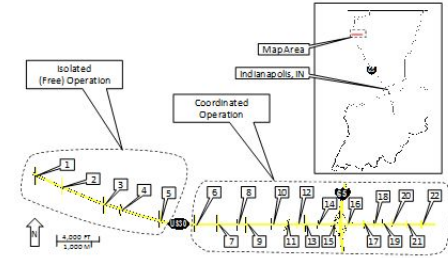
Typical Corridor (22 Intersections)



Really Hard
to get perfect
for 22
Intersections

Coordination: **Split**, Cycle, Offset

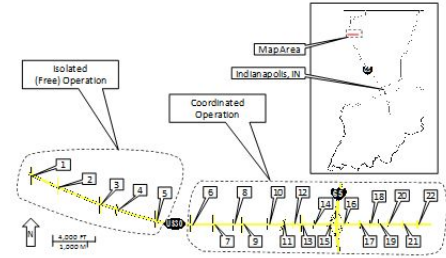
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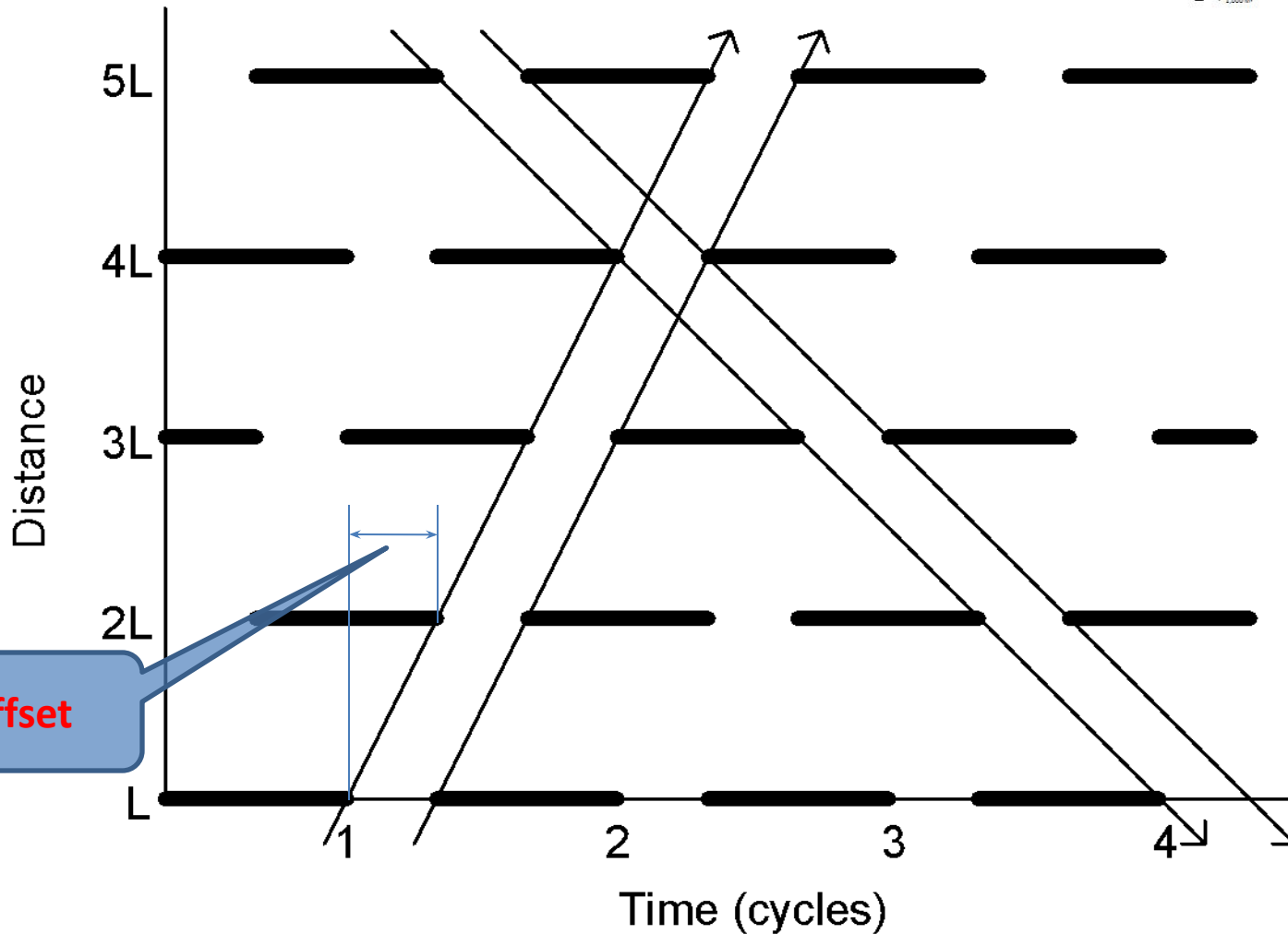
Phone calls
work pretty
well

Coordination: Split, Cycle, **Offset**

Typical Corridor (22 Intersections)



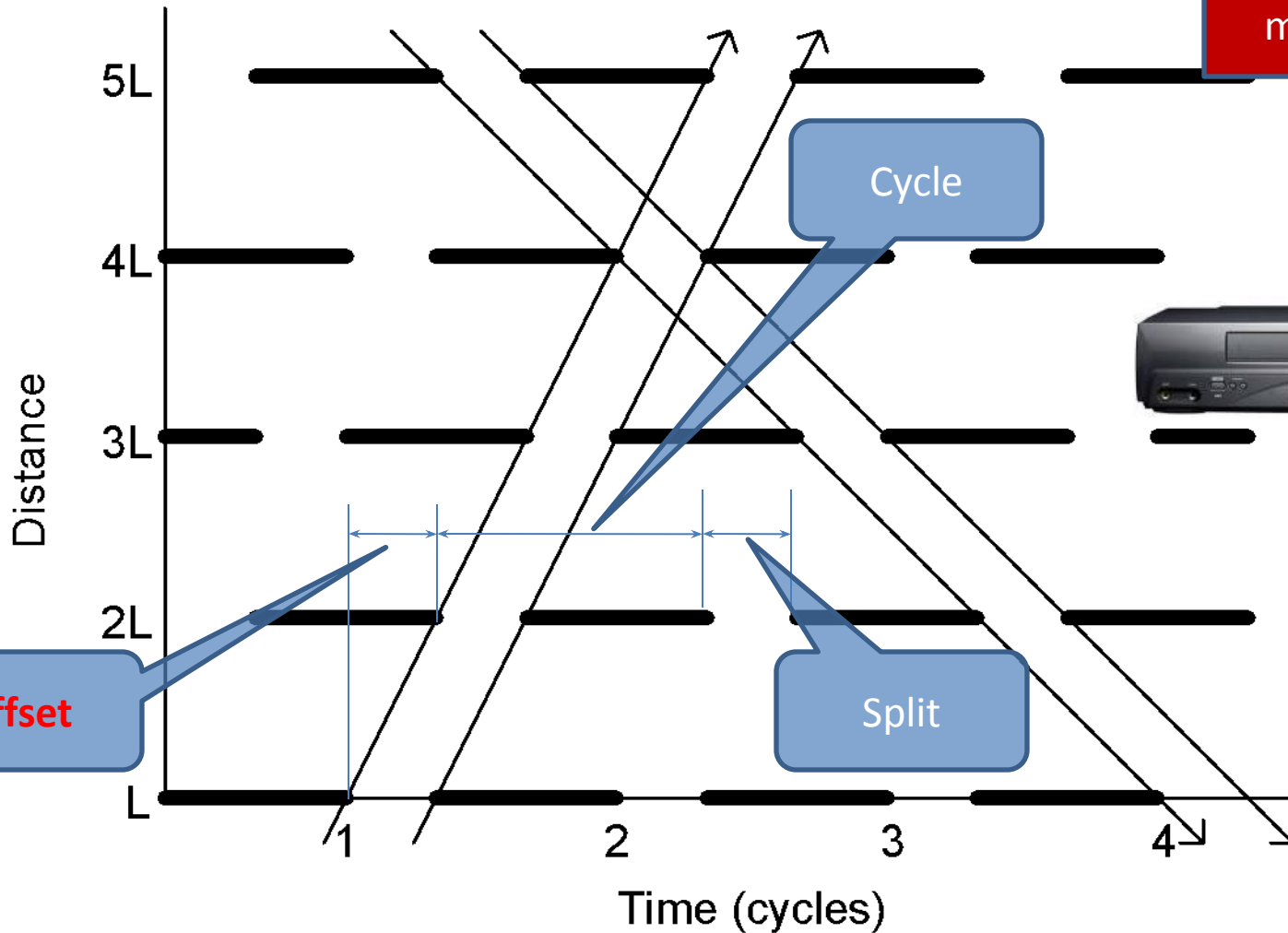
Tuning is
labor
intensive



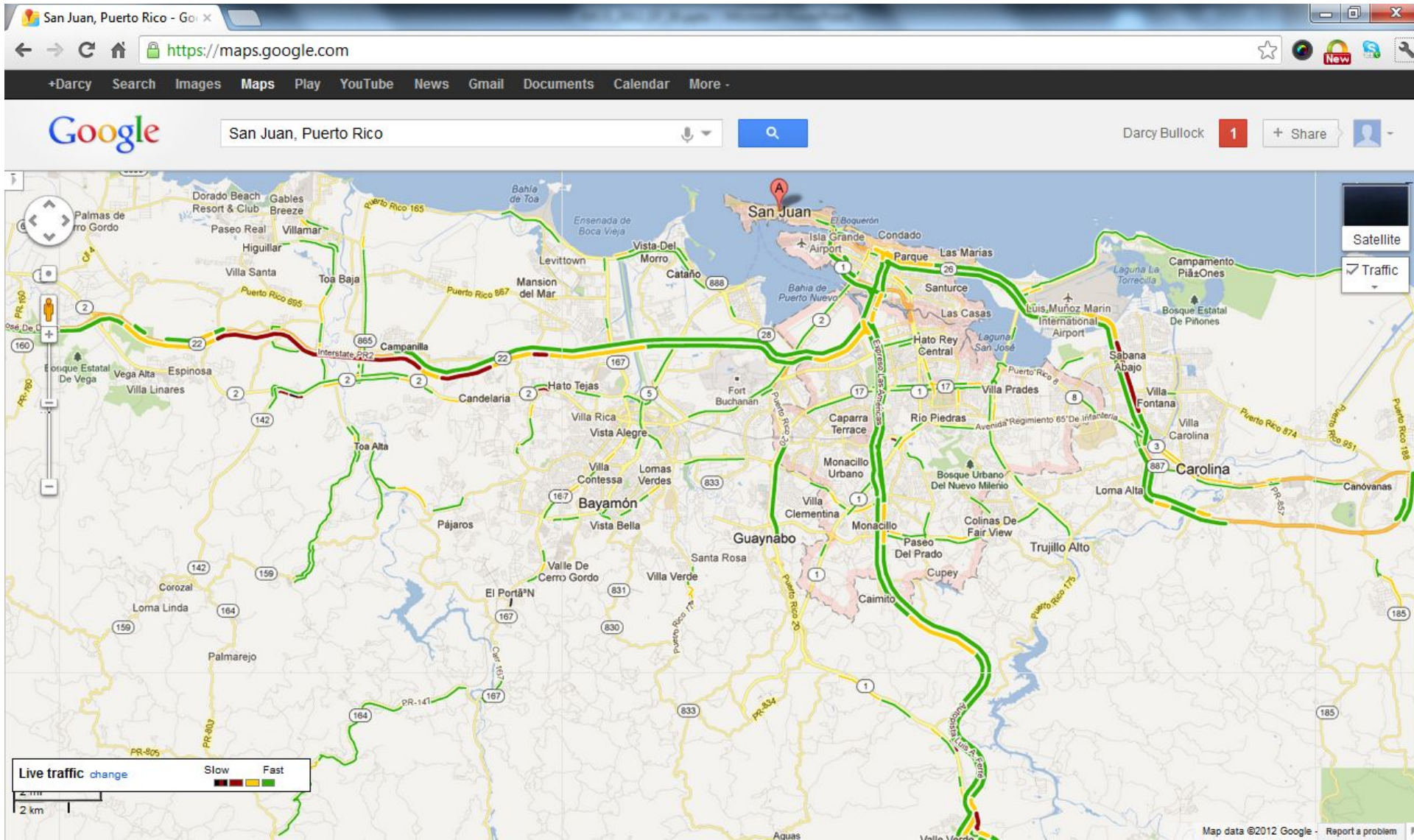
Offset

Coordination: Split, Cycle, Offset

74,000
parameters, 1000's
of opportunities to
make mistakes

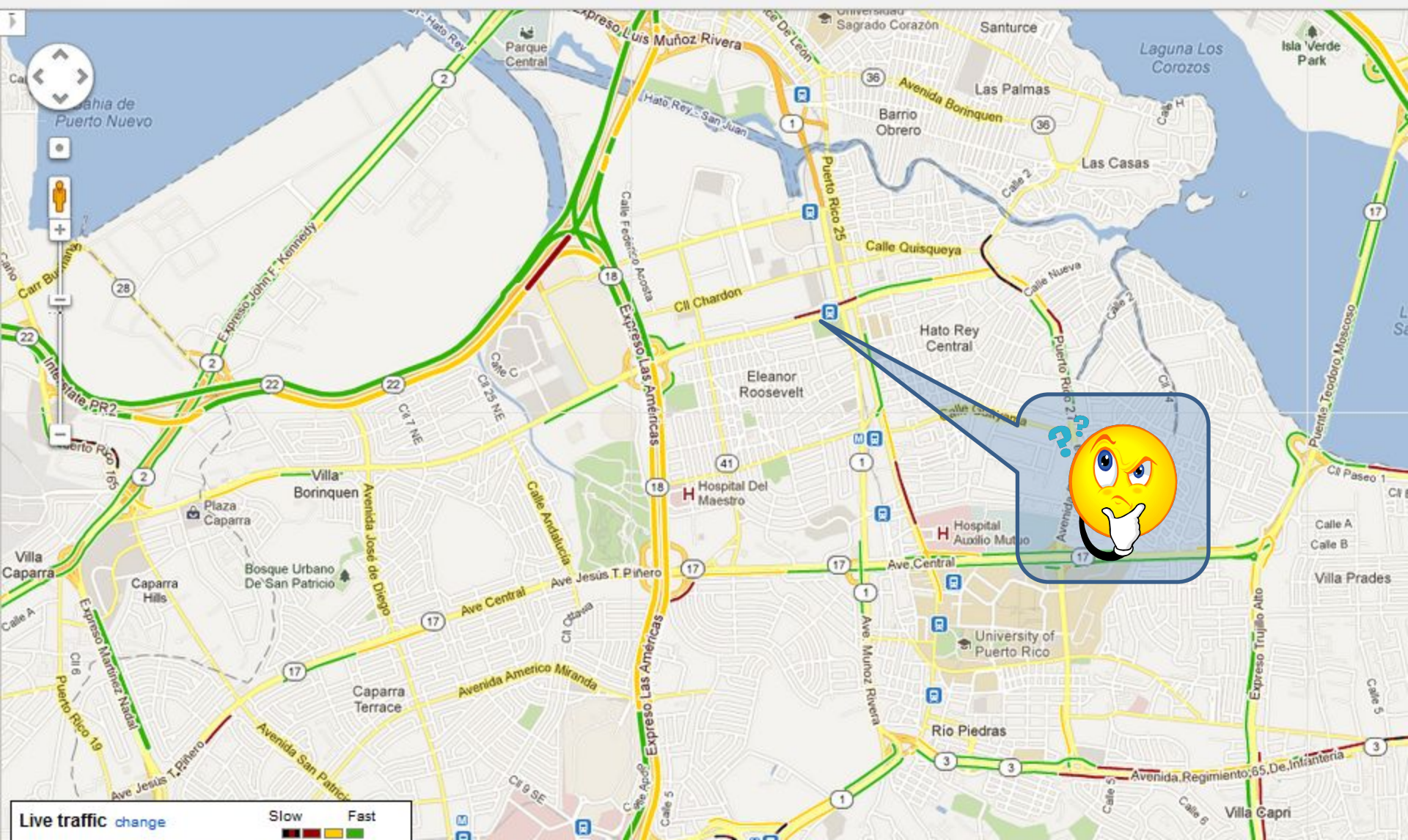


San Juan





San Juan, Puerto Rico

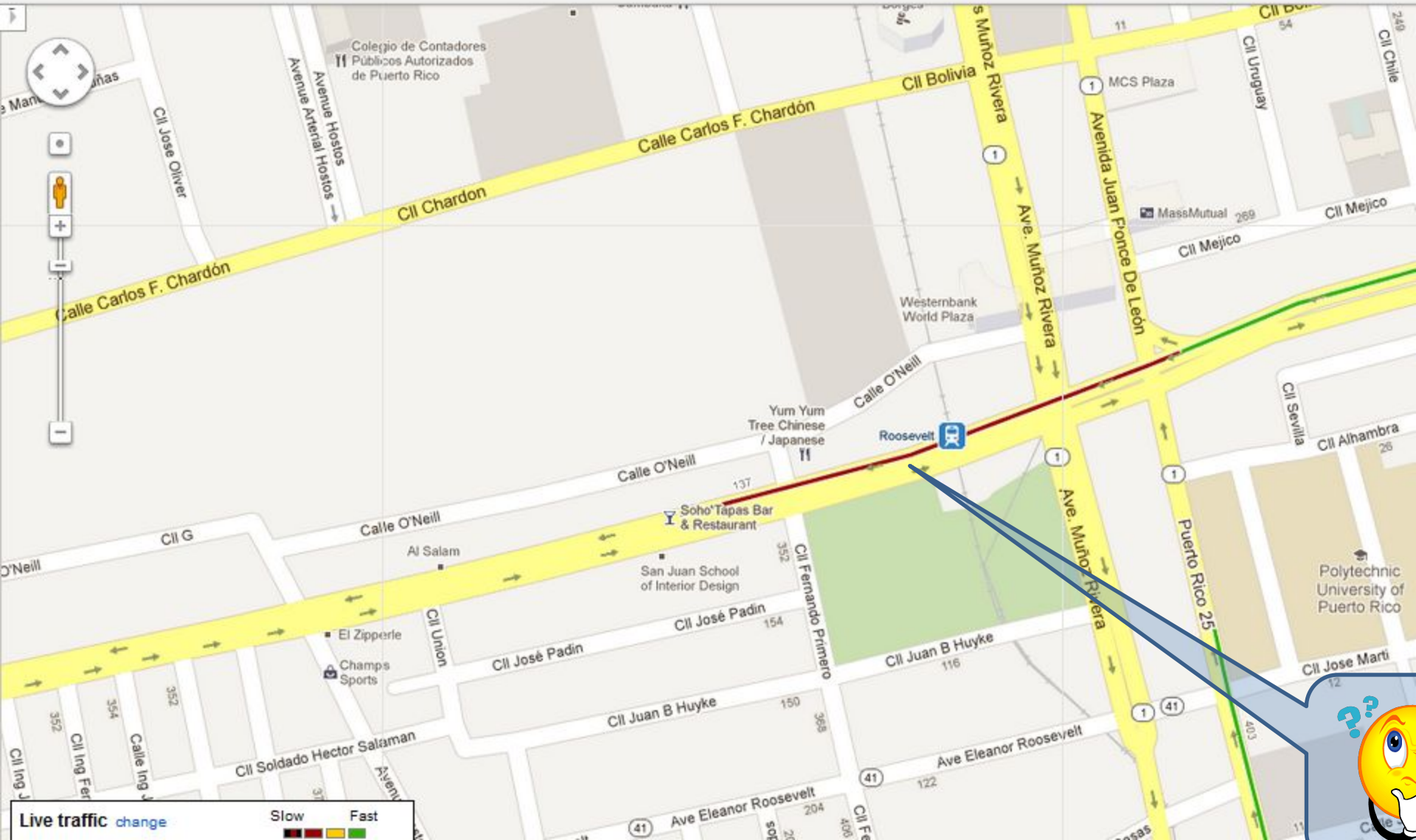


Live traffic change

| Slow | Fast |
|------|------|
| | |



San Juan, Puerto Rico



Live traffic [change](#)

| Slow | Fast |
|------|------|
| | |



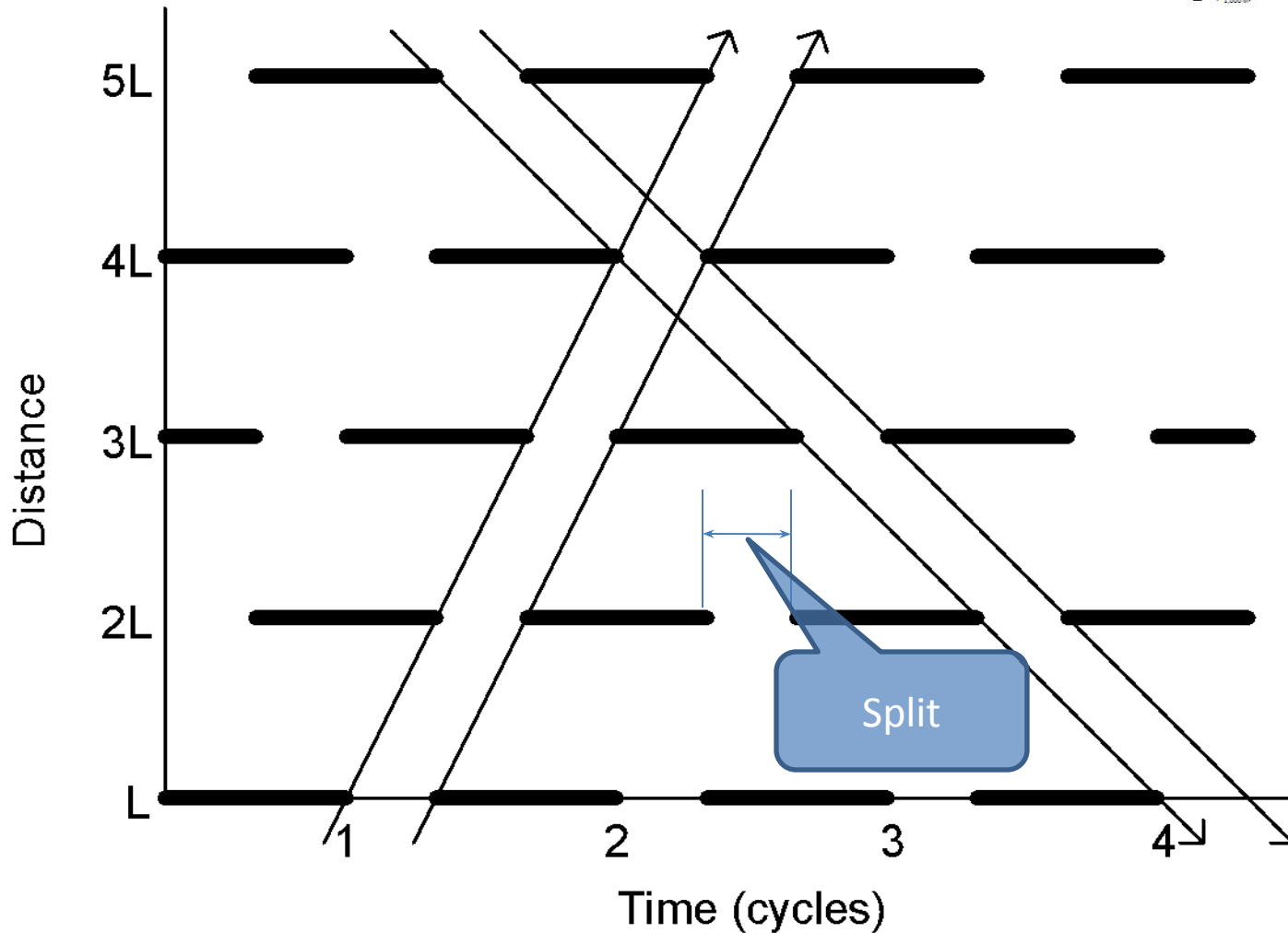
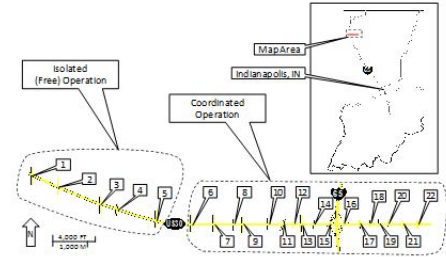
A Picture Book Approach to Traffic Signal Management

- ...so we can find our problems,
- but how are we going to fix them

Diagnostics (Andrew Nichols)

Coordination: **Split**, Cycle, Offset

Typical Corridor (22 Intersections)



We can improve on phone calls

V/C Ratios @ Intersection B Tuesday (12/6)

Highway Capacity Manual Delay Equation

$$d = d_1(PF) + d_2 + d_3$$

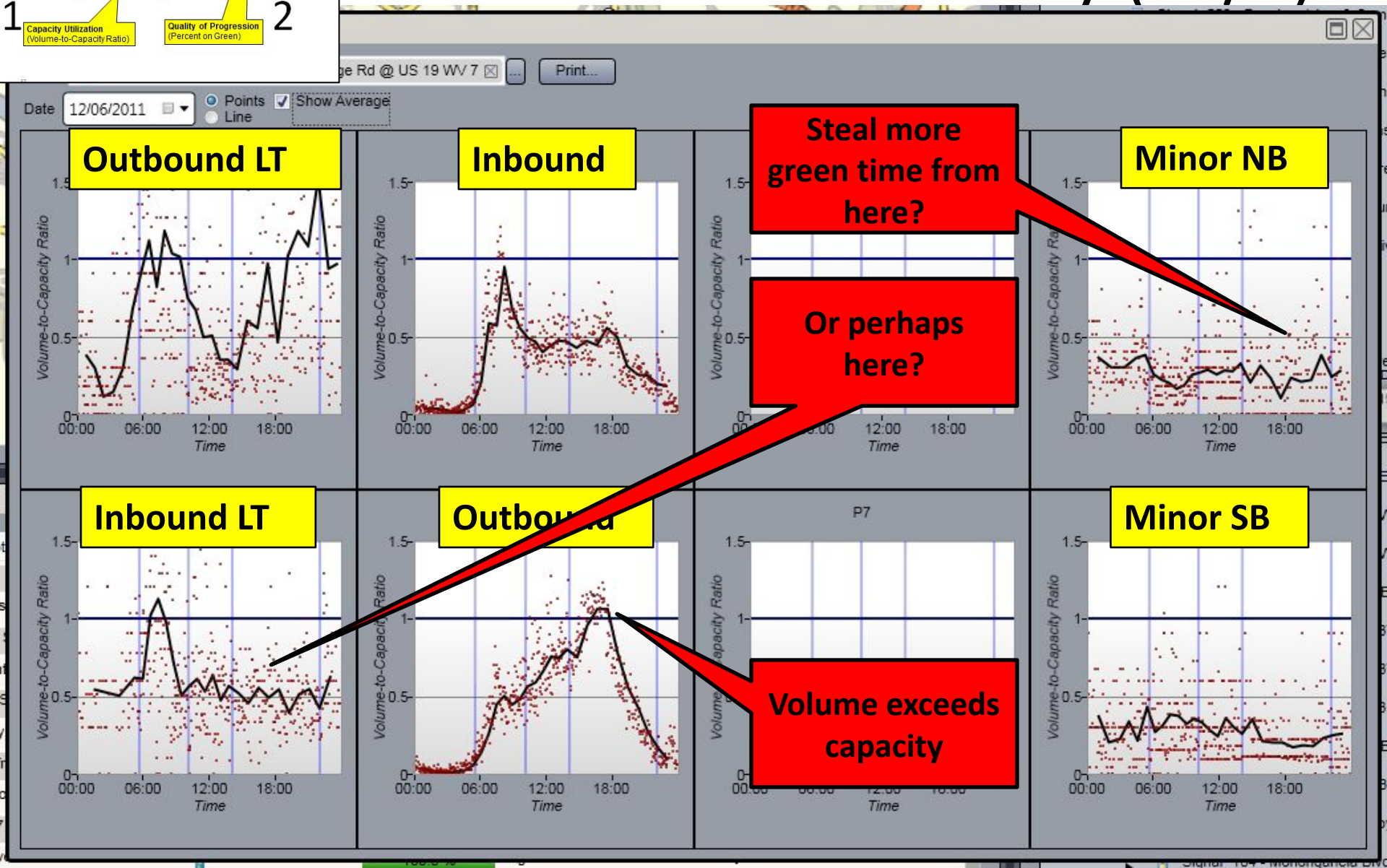
Oversaturation
(Split Failures)

$$d_{1,a} = \frac{0.5C \left(1 - \frac{g_{b,a}}{C_a}\right)^2}{1 - \min(1, X_{b,a}) \frac{g_{b,a}}{C_a}}$$

$$PF_{b,a} = \frac{1 - P_{b,a}}{\left(1 - \frac{g_{b,a}}{C}\right) f_{PA}}$$

1 Capacity Utilization
(Volume-to-Capacity Ratio)

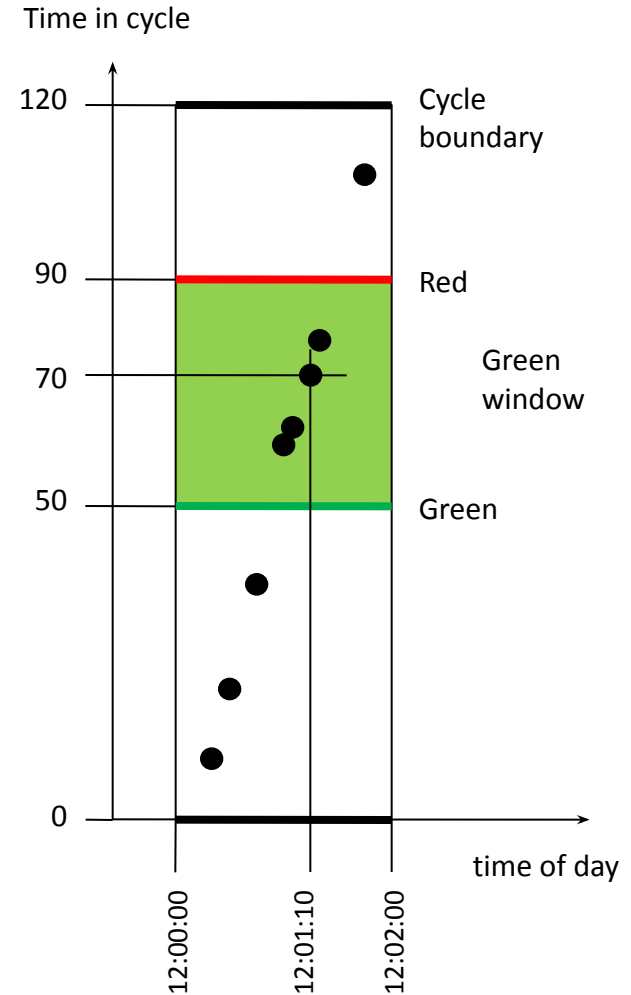
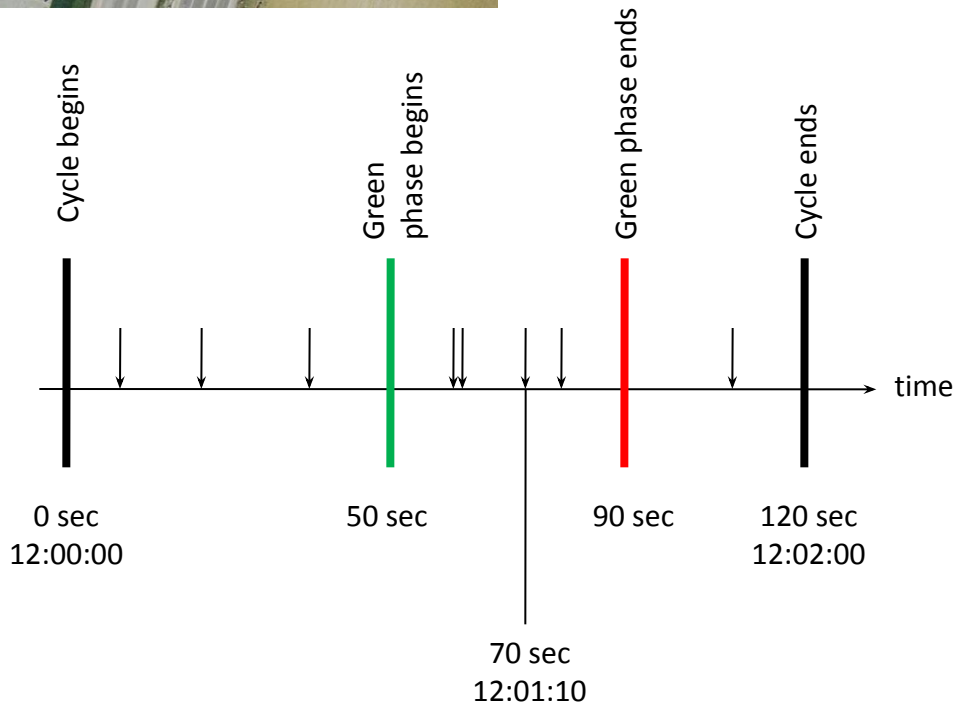
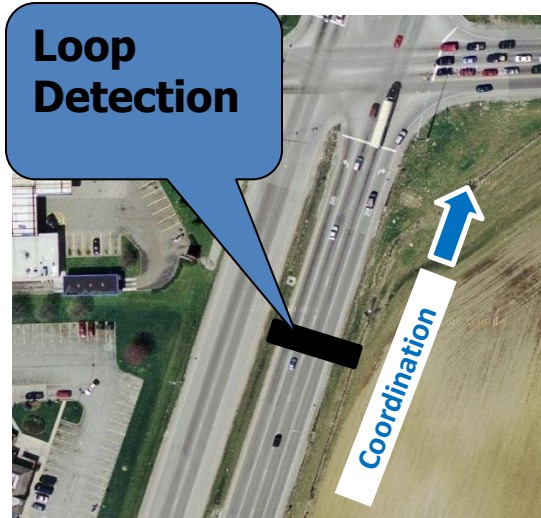
2 Quality of Progression
(Percent on Green)

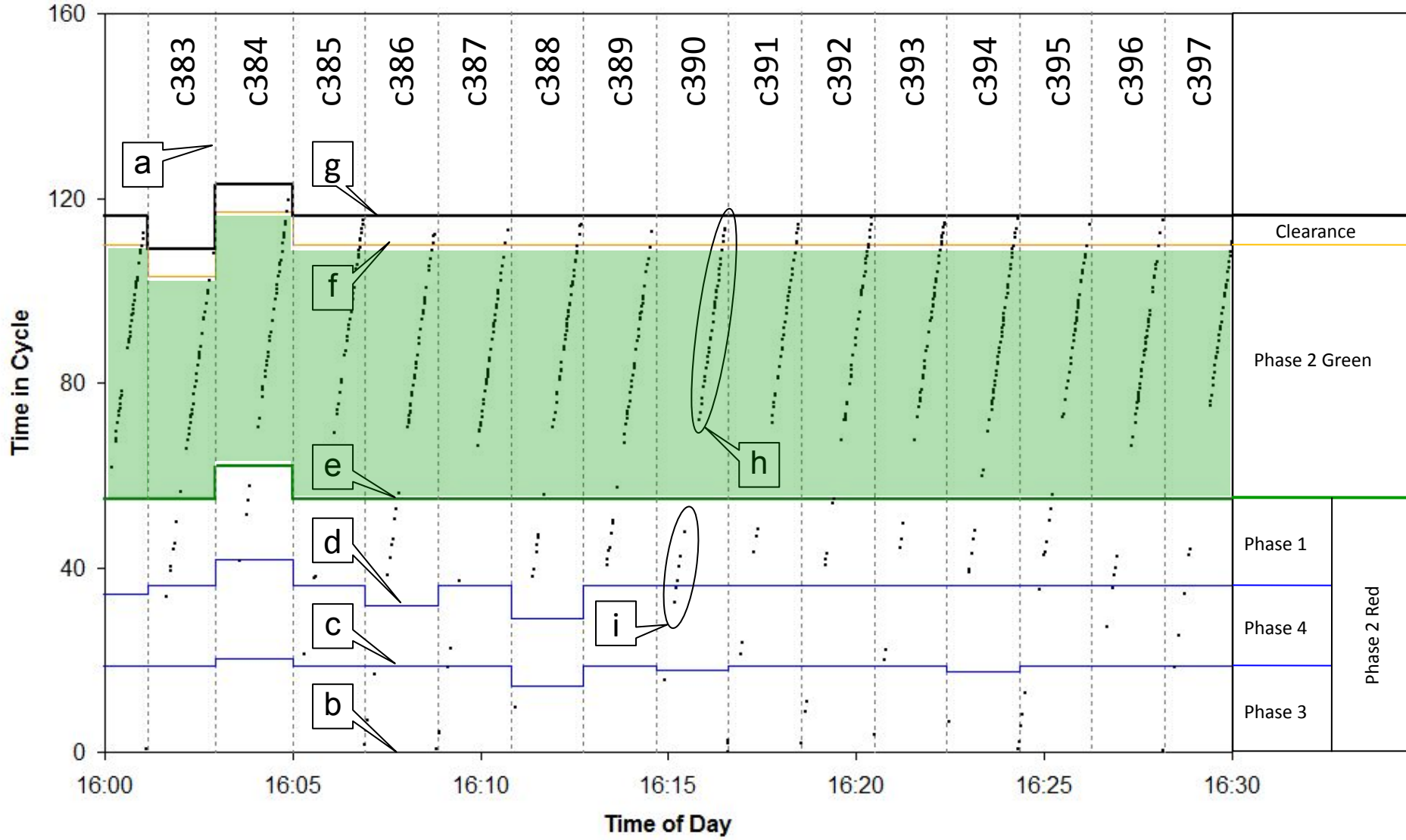


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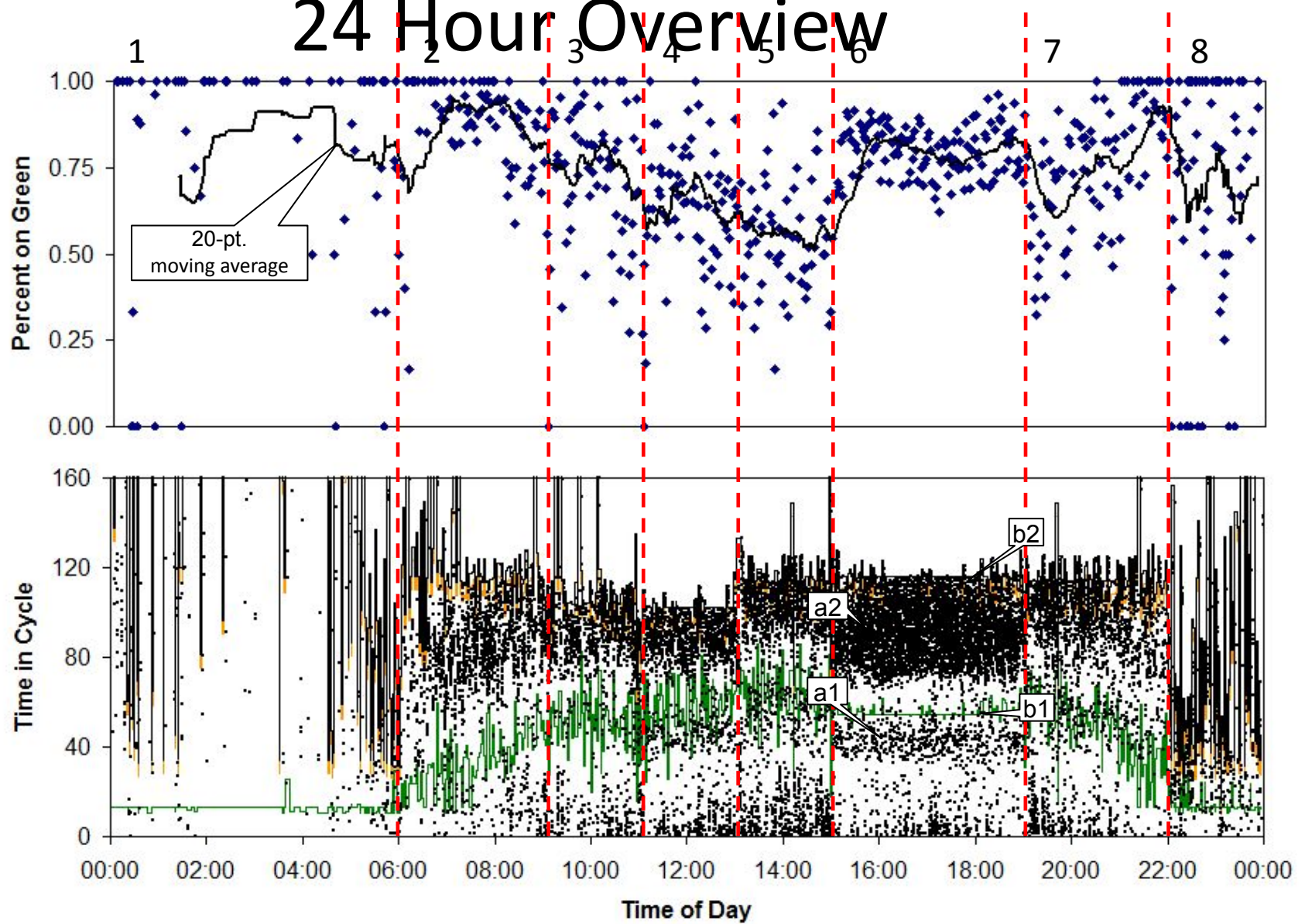
Purdue Coordination Diagram Construction (PCD)





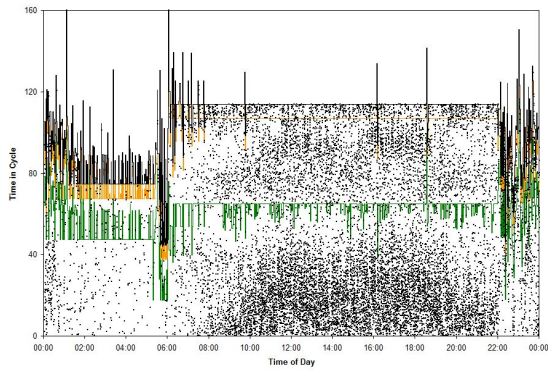
Timing Plan Pattern

24 Hour Overview

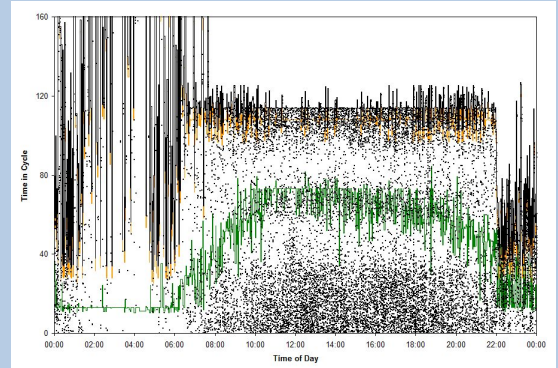


Travel Times

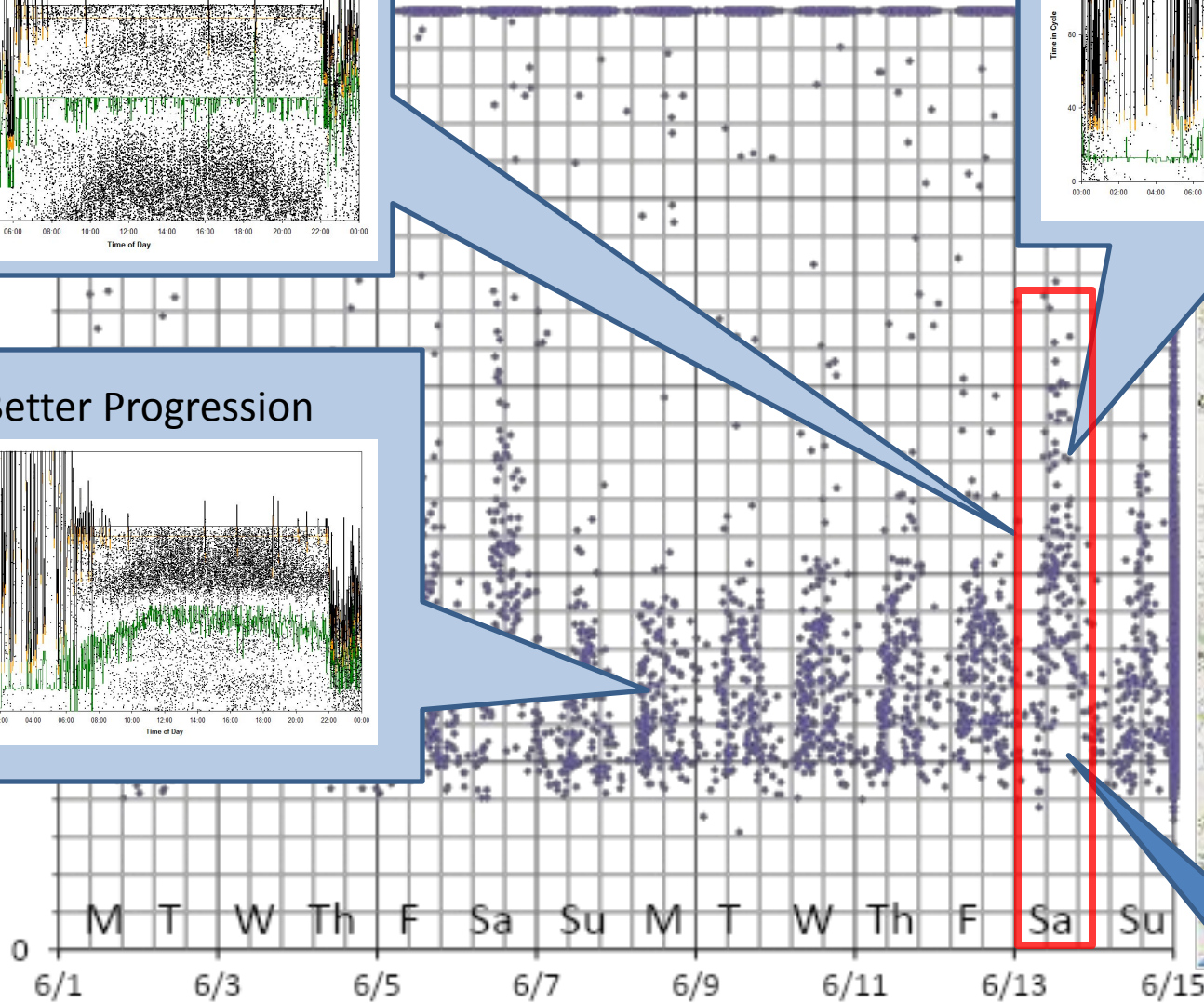
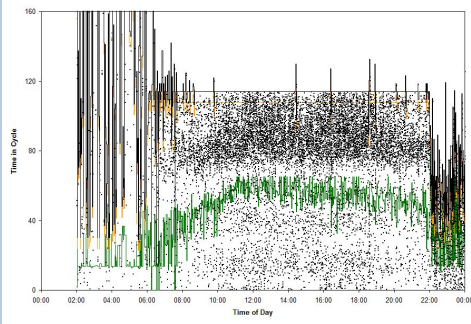
NB @ SR 238



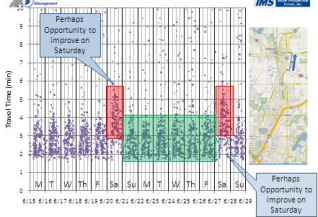
NB @ Pleasant



Better Progression

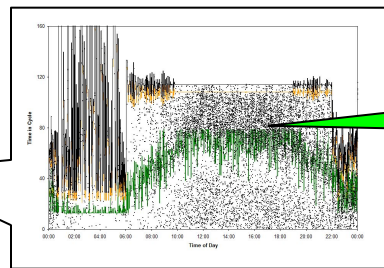
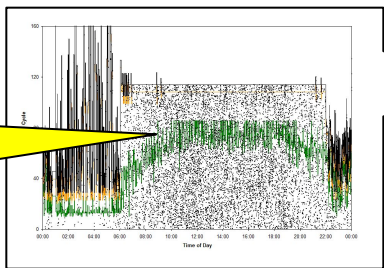


Perhaps Opportunity to improve on Saturday



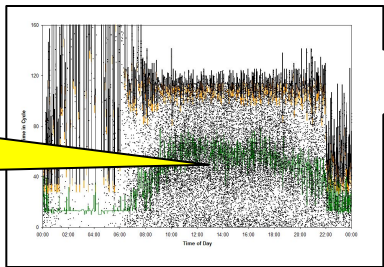
Saturday Offset Adjustment

Random arrivals

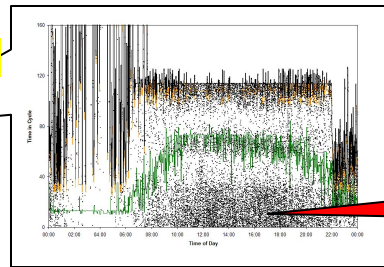


good

No platoons

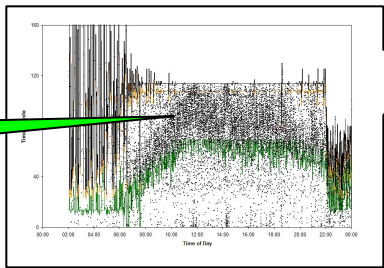


Pleasant

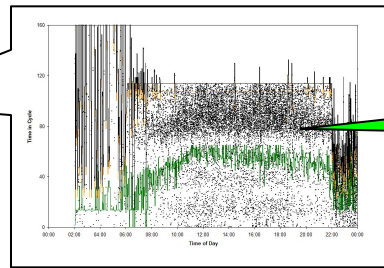


bad

good

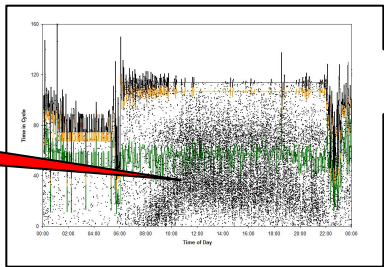


Town & Country

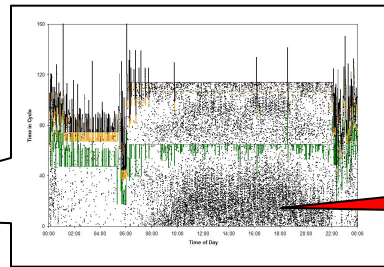


good

bad



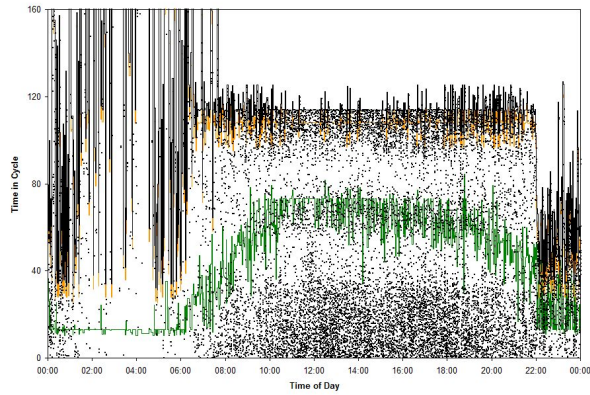
Greenfield



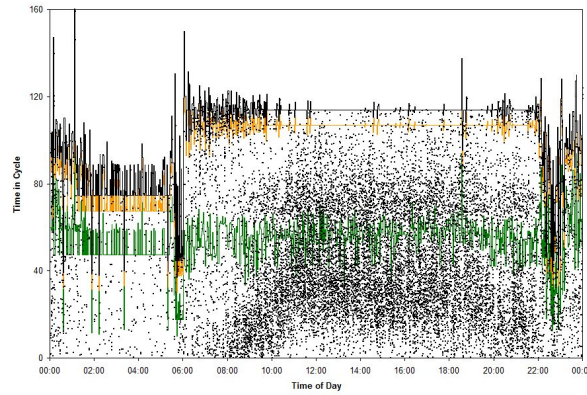
bad

Three Poor Offsets

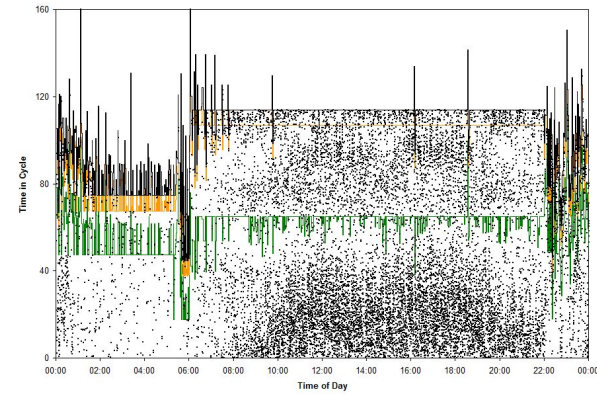
NB @ 37/Pleasant



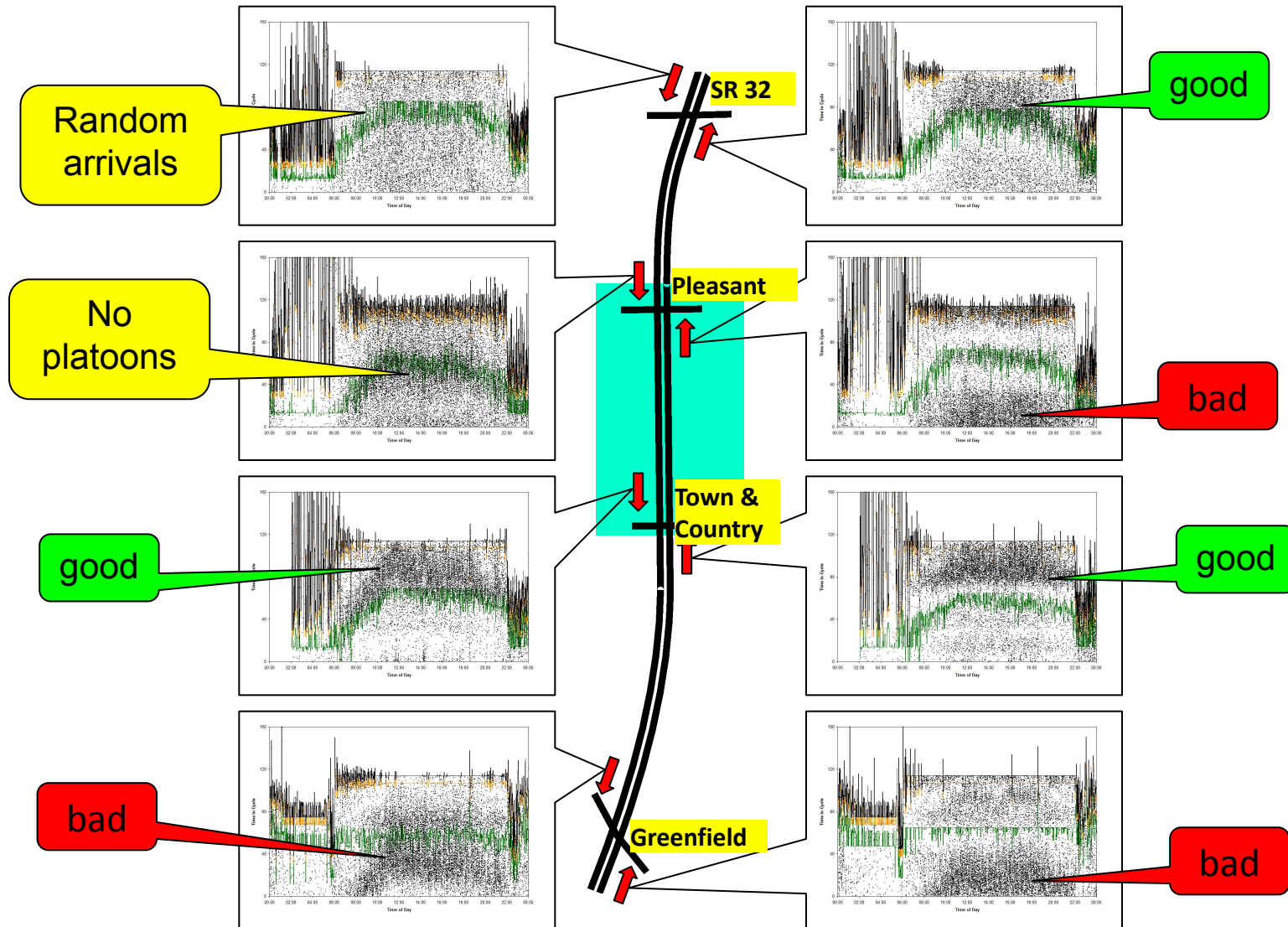
SB @ 37/Greenfield



NB @ 37/Greenfield



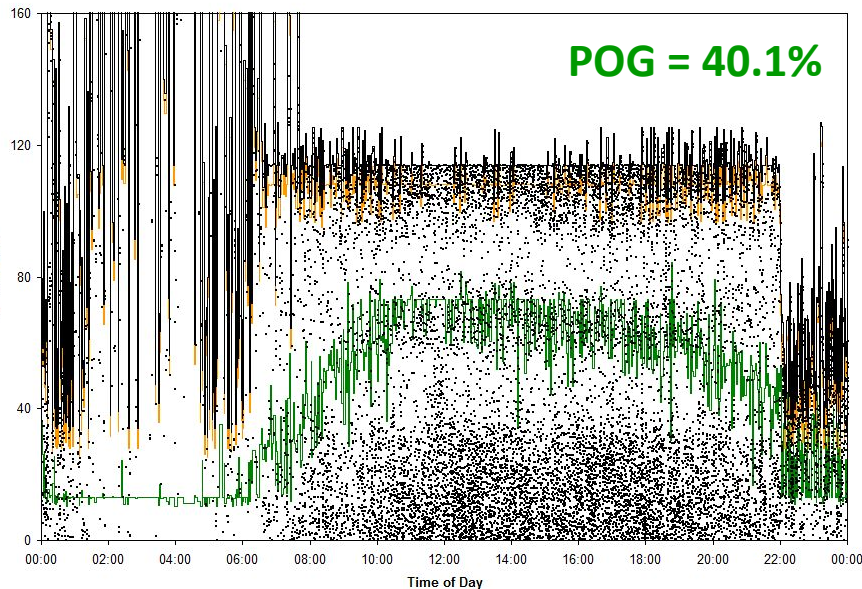
Offset Adjustments on Middle Segment



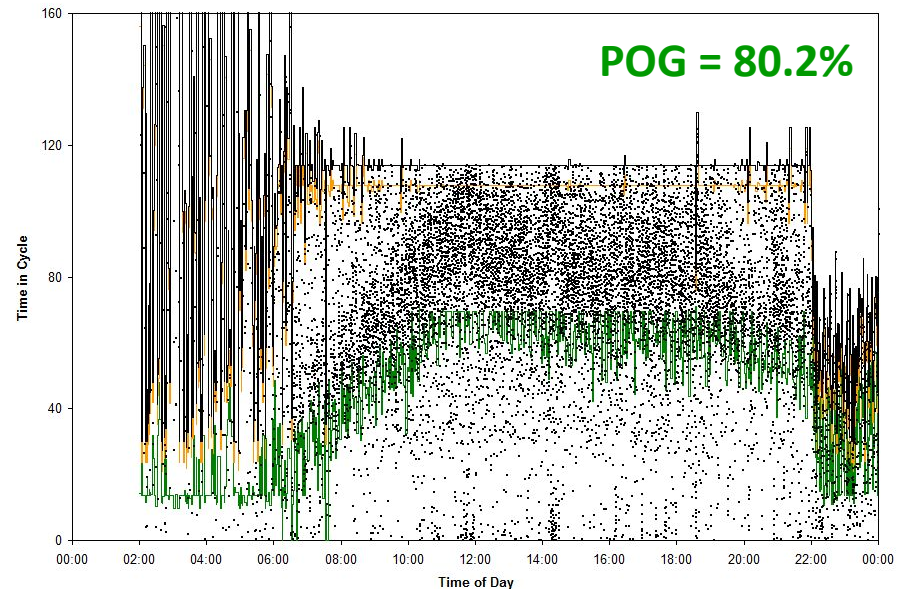
Offset Adjustments on Middle Segment

- Northbound at 37/Pleasant is bad. The platoon is captured in red.
- However, any offset adjustments that we make will also impact Southbound progression at 37/Town and Country (intersection to south) by shifting arrivals.
- We can mitigate any impacts at 32/37 (intersection to north) by adjusting its offset to keep it fixed relative to 37/Pleasant.

NB @ 37/Pleasant



SB @ 37/Town and Country

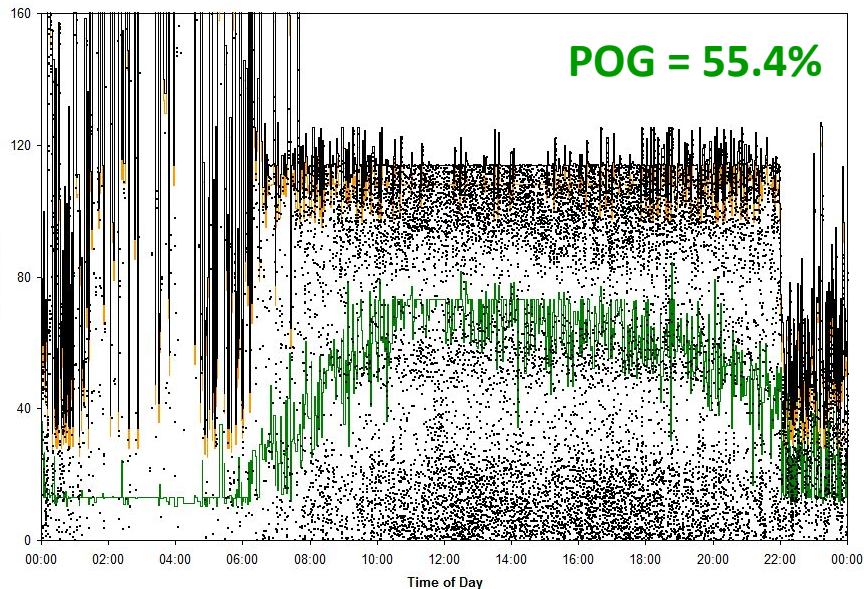


5069 arrivals on green
(0600-2200)

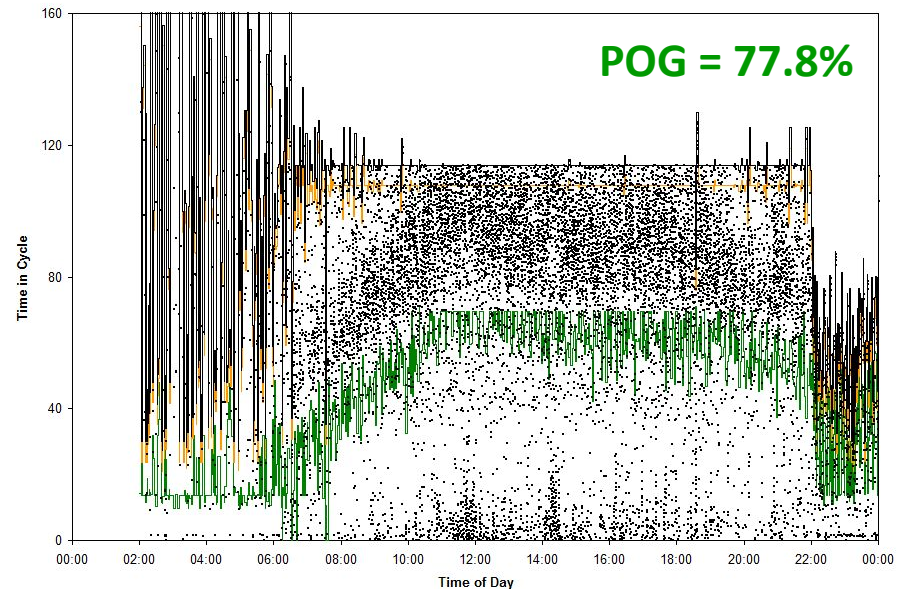
Add 10 seconds at 37/Pleasant

- Green times will occur 10 seconds earlier at 37 & Pleasant
 - Equivalent to vehicles arriving 10 seconds later
- Southbound vehicles will arrive 10 seconds earlier at 37 & Town and Country

NB @ 37/Pleasant



SB @ 37/Town and Country

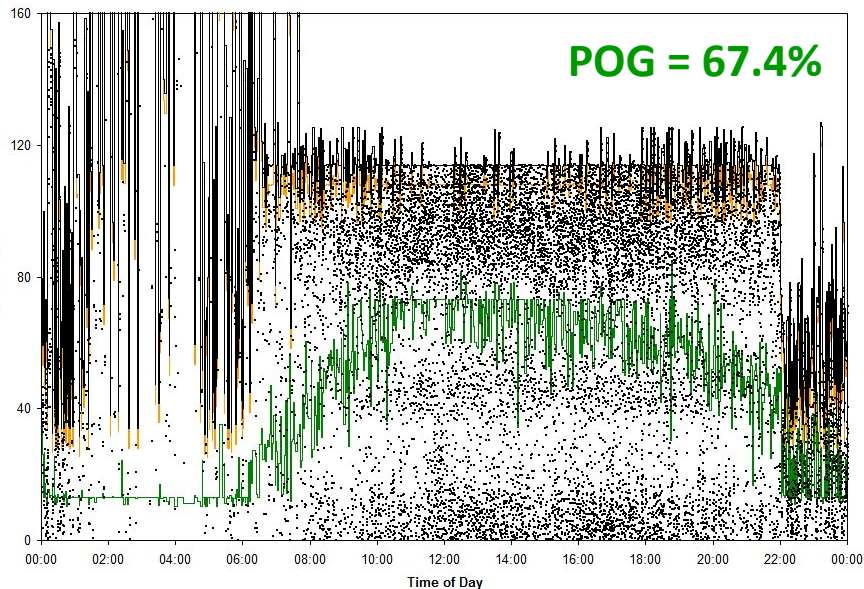


5589 arrivals on green

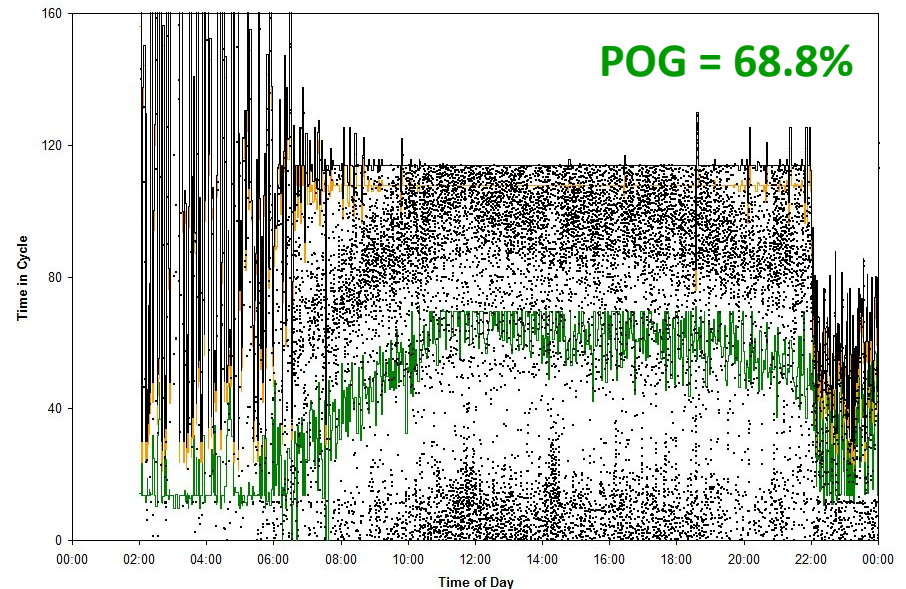
Add 20 seconds at 37/Pleasant

- Green times will occur 20 seconds earlier at 37 & Pleasant
 - Equivalent to vehicles arriving 20 seconds later
- Southbound vehicles will arrive 20 seconds earlier at 37 & Town and Country

NB @ 37/Pleasant



SB @ 37/Town and Country

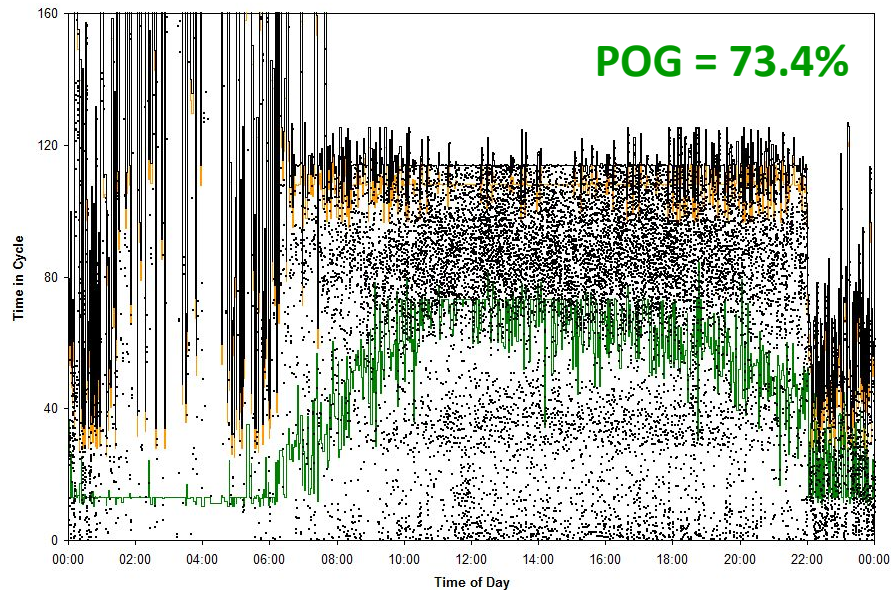


5688 arrivals on green

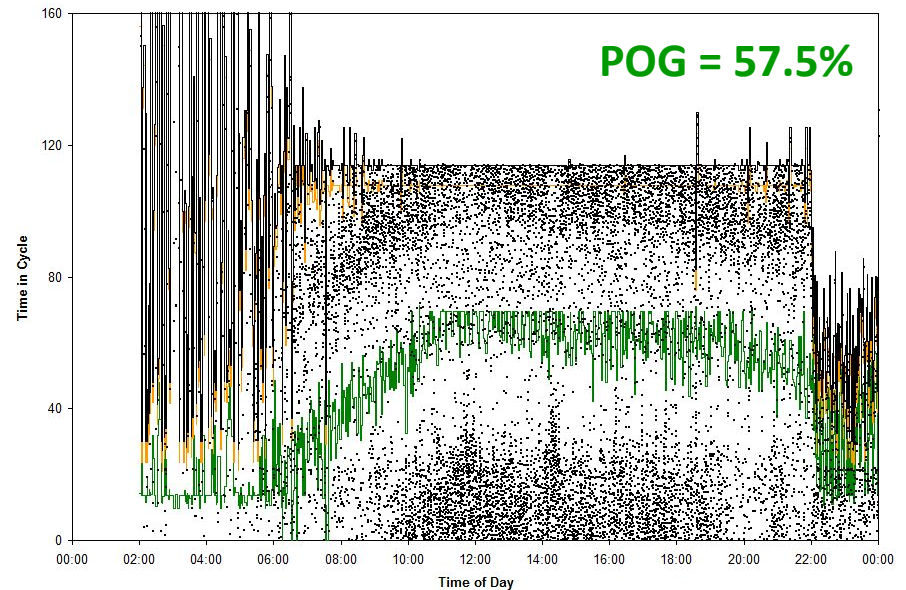
Add 30 seconds at 37/Pleasant

- Green times will occur 30 seconds earlier at 37 & Pleasant
 - Equivalent to vehicles arriving 30 seconds later
- Southbound vehicles will arrive 30 seconds earlier at 37 & Town and Country

NB @ 37/Pleasant



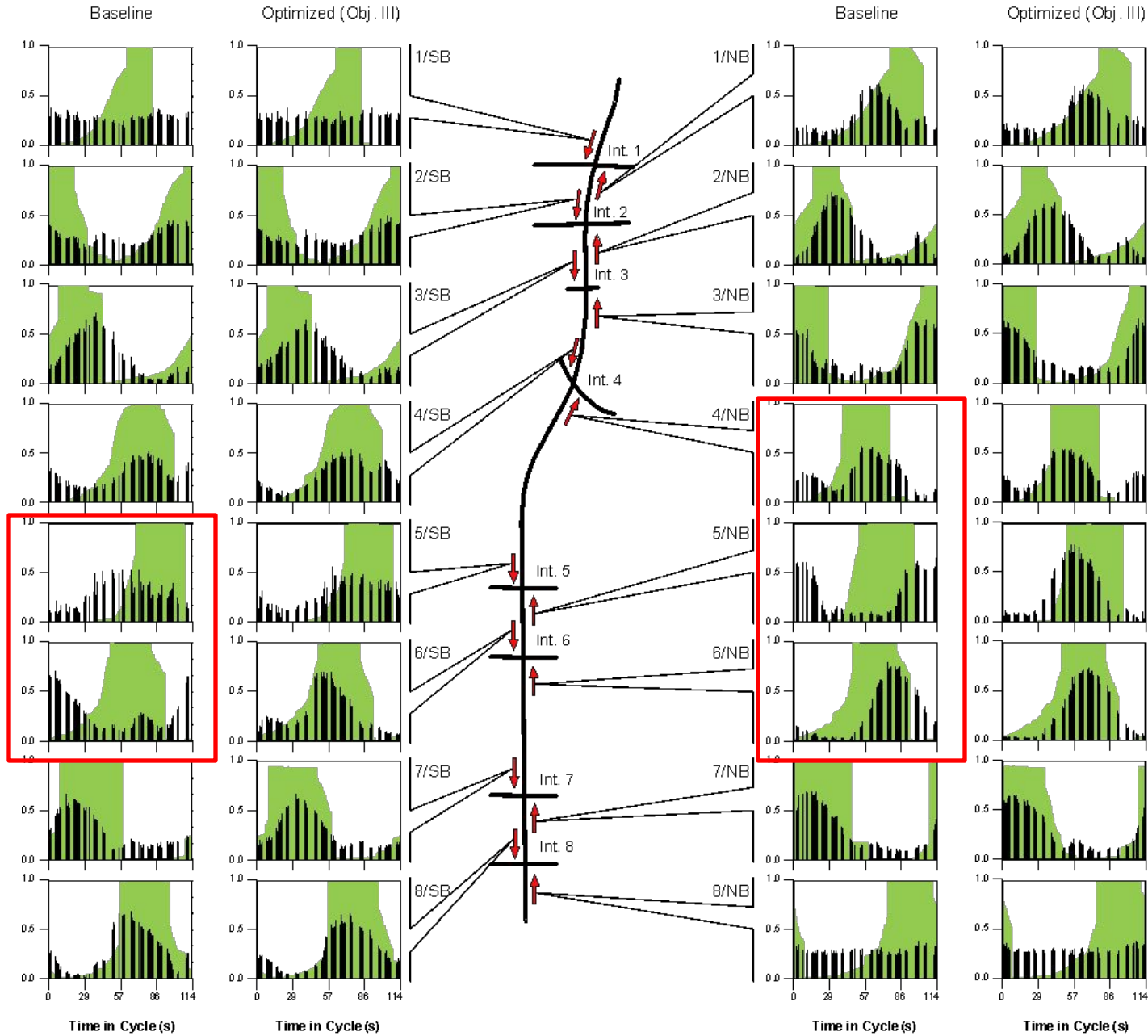
SB @ 37/Town and Country



5446 arrivals on green

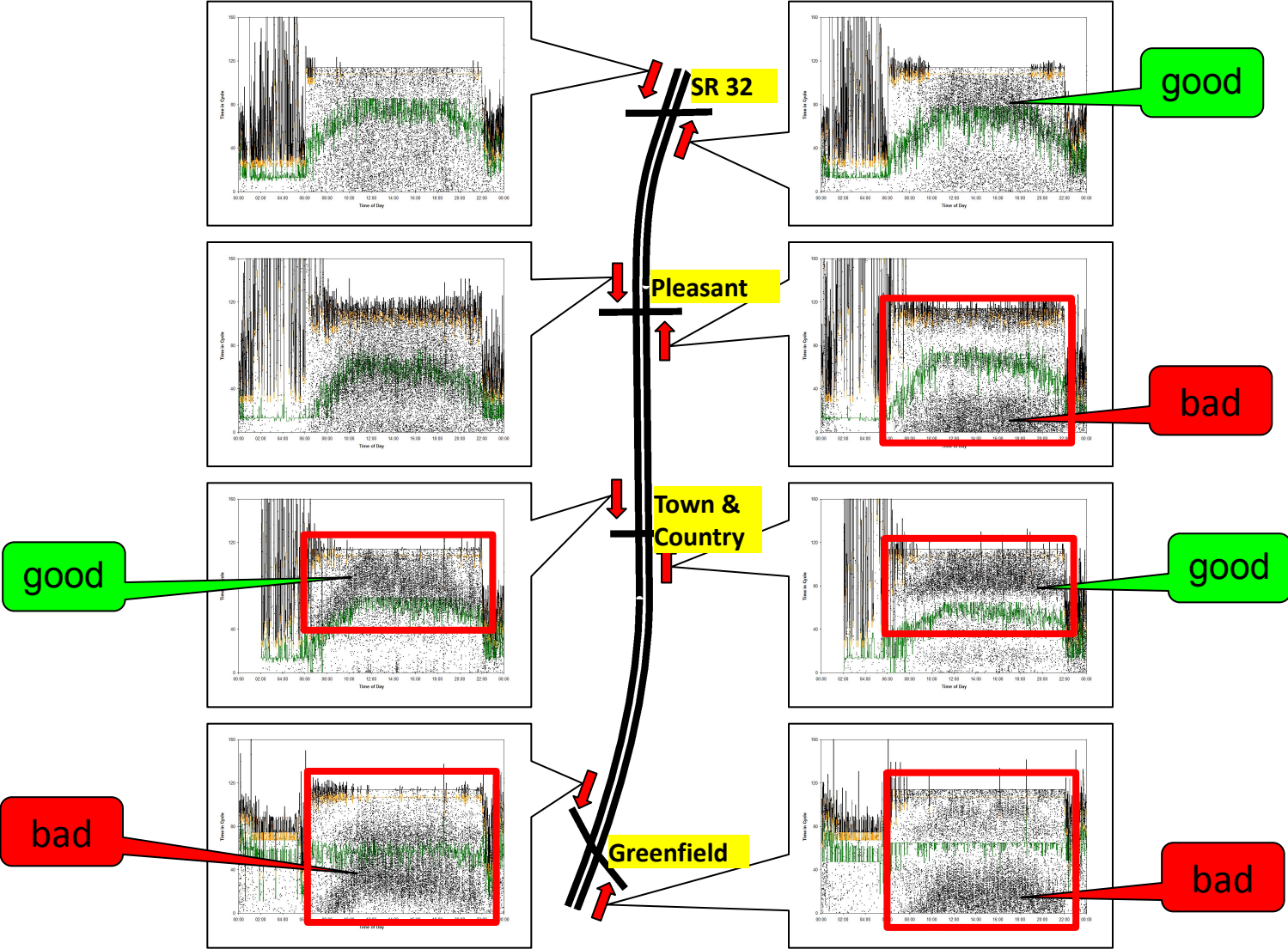
Southbound

Northbound

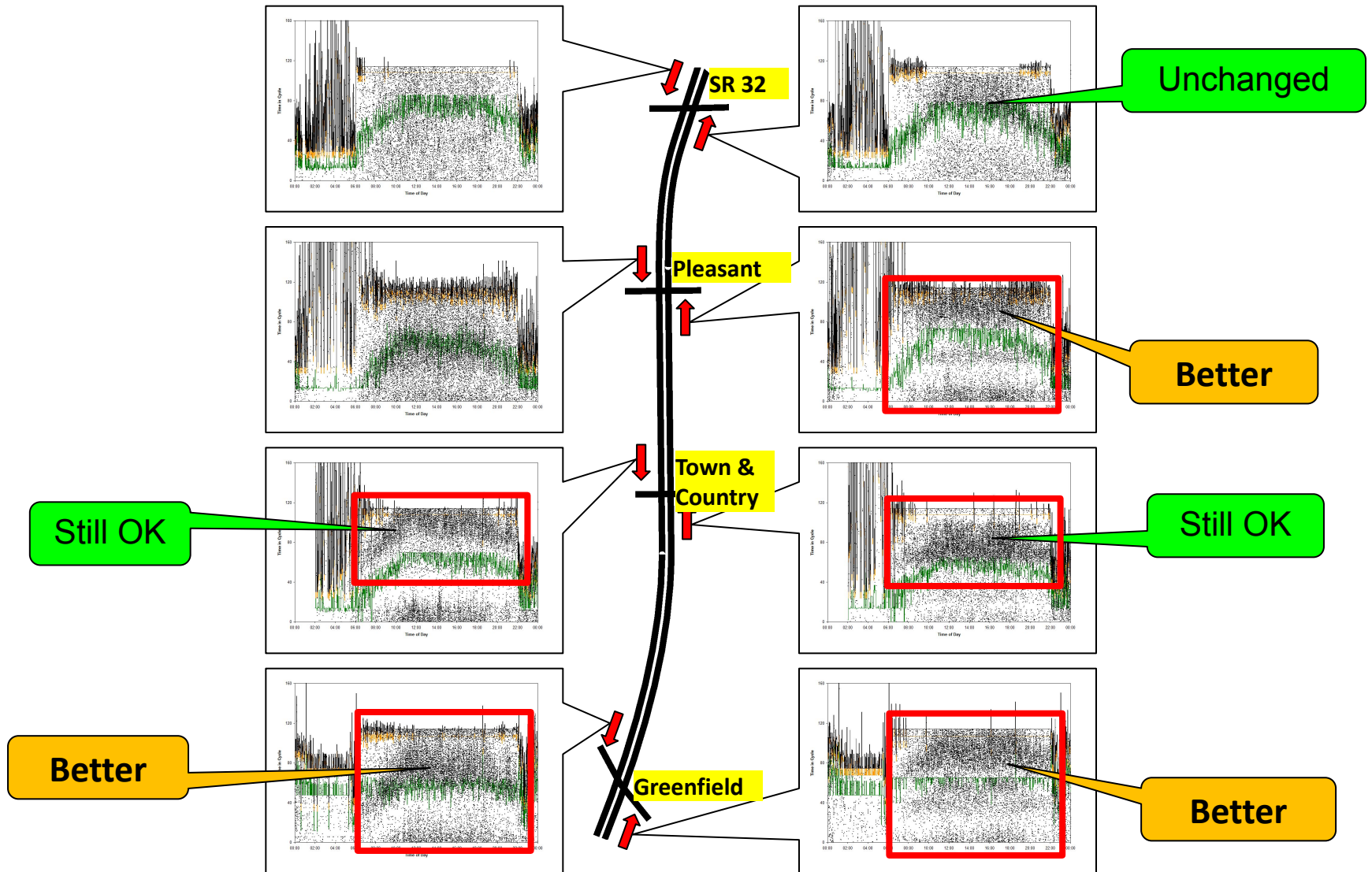


Insert Link Pivot Animation

Comparison with original (actual “before” case)



Predicted Vehicle Distributions with Offset Adjustments

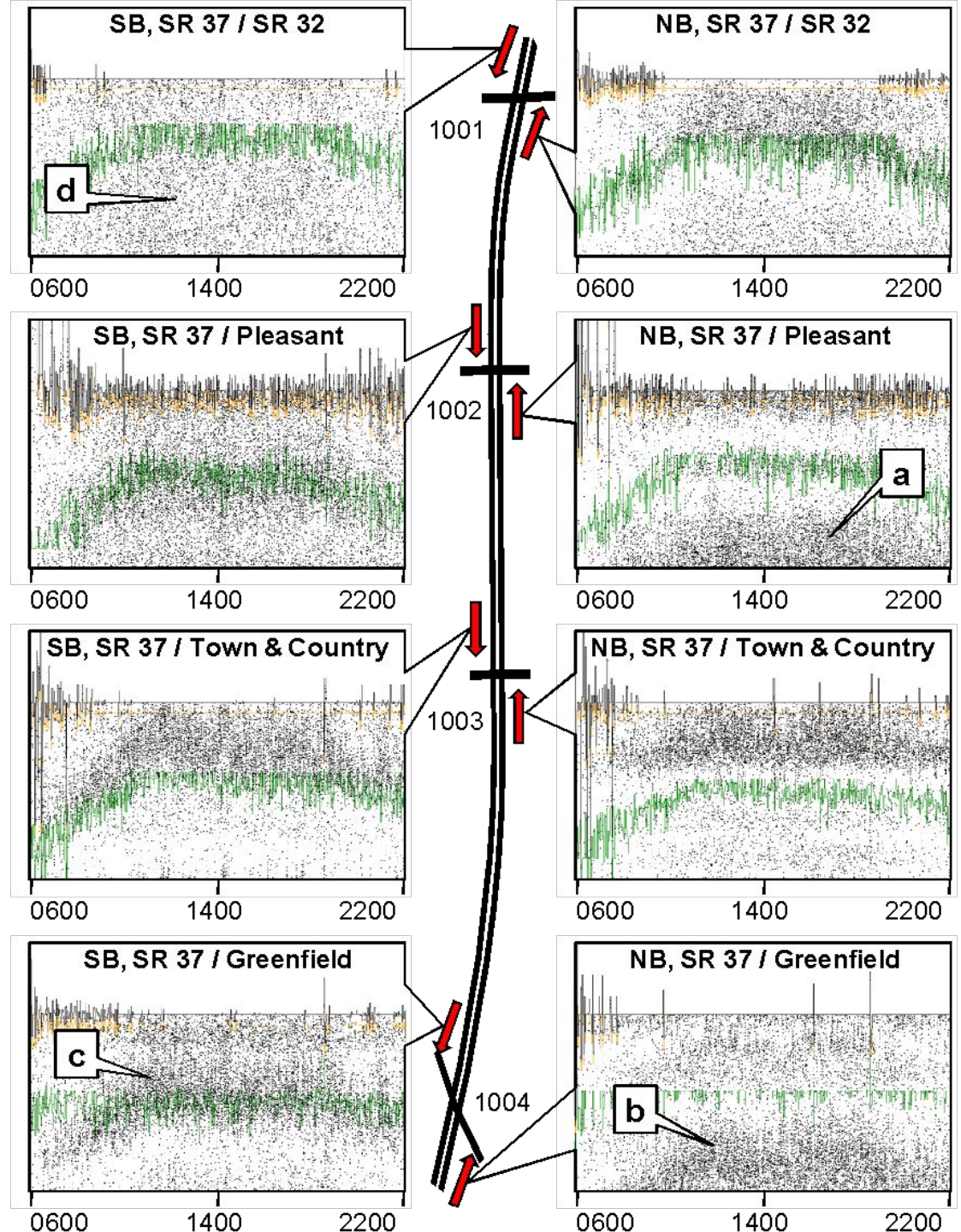


Outline

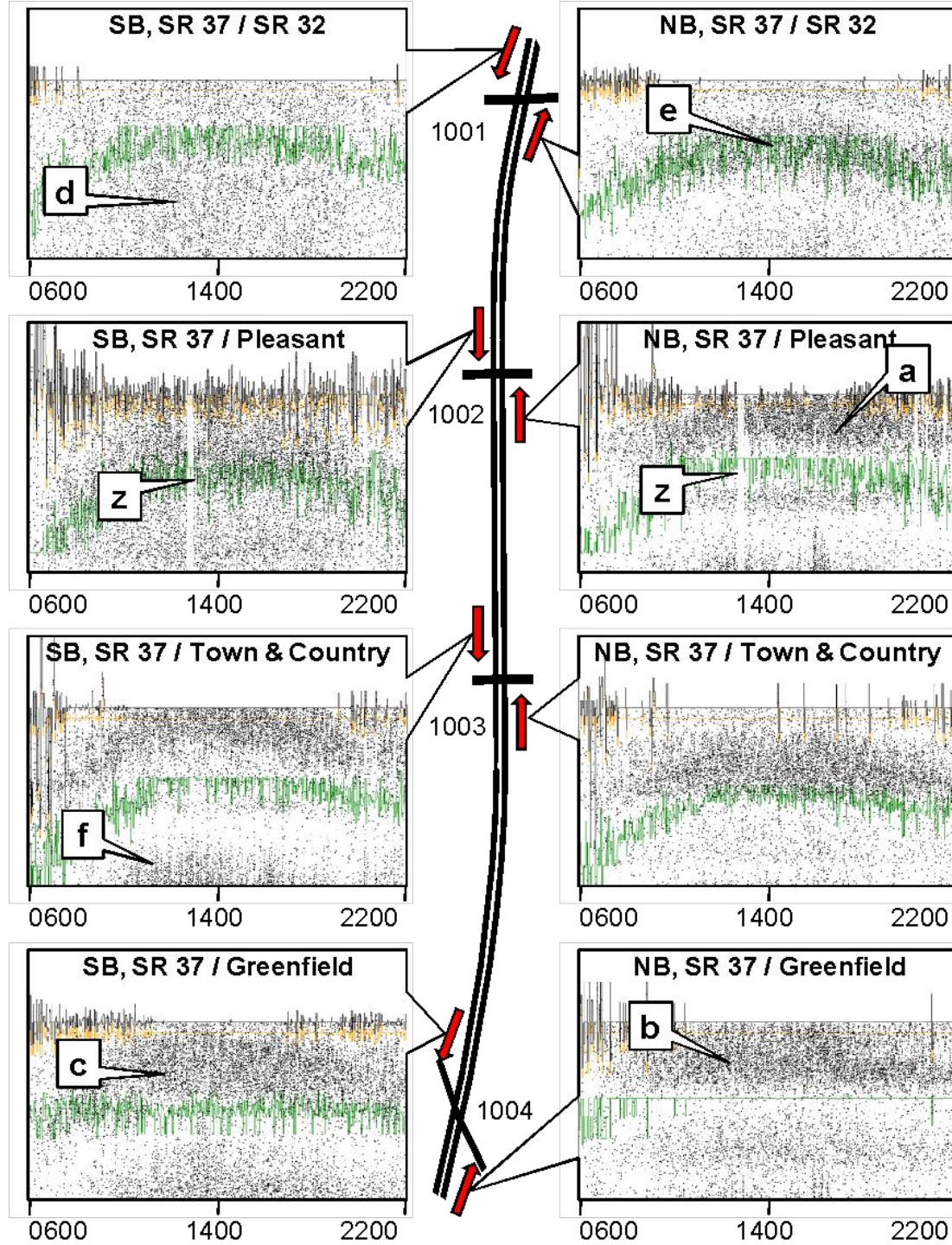
- Signal Management/ Timing overview
- Data Sources
 - Controller
 - Probe Vehicles
- Fundamentals
- Data ->Information to assess fundamentals
- **Results**
- Q&A..Dialog

So..did it have an impact.

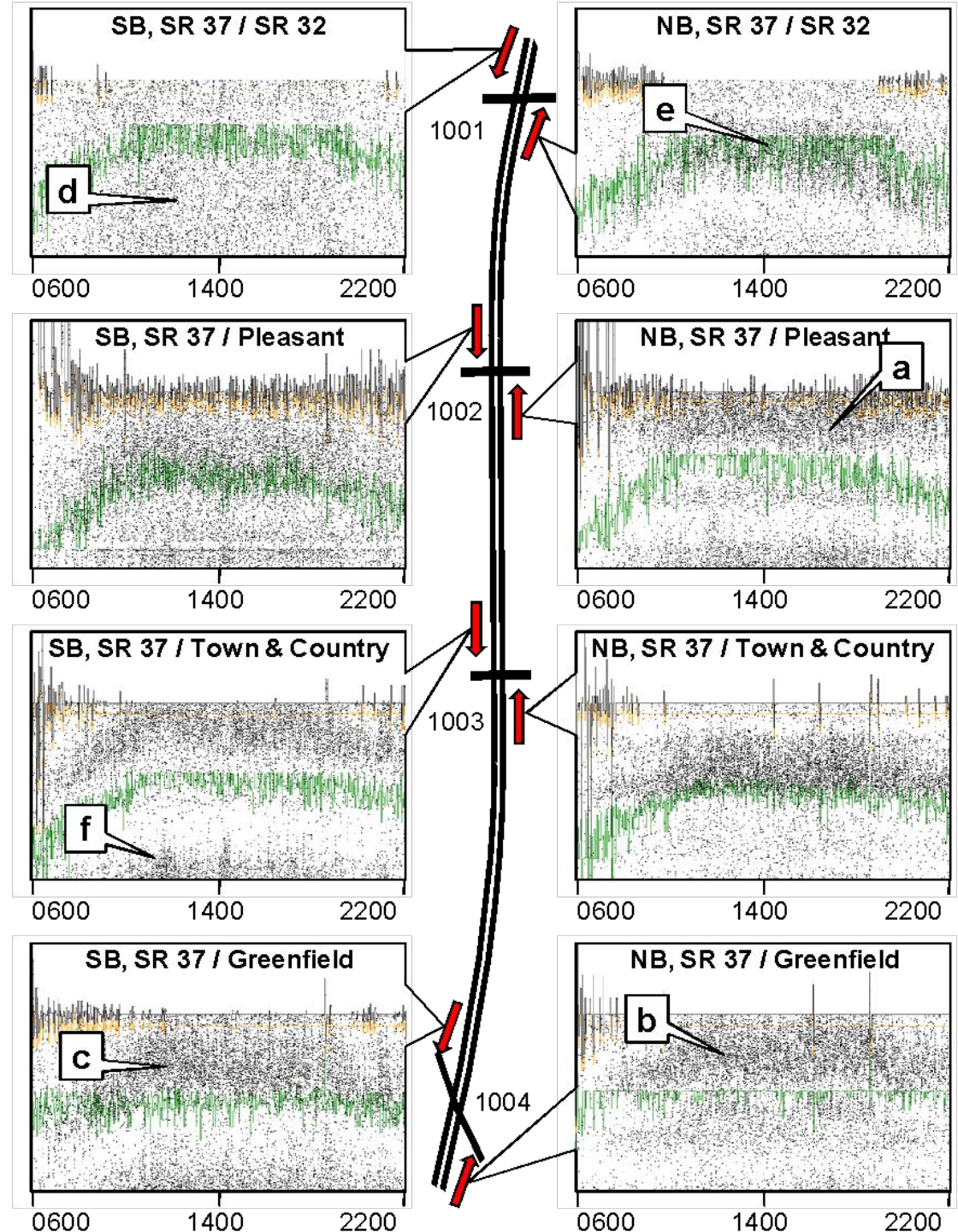
Before



After



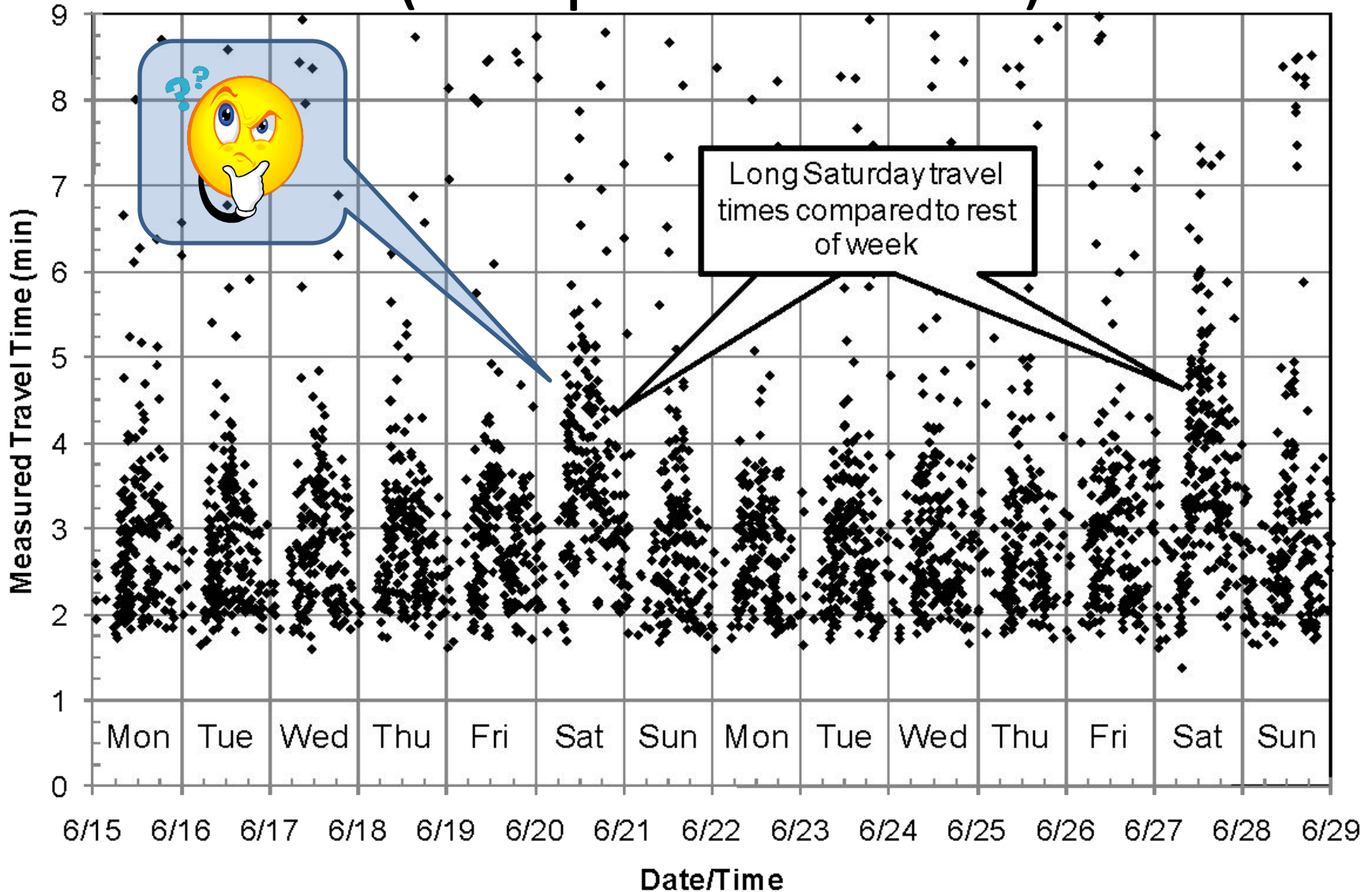
Predicted



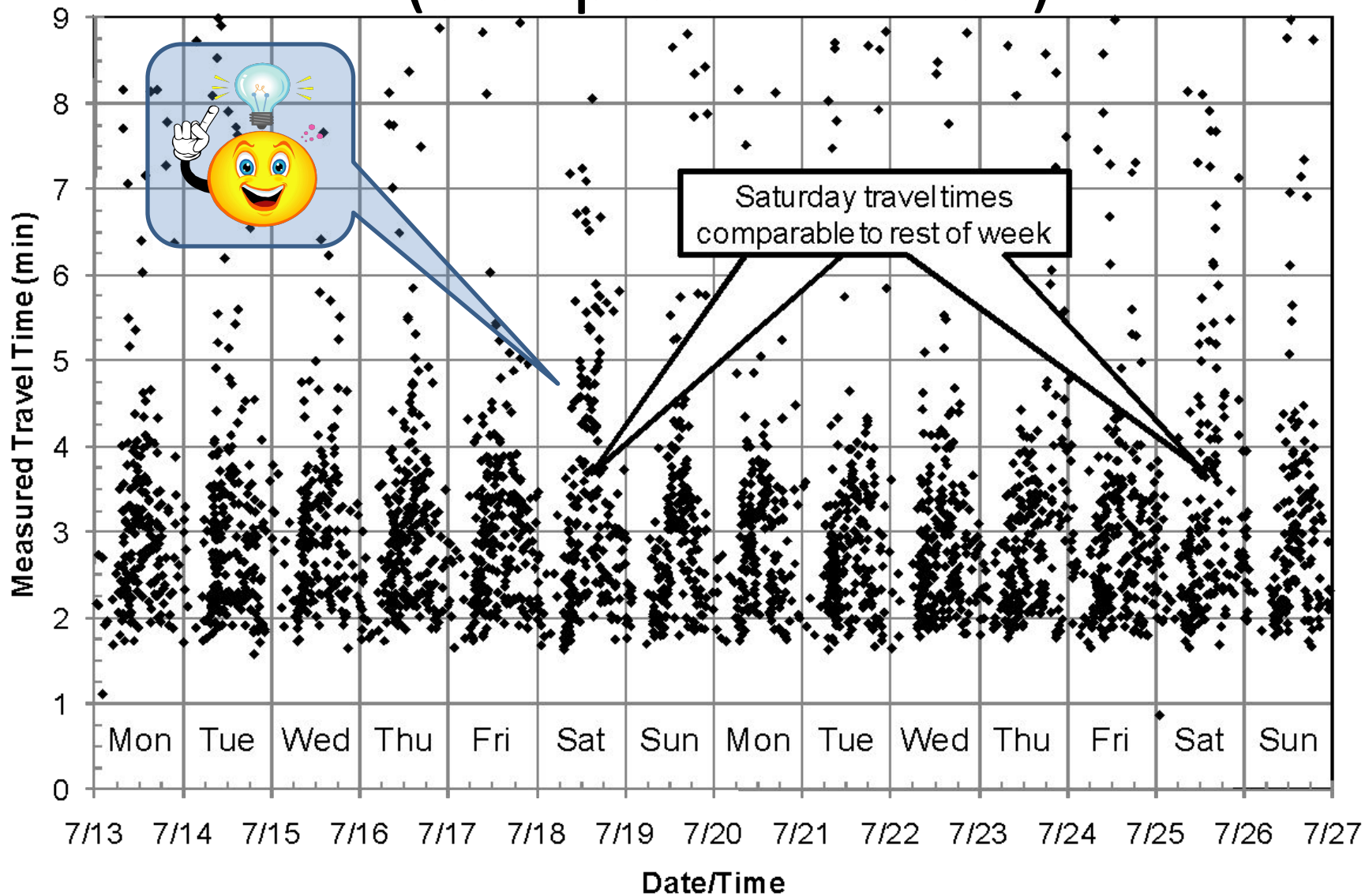
Change in Arrivals on Green

| Intersection | Movement | MOE | June 06, Actual | June 06, Predicted After Offset Adjustment | July 25, Actual | July 18, Actual* |
|-----------------------------------|------------|-----------------|--------------------|--|--------------------|---------------------|
| SR 37 & SR 32 | Northbound | N _g | 1755 | 1425 | 1472 | 1810 |
| | | POG | 59.6% | 48.4% | 54.9% | 56.8% |
| | Southbound | N _g | 1702 | 1702 | 1544 | 1659 |
| | | POG | 41.2% | 41.2% | 42.4% | 39.0% |
| SR 37 & Pleasant St. | Northbound | N _g | 1628 | 2655 | 2741 | 2995* |
| | | POG | 40.1% | 65.5% | 76.0% | 76.6%* |
| | Southbound | N _g | 3180 | 3674 | 3371 | 3471* |
| | | POG | 52.9% | 61.2% | 62.7% | 63.0%* |
| SR 37 & Town and Country Blvd. | Northbound | N _g | 3114 | 2961 | 2974 | 3507 |
| | | POG | 79.5% | 75.9% | 81.0% | 78.7% |
| | Southbound | N _g | 3441 | 3056 | 2875 | 3007 |
| | | POG | 80.2% | 71.1% | 72.6% | 73.0% |
| SR 37 & Greenfield Ave. | Northbound | N _g | 1678 | 2917 | 2827 | 3438 |
| | | POG | 37.9% | 65.6% | 68.6% | 69.8% |
| | Southbound | N _g | 2979 | 3215 | 3045 | 3221 |
| | | POG | 58.9% | 63.3% | 67.5% | 68.2% |
| Arterial Network | | ?N _g | 19477 | 21605 | 20849 | 23108 |
| | | N | 34856 | 34856 | 31569 | 35072 |
| | | Overall POG | 55.9% | 62.0% | 66.0% | 65.9% |

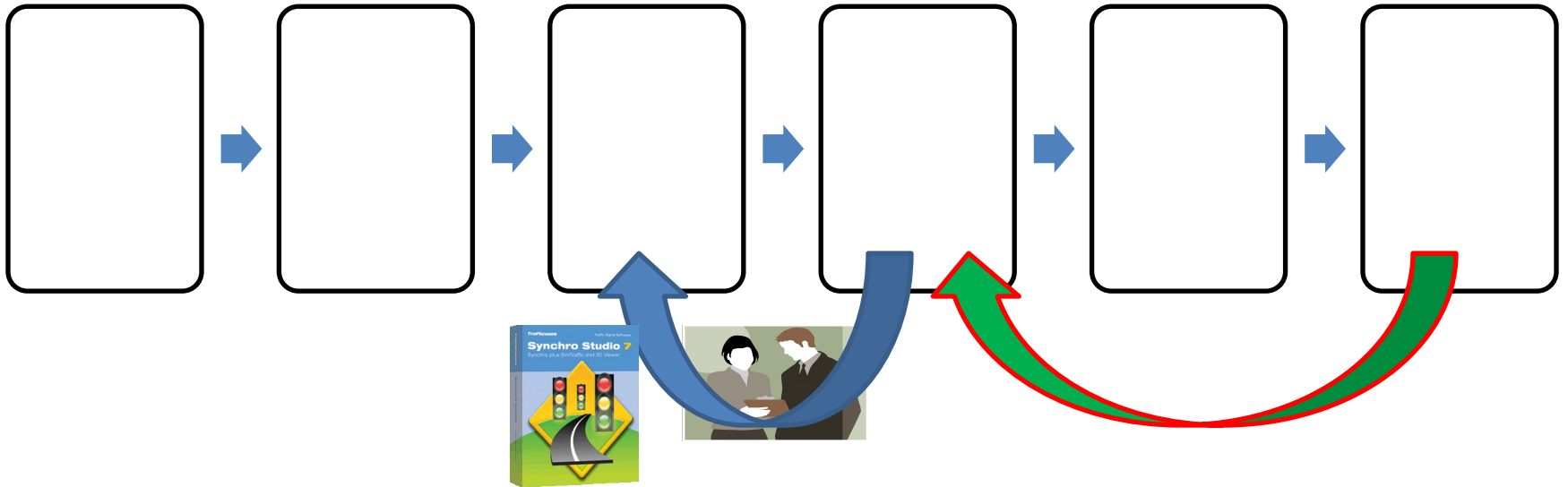
Before (Sample size=4797)



After (Sample size=5401)

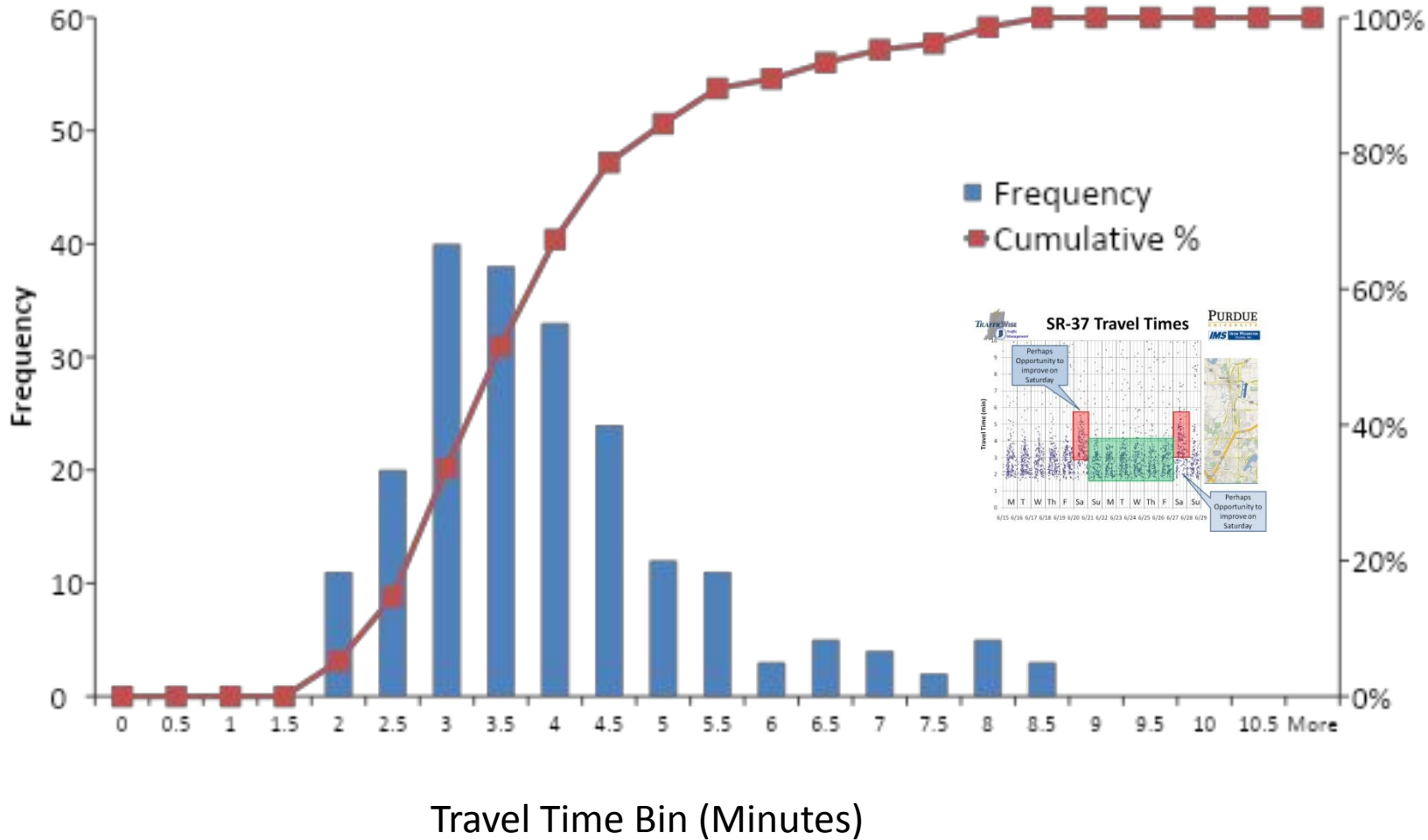


Lets Evaluate the Impact Statistically and Financially



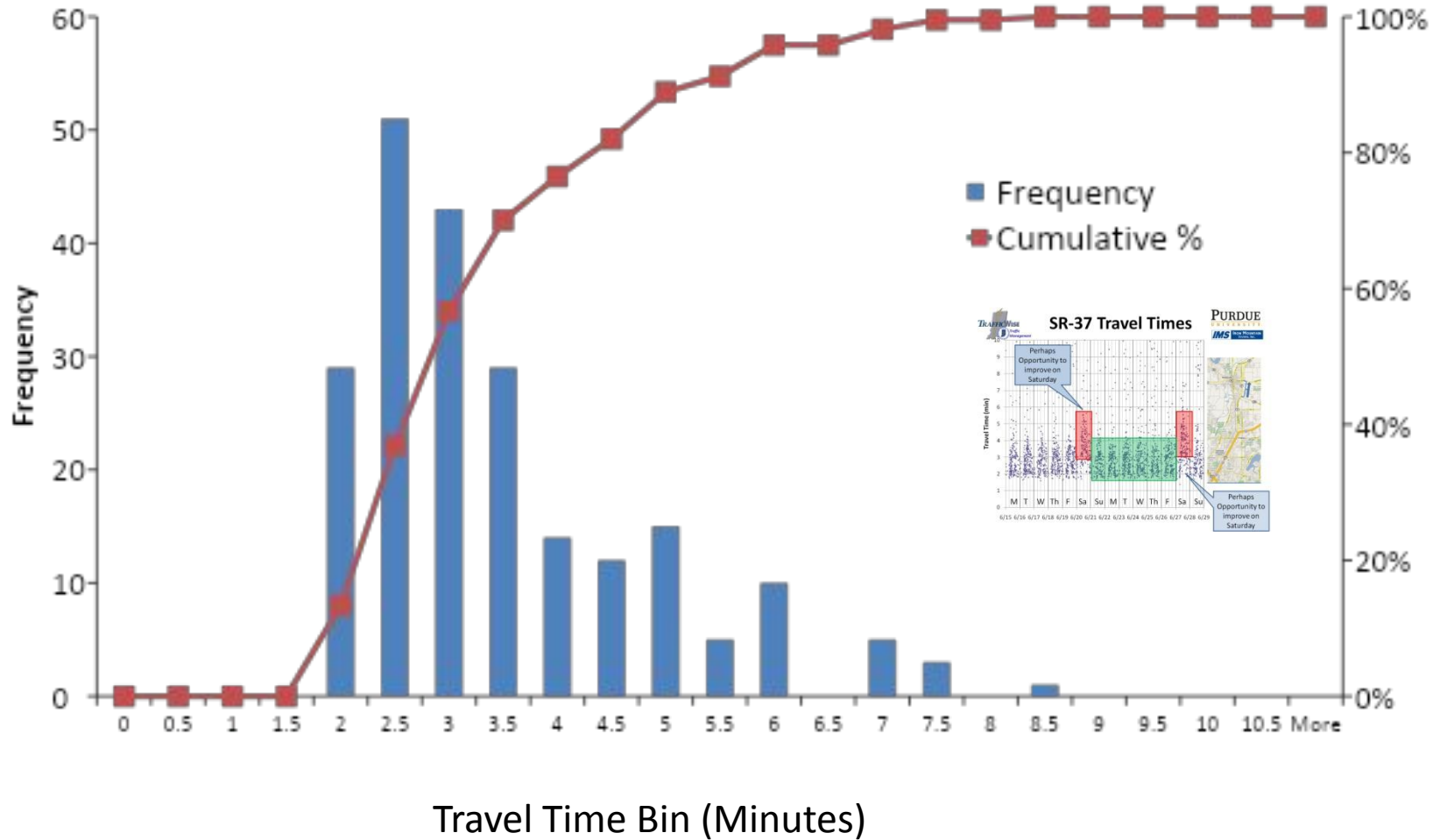
NB: June 6, 2009

0900-1200 Travel Time Histograms

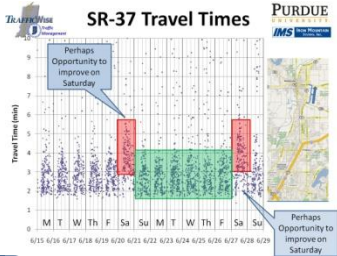


NB: July 18, 2009

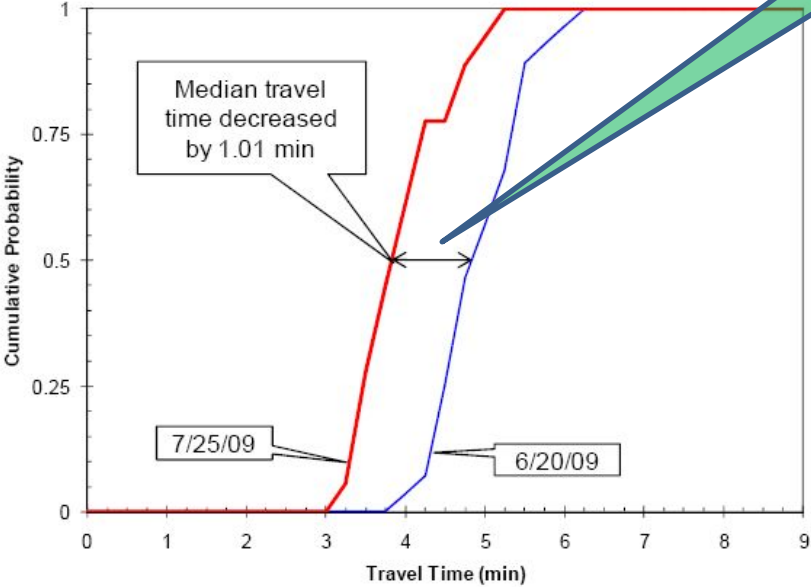
0900-1200 Travel Time Histograms



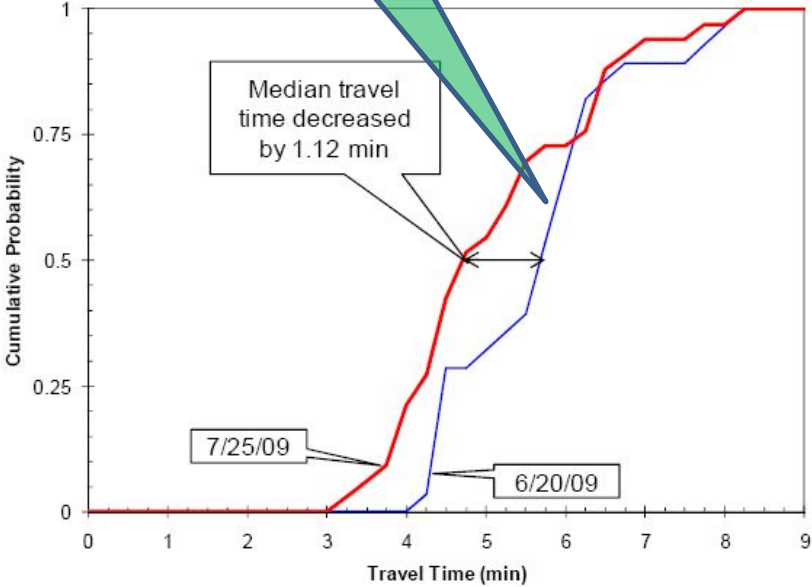
Before (6/20/09) After (7/25/09)



~1 min Travel Time Reduction



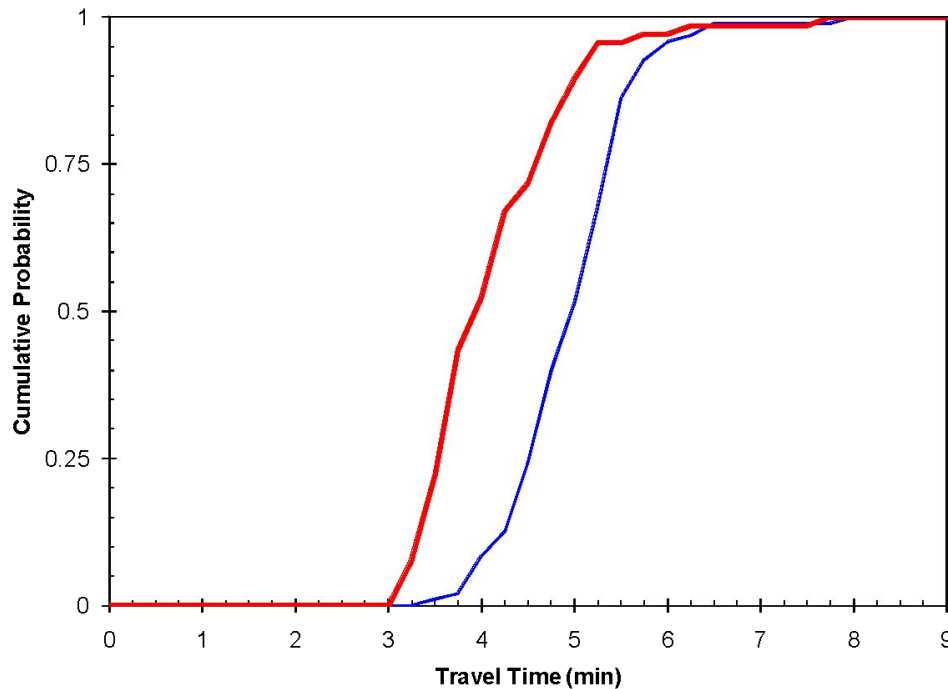
(a) Northbound on SR 37 (Midblock)



(b) Southbound on SR 37 (Midblock)

Business Case: SR 37 Timing Improvements

(Largest Cost Benefit/Reduction/Avoidance)



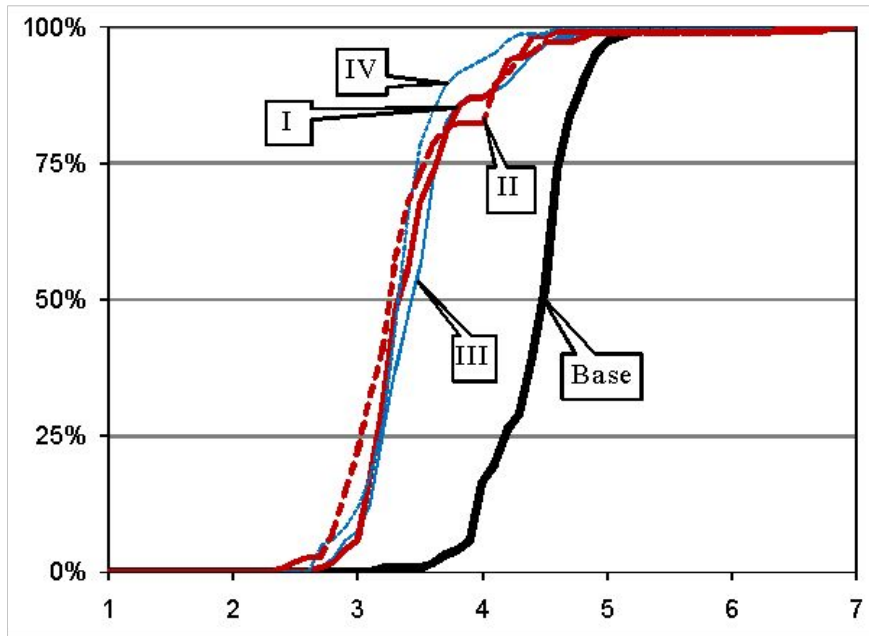
0600 -2200 (8,500 veh)

USER SAVINGS

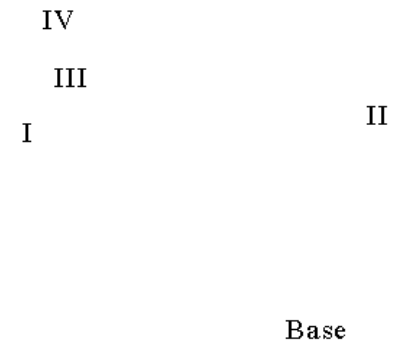
- Travel time tests for SR37 Corridor have improved Northbound Travel Time by ~ 1 Minute.
- **~8,500** Cars per Day Are Effected by this benefit (NB).
- **~0.17 Cents** per minute (\$10/hour) saved for each driver in fuel costs and time value.
- **~1.0 Minutes** are assumed saved on average for the intersection over 1-Year with improvements.
- User benefit =

(8,500 Veh/Day * \$0.17/min * 1-min/Veh * 2*52 Days/Year)=
\$150,000/year for a 1.6 mile stretch of roadway is realized.

Travel Time between 4 intersections



(e) Southbound, Case B to Case C.



(f) Northbound, Case C to Case B.

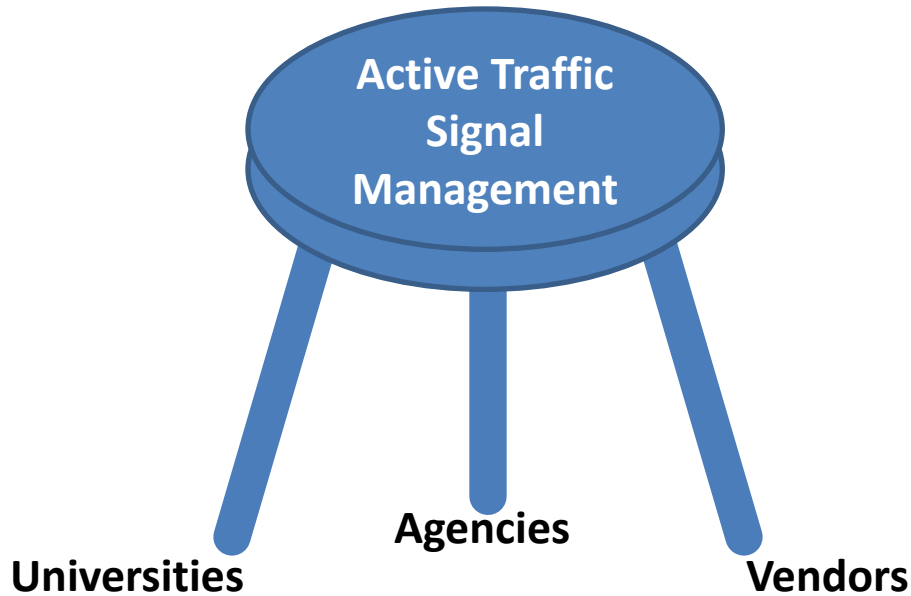
Cumulative frequency diagrams of probe vehicle travel times for alternative objective functions, Saturday, 1500-1800.

Economic Impact (52 Saturdays)

| Objective | | Daily | | | | Annual | | | |
|-------------------------------------|---------------------|----------------------------|---|-------------------------|---------------|------------|---|-------------------------|---------------|
| | | Total Time Saved (veh-min) | CO ₂ Emission Reduction (tons) | CO ₂ Savings | User Benefits | Multiplier | CO ₂ Emission Reduction (tons) | CO ₂ Savings | User Benefits |
| (a) System 1, Northern Section | | | | | | | | | |
| I | Min Delay | 5032 | 0.71 | \$16 | \$1,697 | 52 | 37 | \$810 | \$88,233 |
| II | Min Delay and Stops | 3813 | 0.54 | \$12 | \$1,286 | 52 | 28 | \$614 | \$66,864 |
| III | Max N_g | 1760 | 0.25 | \$5 | \$593 | 52 | 13 | \$283 | \$30,855 |
| IV | Alt. Max N_g | 7883 | 1.11 | \$24 | \$2,658 | 52 | 58 | \$1,268 | \$138,229 |
| (b) System 2, Southern Section | | | | | | | | | |
| I | Min Delay | 24386 | 3.43 | \$75 | \$8,223 | 52 | 178 | \$3,924 | \$427,614 |
| II | Min Delay and Stops | 25327 | 3.56 | \$78 | \$8,541 | 52 | 185 | \$4,075 | \$444,111 |
| III | Max N_g | 25147 | 3.54 | \$78 | \$8,480 | 52 | 184 | \$4,046 | \$440,962 |
| IV | Alt. Max N_g | 26338 | 3.70 | \$81 | \$8,882 | 52 | 193 | \$4,238 | \$461,845 |
| (c) System 1 and System 2, Arterial | | | | | | | | | |
| I | Min Delay | 29418 | 4.14 | \$91 | \$9,920 | 52 | 215 | \$4,733 | \$515,847 |
| II | Min Delay and Stops | 29140 | 4.10 | \$90 | \$9,826 | 52 | 213 | \$4,689 | \$510,976 |
| III | Max N_g | 26907 | 3.78 | \$83 | \$9,073 | 52 | 197 | \$4,329 | \$471,817 |
| IV | Alt. Max N_g | 34221 | 4.81 | \$106 | \$11,540 | 52 | 250 | \$5,506 | \$600,073 |

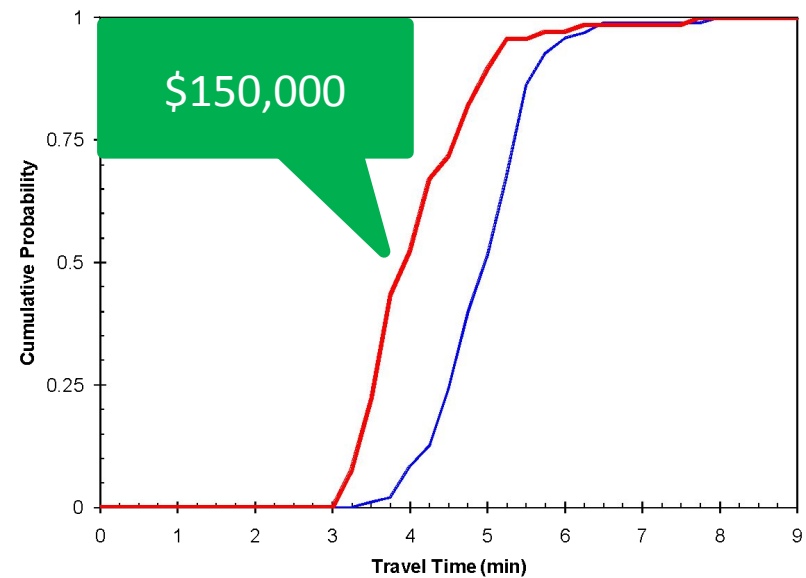
Controller PM + Probe Data

Emerging Shared Vision



1. Develop infrastructure and procedures to systematically prioritize investing engineering resources
2. Assess that impact

We are in a period where we need to re-introduce theory and fundamentals so we change how agencies spec. & operate traffic signals and what vendors provide and



0600 -2200 (8,500 veh)

*What gets measured gets done,
what gets measured and fed back gets done well,
what gets rewarded gets repeated.*

– John E. Jones



Darcy Bullock

darcy@purdue.edu

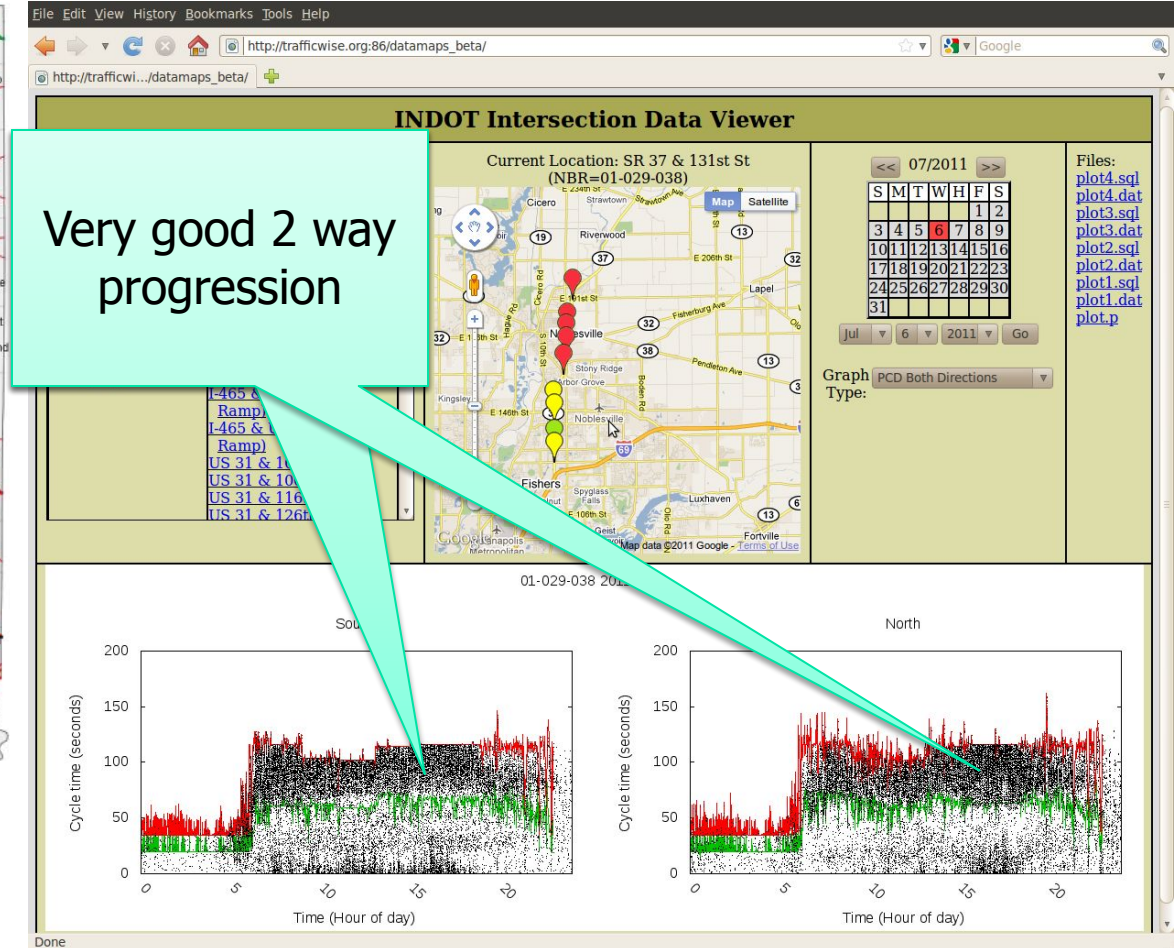
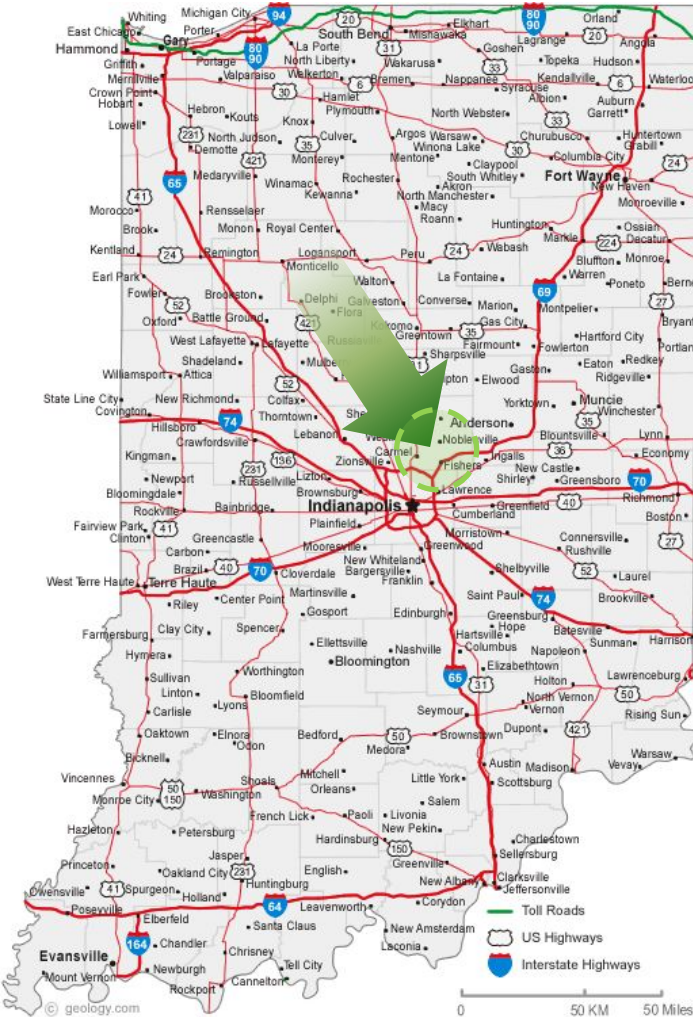
Purdue University School of Civil Engineering

Other Topics

- Detection
- Diagnostics
- Pedestrians
- v/c
- Data Collection
- Datamaps architecture
- Specifications

Diagnostics (Jim Sturdevant)

SR37 Fishers/Noblesville- (9)

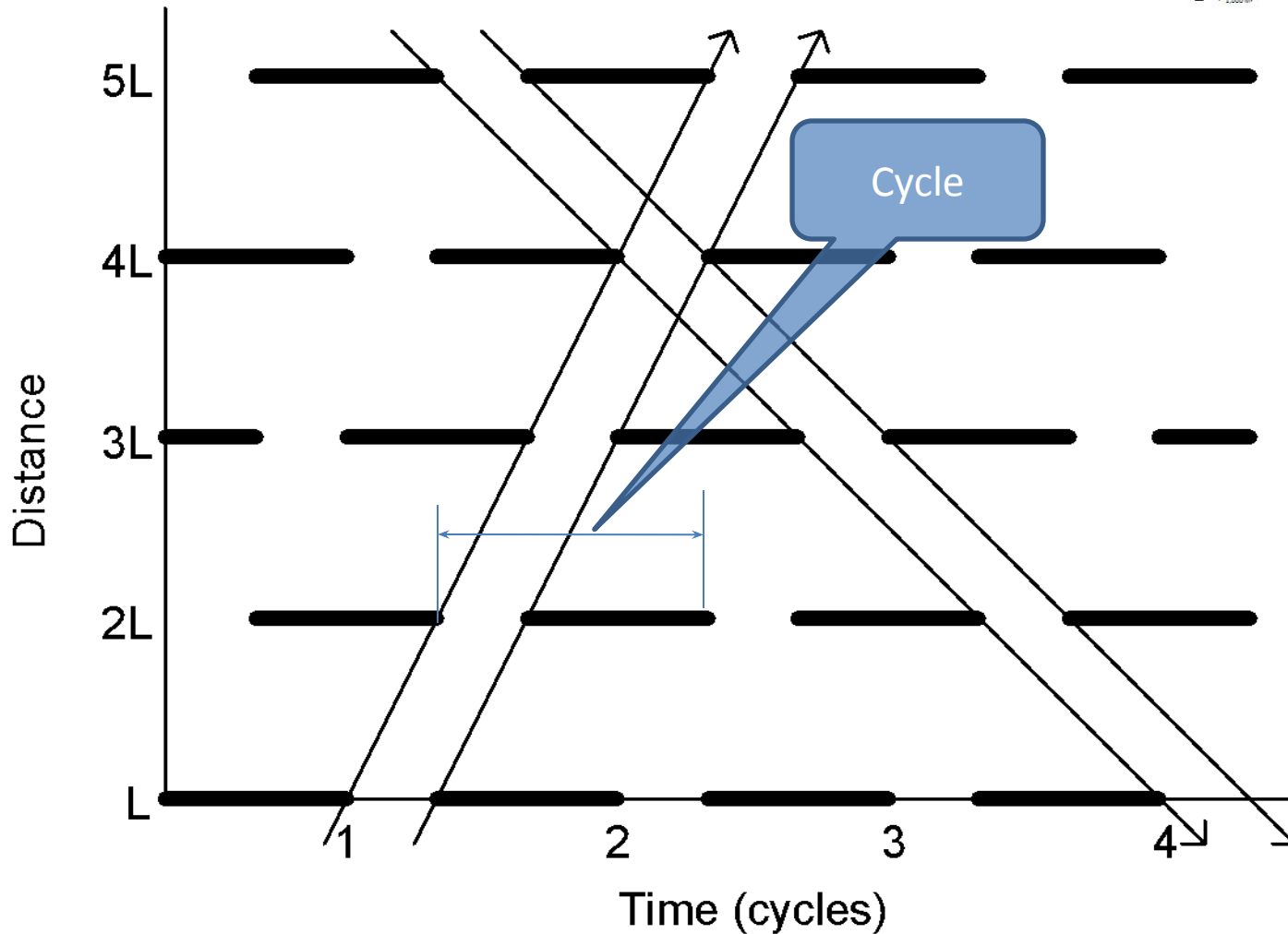
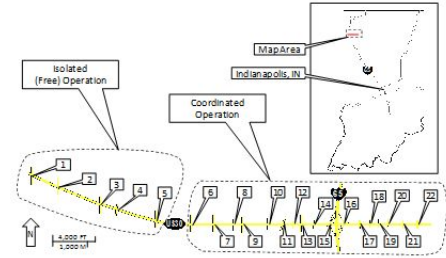


Very good 2 way progression



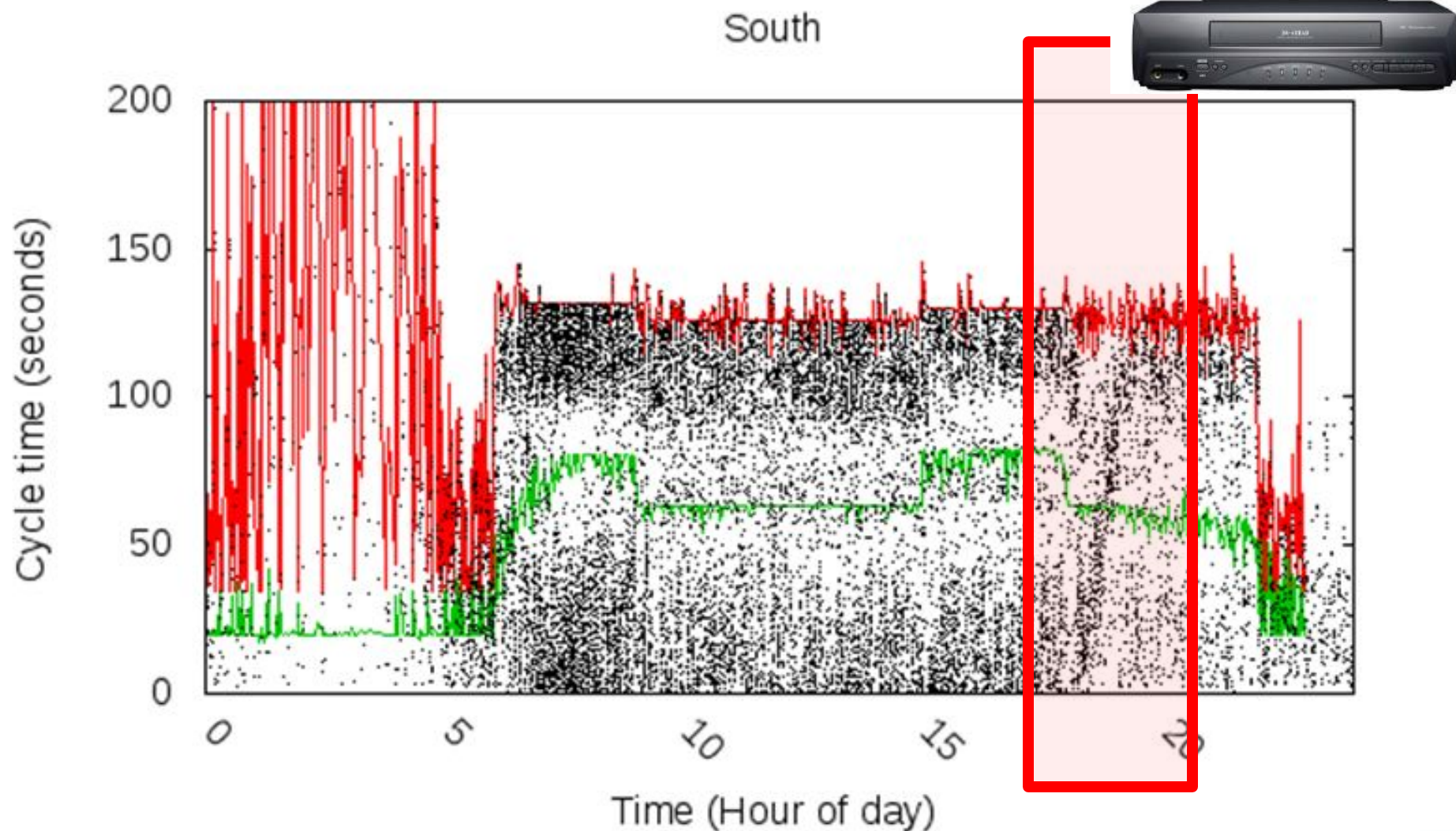
Coordination: Split, **Cycle**, Offset

Typical Corridor (22 Intersections)



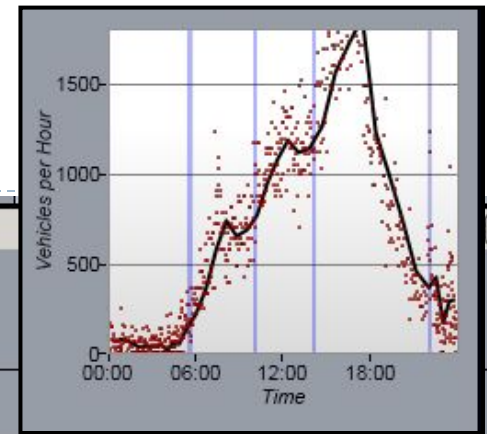
Really Hard
to get perfect
for 22
Intersections

US 31 @ 126th (8 in system)



Diagnostics (Andrew Nichols)

Thursday (12/8)

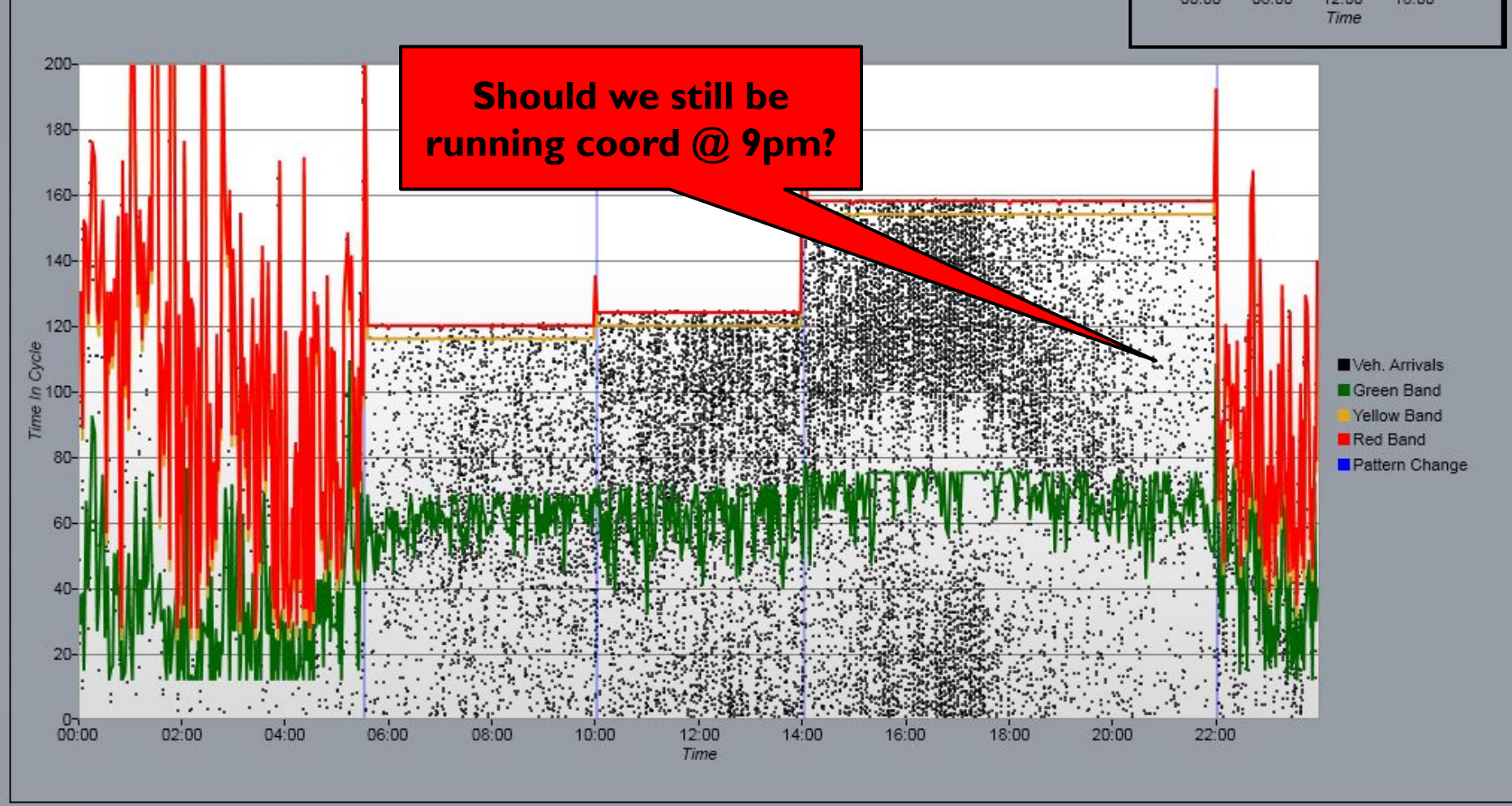


Purdue Coordination Diagram

Signal 102 - Osage Rd & US 19 WV 7 Osage Rd @ US 19 WV 7 Print...

Date 12/08/2011 Phase 6 Points Line

Should we still be running coord @ 9pm?



Austin Ave. Comprehensive Schedule

Weekly Program

| Day | Program Step |
|----------------|--------------|
| Weekly Program | 1 |
| Sunday | 3 |
| Monday | 1 |
| Tuesday | 1 |
| Wednesday | 1 |
| Thursday | 1 |
| Friday | 1 |
| Saturday | 2 |

Program 3 (Sunday) Steps 11-13

Program 1 (Weekday) Steps 1-6

Program 2 (Saturday) Steps 7-10

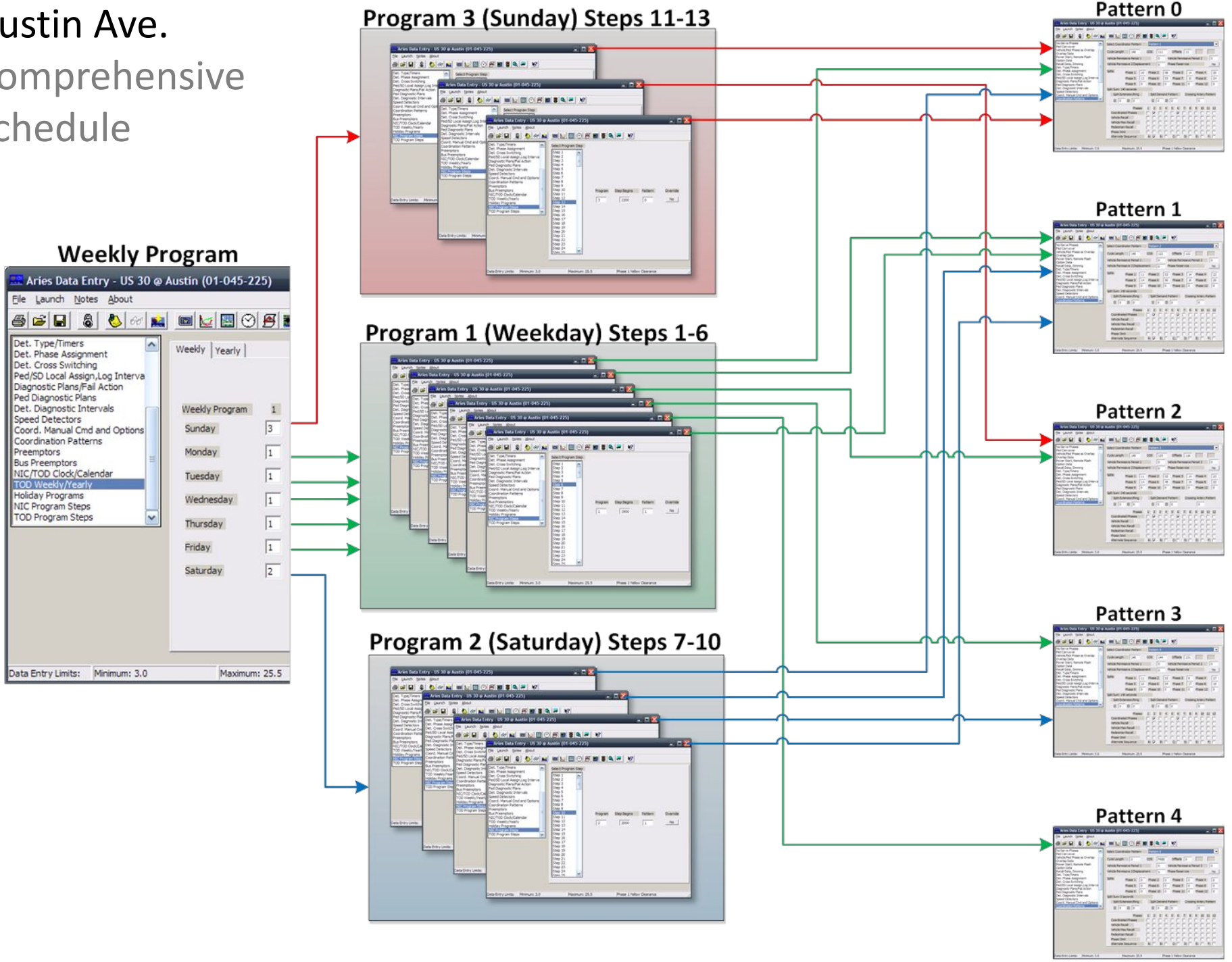
Pattern 0

Pattern 1

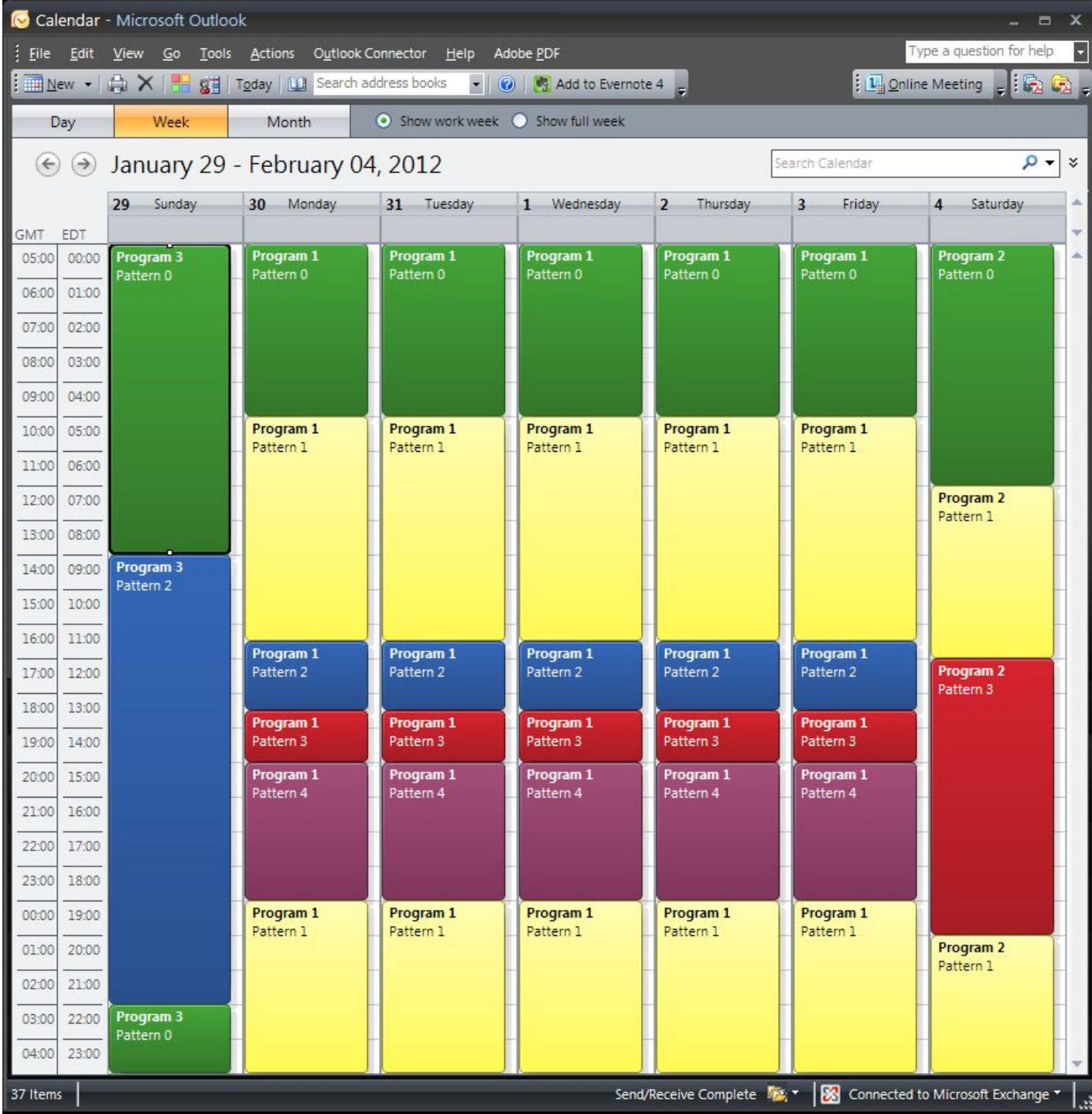
Pattern 2

Pattern 3

Pattern 4



Austin Weekly Program January 29 - February 4



Austin Weekly Program

Calendar - Microsoft Outlook

File Edit View Go Tools Actions Outlook Connector Help Adobe PDF

New Search address books Add to Evernote 4 Online Meeting

Calendar << Day Week Month Show work week Show full week

January 29 - February 04, 2012

Search Calendar

| | 29 Sunday | 30 Monday | 31 Tuesday | 1 Wednesday | 2 Thursday | 3 Friday | 4 Saturday |
|-------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| 05:00 | Program 3 Pattern 0 | Program 1 Pattern 0 | Program 1 Pattern 0 | Program 1 Pattern 0 | Program 1 Pattern 0 | Program 1 Pattern 0 | Program 2 Pattern 0 |
| 06:00 | | | | | | | |
| 07:00 | | | | | | | |
| 08:00 | | | | | | | |
| 09:00 | | | | | | | |
| 10:00 | | Program 1 Pattern 1 | Program 1 Pattern 1 | Program 1 Pattern 1 | Program 1 Pattern 1 | Program 1 Pattern 1 | |
| 11:00 | | | | | | | |
| 12:00 | | | | | | | |
| 13:00 | | | | | | | |
| 14:00 | Program 3 Pattern 2 | | | | | | |
| 15:00 | | | | | | | |
| 16:00 | | | | | | | |
| 17:00 | | Program 1 Pattern 2 | Program 1 Pattern 2 | Program 1 Pattern 2 | Program 1 Pattern 2 | Program 1 Pattern 2 | |
| 18:00 | | | | | | | |
| 19:00 | | Program 1 Pattern 3 | Program 1 Pattern 3 | Program 1 Pattern 3 | Program 1 Pattern 3 | Program 1 Pattern 3 | Program 2 Pattern 3 |
| 20:00 | | Program 1 Pattern 4 | Program 1 Pattern 4 | Program 1 Pattern 4 | Program 1 Pattern 4 | Program 1 Pattern 4 | |
| 21:00 | | | | | | | |
| 22:00 | | | | | | | |
| 23:00 | | | | | | | |
| 00:00 | | | | | | | |
| 01:00 | | | | | | | |
| 02:00 | | | | | | | |
| 03:00 | | | | | | | |
| 04:00 | Program 3 Pattern 0 | | | | | | Program 2 Pattern 1 |

37 Items | All folders are up to date. | Connected to Microsoft Exchange

Austin – Program 1 (Weekday)

February 1

Calendar - Microsoft Outlook

File Edit View Go Tools Actions Outlook Connector Help Adobe PDF Type a question for help

New [Print] [Close] [Today] [Search address books] [Add to Evernote 4] [Online Meeting]

Calendar << Day Week Month >>

January 2012
S M T W T F S
25 26 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

February 2012
S M T W T F S
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 1 2 3
10 4 5 6 7 8 9 10

All Calendar Items

My Calendars

- Calendar
- Alex's calendar in amhain
- Birthday calendar in amhain
- US Holidays in amhain@i

People's Calendars

- Remias, Stephen M
- Brunton, Bridget E - JTRP Va
- Brunton, Bridget E - JTRP Pro

Other Calendars

- How to Share Calendars
- Open a Shared Calendar...
- Share My Calendar...
- Send a Calendar via E-mail...
- Publish My Calendar...
- Add New Group

February 01, 2012 Search Calendar

1 Wednesday

| GMT | EDT | Event |
|-------|-------|---------------------|
| 05:00 | 00:00 | Program 1 Pattern 0 |
| 06:00 | 01:00 | |
| 07:00 | 02:00 | |
| 08:00 | 03:00 | |
| 09:00 | 04:00 | |
| 10:00 | 05:00 | Program 1 Pattern 1 |
| 11:00 | 06:00 | |
| 12:00 | 07:00 | |
| 13:00 | 08:00 | |
| 14:00 | 09:00 | |
| 15:00 | 10:00 | |
| 16:00 | 11:00 | |
| 17:00 | 12:00 | Program 1 Pattern 2 |
| 18:00 | 13:00 | |
| 19:00 | 14:00 | Program 1 Pattern 3 |
| 20:00 | 15:00 | |
| 21:00 | 16:00 | Program 1 Pattern 4 |
| 22:00 | 17:00 | |
| 23:00 | 18:00 | |
| 00:00 | 19:00 | Program 1 Pattern 1 |
| 01:00 | 20:00 | |
| 02:00 | 21:00 | |
| 03:00 | 22:00 | |
| 04:00 | 23:00 | |

6 Items | Send/Receive Complete | Connected to Microsoft Exchange

Robin Hood – Program 1 (Weekday)

February 1

Calendar - Microsoft Outlook

File Edit View Go Tools Actions Outlook Connector Help Adobe PDF

Calendar

January 2012

February 2012

February 01, 2012

Wednesday

| GMT | EDT | Event |
|-------|-------|------------------------|
| 05:00 | 00:00 | Program 1 Pattern 0 |
| 06:00 | 01:00 | |
| 07:00 | 02:00 | |
| 08:00 | 03:00 | |
| 09:00 | 04:00 | |
| 10:00 | 05:00 | |
| 11:00 | 06:00 | Program 1 Pattern 1 |
| 12:00 | 07:00 | |
| 13:00 | 08:00 | Program 1 Pattern 2 |
| 14:00 | 09:00 | |
| 15:00 | 10:00 | Program 1 Pattern 3 |
| 16:00 | 11:00 | |
| 17:00 | 12:00 | Program 1 Pattern 4 |
| 18:00 | 13:00 | |
| 19:00 | 14:00 | Program 1; Pattern 5 |
| 20:00 | 15:00 | Program 1 Pattern 6 |
| 21:00 | 16:00 | |
| 22:00 | 17:00 | |
| 23:00 | 18:00 | Program 1 Pattern 4 |
| 00:00 | 19:00 | |
| 01:00 | 20:00 | |
| 02:00 | 21:00 | Program 1 Pattern 0 |
| 03:00 | 22:00 | |
| 04:00 | 23:00 | |

All Calendar Items

My Calendars

- Calendar
- Alex's calendar in amhainen
- Birthday calendar in amhainen
- US Holidays in amhainen@i

People's Calendars

- Remias, Stephen M
- Brunton, Bridget E - JTRP Va
- Brunton, Bridget E - JTRP Pro

Other Calendars

- How to Share Calendars
- Open a Shared Calendar...
- Share My Calendar...
- Send a Calendar via E-mail...
- Publish My Calendar...
- Add New Group

9 Items | All folders are up to date. | Connected to Microsoft Exchange

Comparison of Weekday Programs

Calendar <<

January 2012

S M T W T F S

25 26 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

February 2012

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 1 2 3

4 5 6 7 8 9 10

All Calendar Items

My Calendars

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People's Calendars

- Remias, Stephen M
- Brunton, Bridget E - JTRP Va
- Brunton, Bridget E - JTRP Pro

Other Calendars

[How to Share Calendars](#)

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Day Week Month

February 01, 2012 Search Calendar

GMT EDT

1 Wednesday

Robin Hood

| | | |
|-------|-------|----------------------|
| 05:00 | 00:00 | Program 1 Pattern 0 |
| 06:00 | 01:00 | |
| 07:00 | 02:00 | |
| 08:00 | 03:00 | |
| 09:00 | 04:00 | |
| 10:00 | 05:00 | |
| 11:00 | 06:00 | Program 1 Pattern 1 |
| 12:00 | 07:00 | |
| 13:00 | 08:00 | Program 1 Pattern 2 |
| 14:00 | 09:00 | |
| 15:00 | 10:00 | Program 1 Pattern 3 |
| 16:00 | 11:00 | |
| 17:00 | 12:00 | Program 1 Pattern 4 |
| 18:00 | 13:00 | |
| 19:00 | 14:00 | Program 1; Pattern 5 |
| 20:00 | 15:00 | Program 1 Pattern 6 |
| 21:00 | 16:00 | |
| 22:00 | 17:00 | |
| 23:00 | 18:00 | Program 1 Pattern 4 |
| 00:00 | 19:00 | |
| 01:00 | 20:00 | |
| 02:00 | 21:00 | Program 1 Pattern 0 |
| 03:00 | 22:00 | |
| 04:00 | 23:00 | |

Week Month

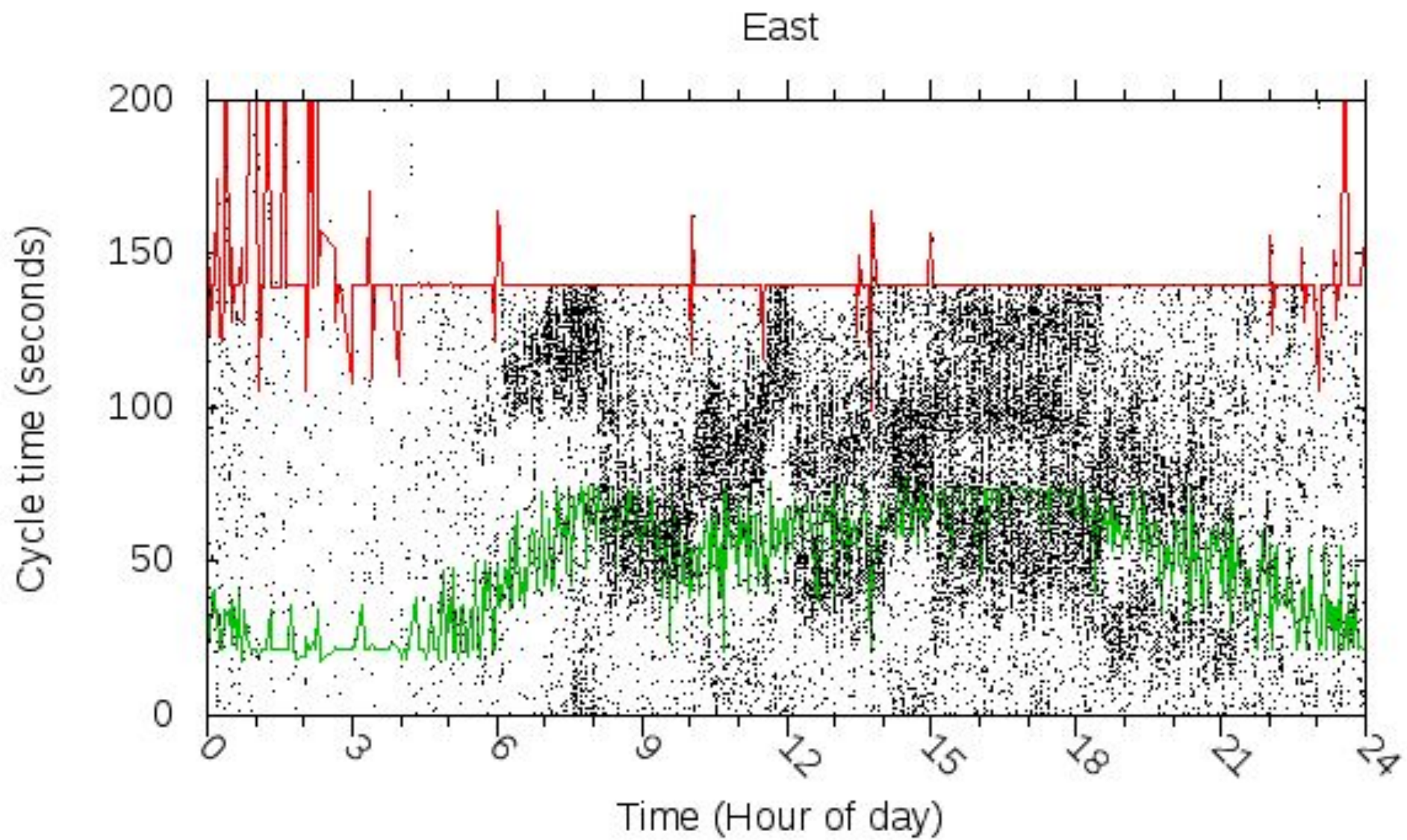
February 01, 2012 Search Calendar

1 Wednesday

Austin

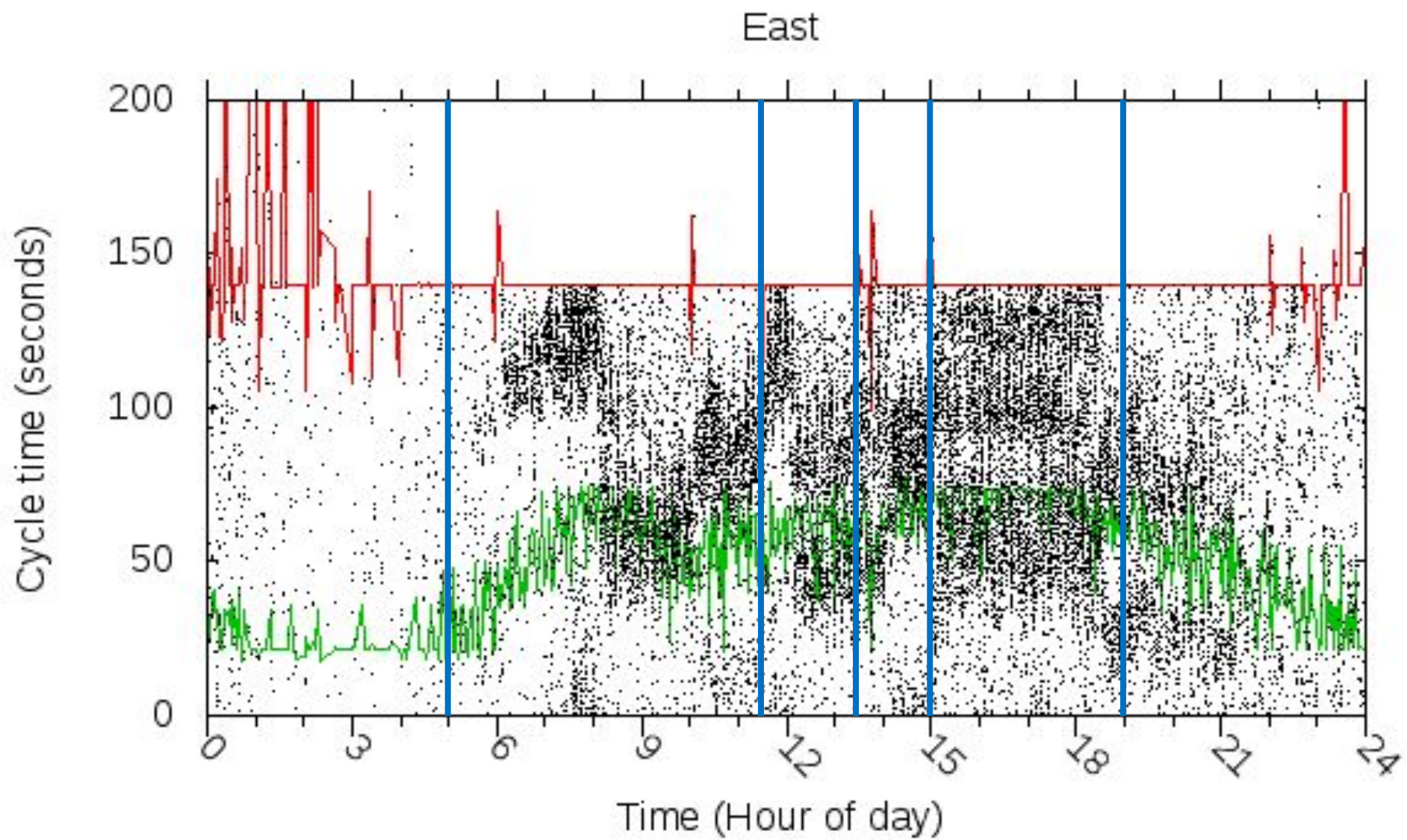
| | | |
|-------|-------|---------------------|
| 05:00 | 00:00 | Program 1 Pattern 0 |
| 06:00 | 01:00 | |
| 07:00 | 02:00 | |
| 08:00 | 03:00 | |
| 09:00 | 04:00 | |
| 10:00 | 05:00 | |
| 11:00 | 06:00 | Program 1 Pattern 1 |
| 12:00 | 07:00 | |
| 13:00 | 08:00 | Program 1 Pattern 2 |
| 14:00 | 09:00 | |
| 15:00 | 10:00 | Program 1 Pattern 3 |
| 16:00 | 11:00 | |
| 17:00 | 12:00 | Program 1 Pattern 2 |
| 18:00 | 13:00 | Program 1 Pattern 3 |
| 19:00 | 14:00 | Program 1 Pattern 4 |
| 20:00 | 15:00 | Program 1 Pattern 4 |
| 21:00 | 16:00 | |
| 22:00 | 17:00 | |
| 23:00 | 18:00 | Program 1 Pattern 1 |
| 00:00 | 19:00 | |
| 01:00 | 20:00 | |
| 02:00 | 21:00 | |
| 03:00 | 22:00 | |
| 04:00 | 23:00 | |

Austin EB PCD (coming from Adjacent System)

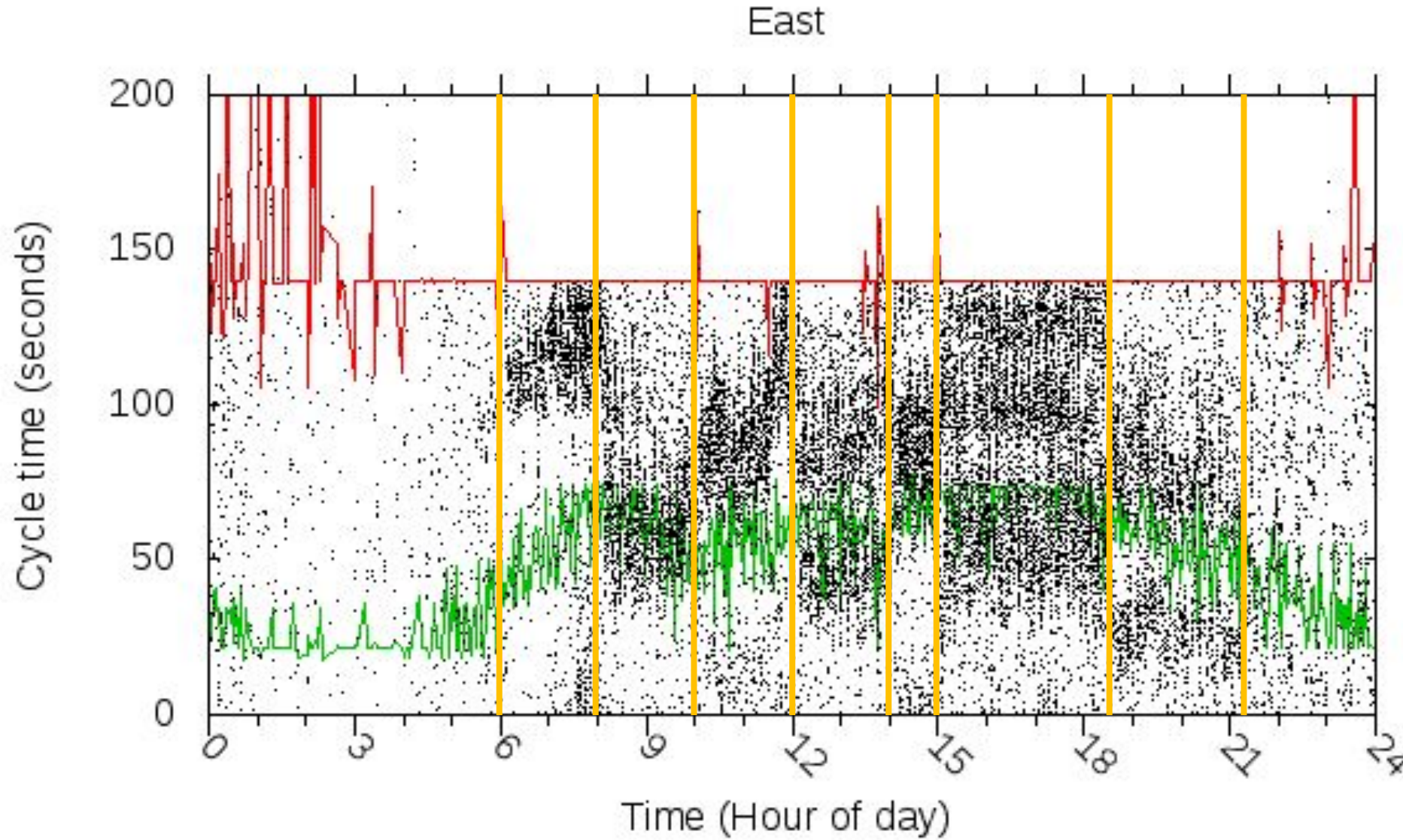


Austin EB PCD (coming from Adjacent System)

Austin Programs

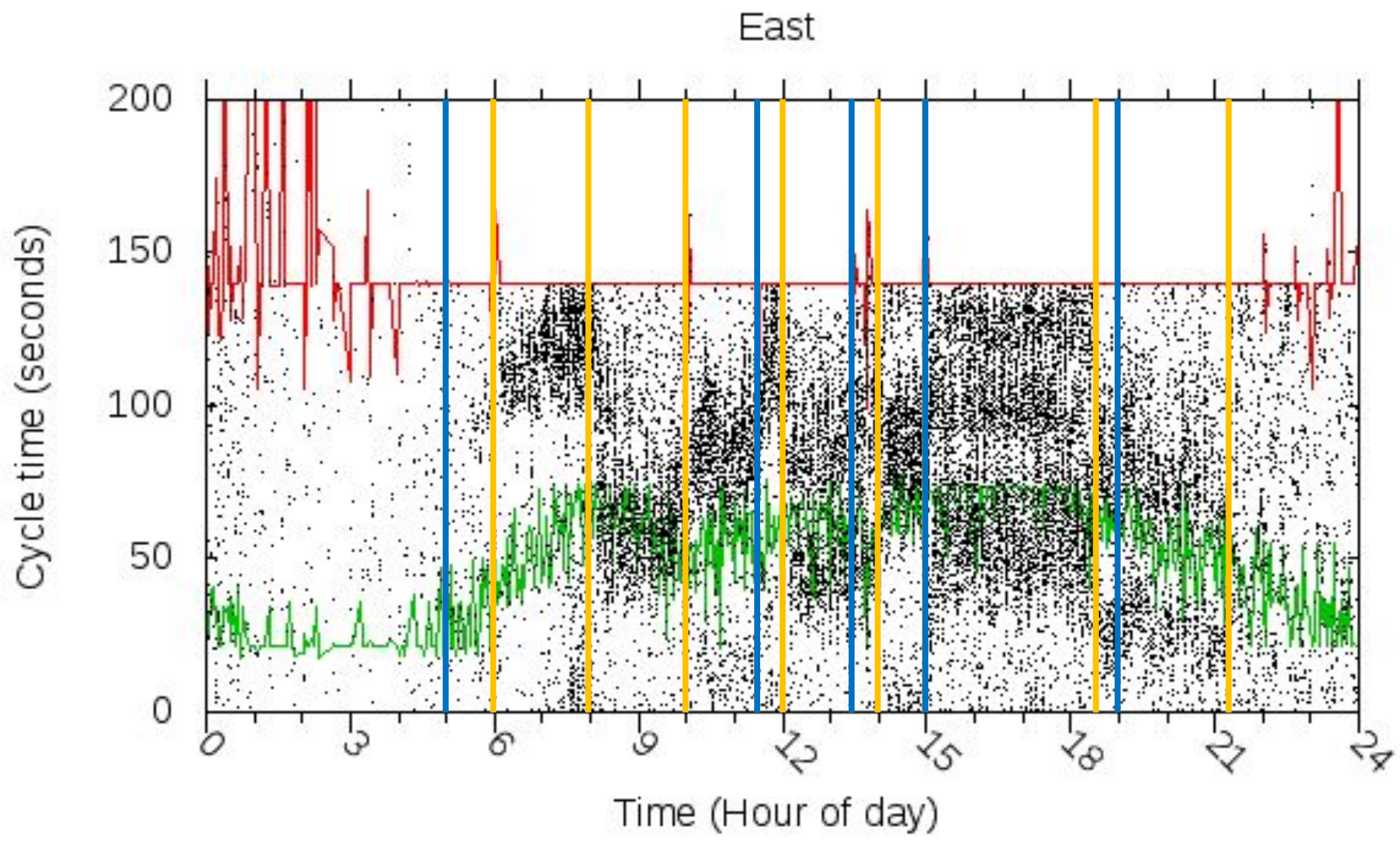


Austin EB PCD (coming from Adjacent System) Robin Hood Programs



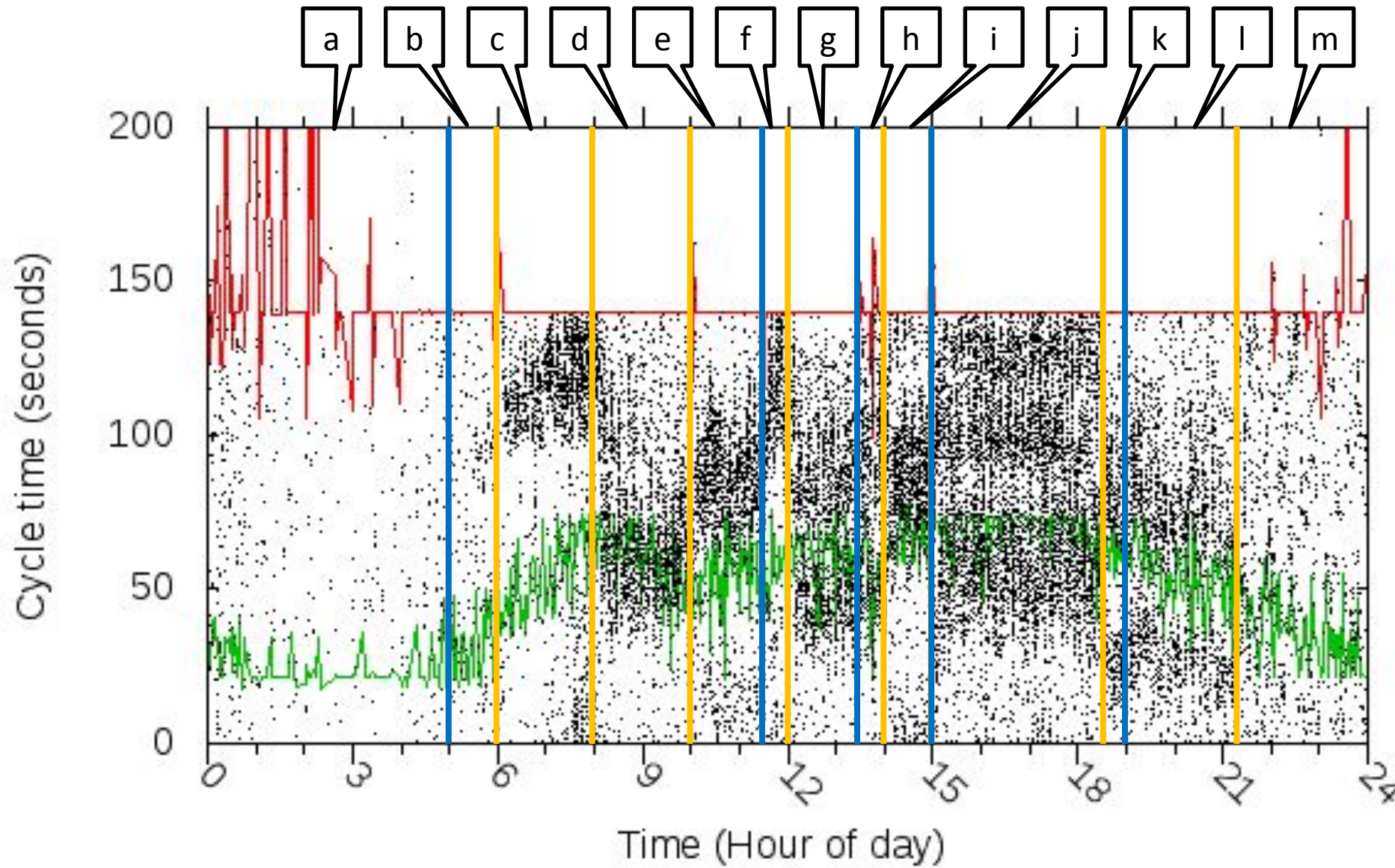
Austin EB PCD (coming from Adjacent System)

Both Programs



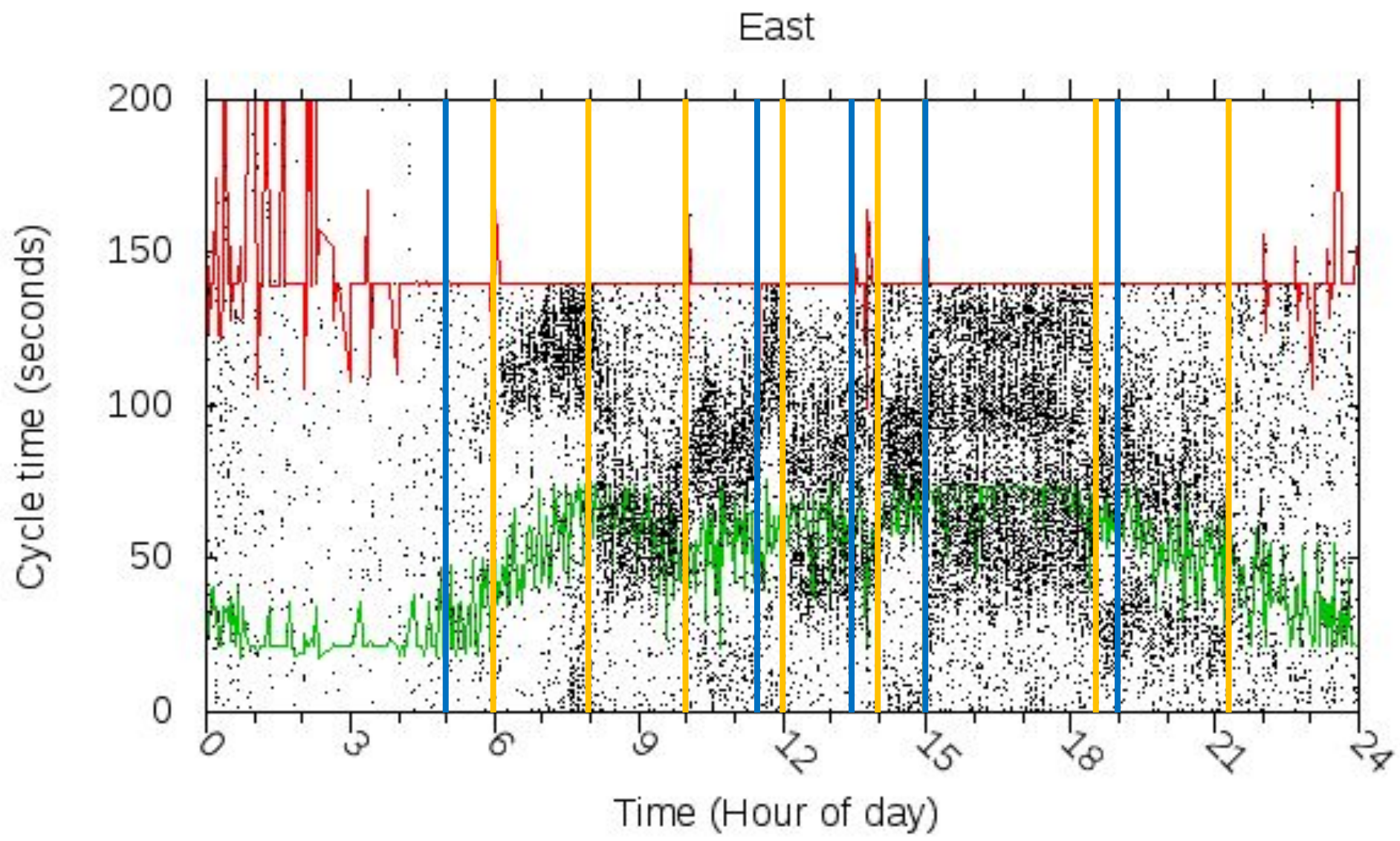
Austin EB PCD (coming from Adjacent System) – 13 Periods

Both Programs



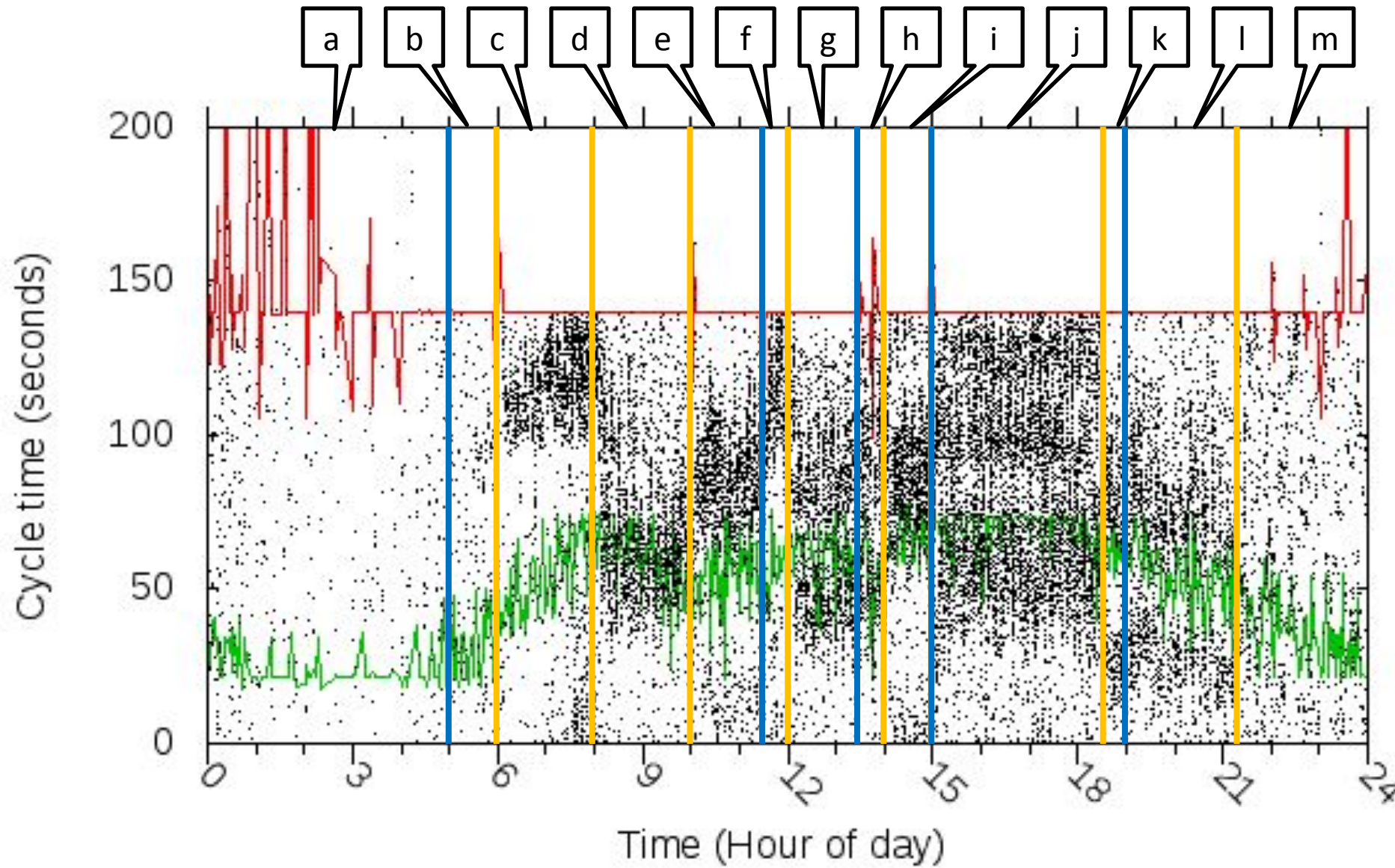
Austin EB PCD (coming from Adjacent System)

Both Programs



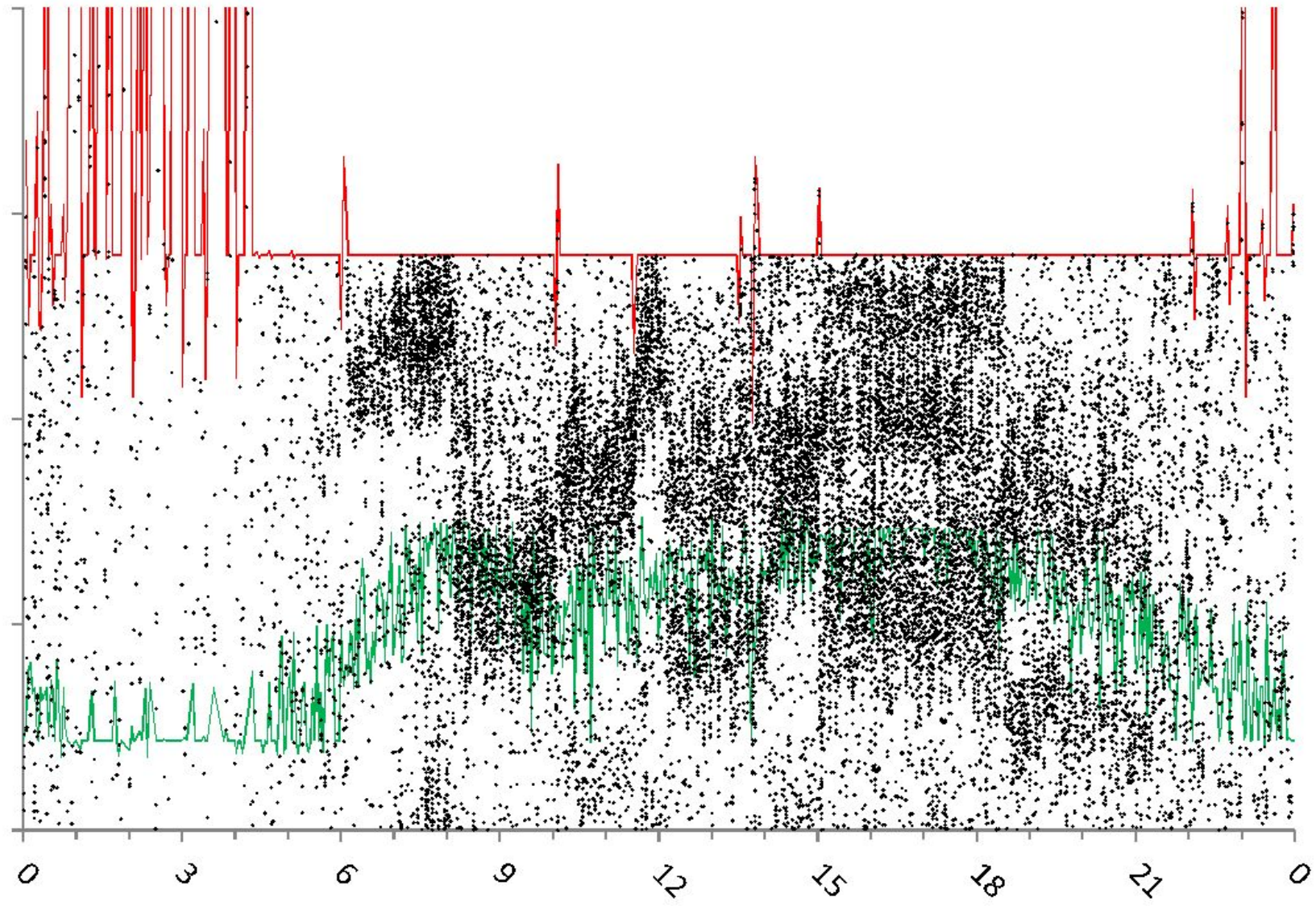
Austin EB PCD (coming from Adjacent System) – 13 Periods

Both Programs



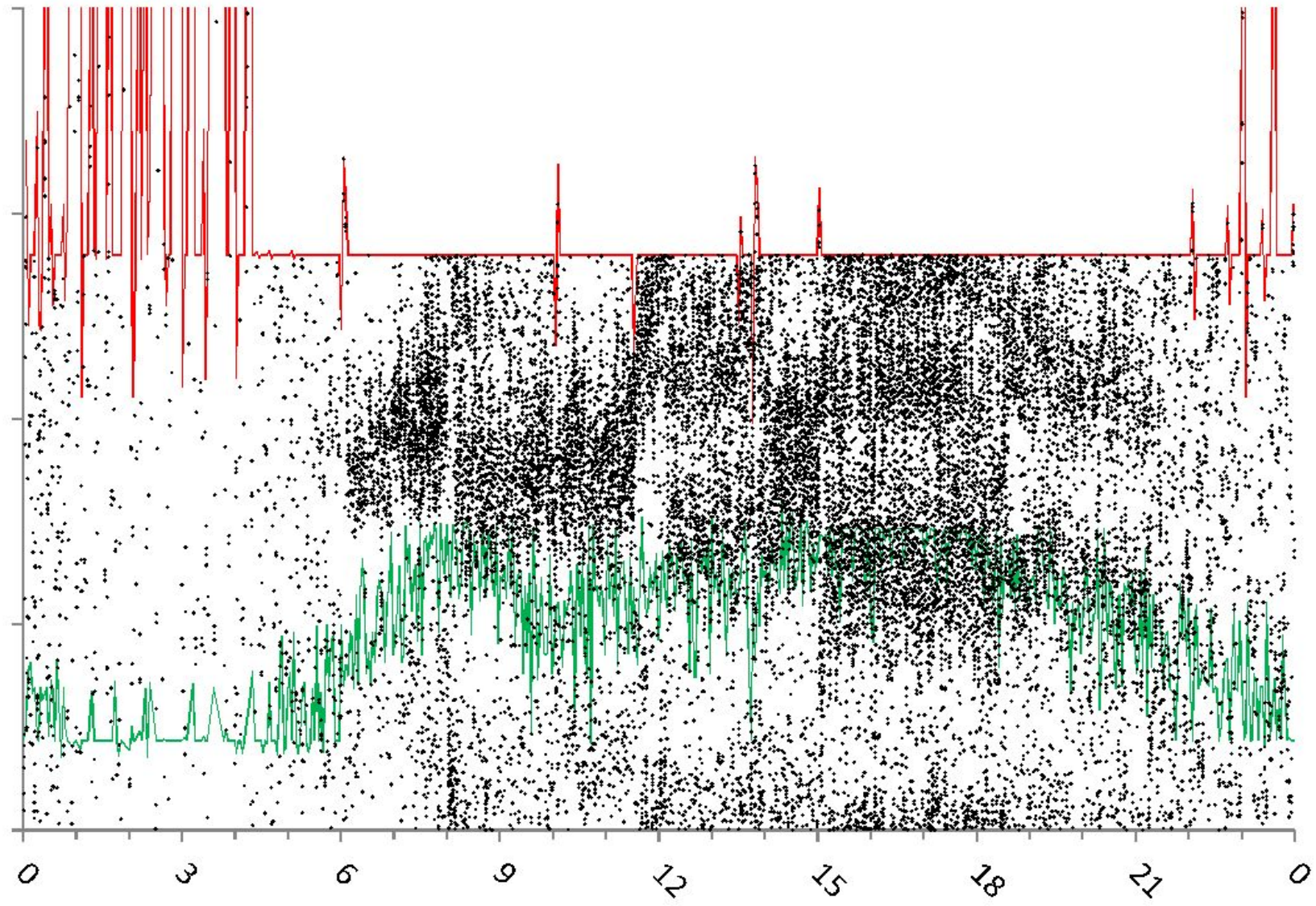
Austin EB PCD (coming from Adjacent System) – BEFORE

12,876 Arrivals on Green



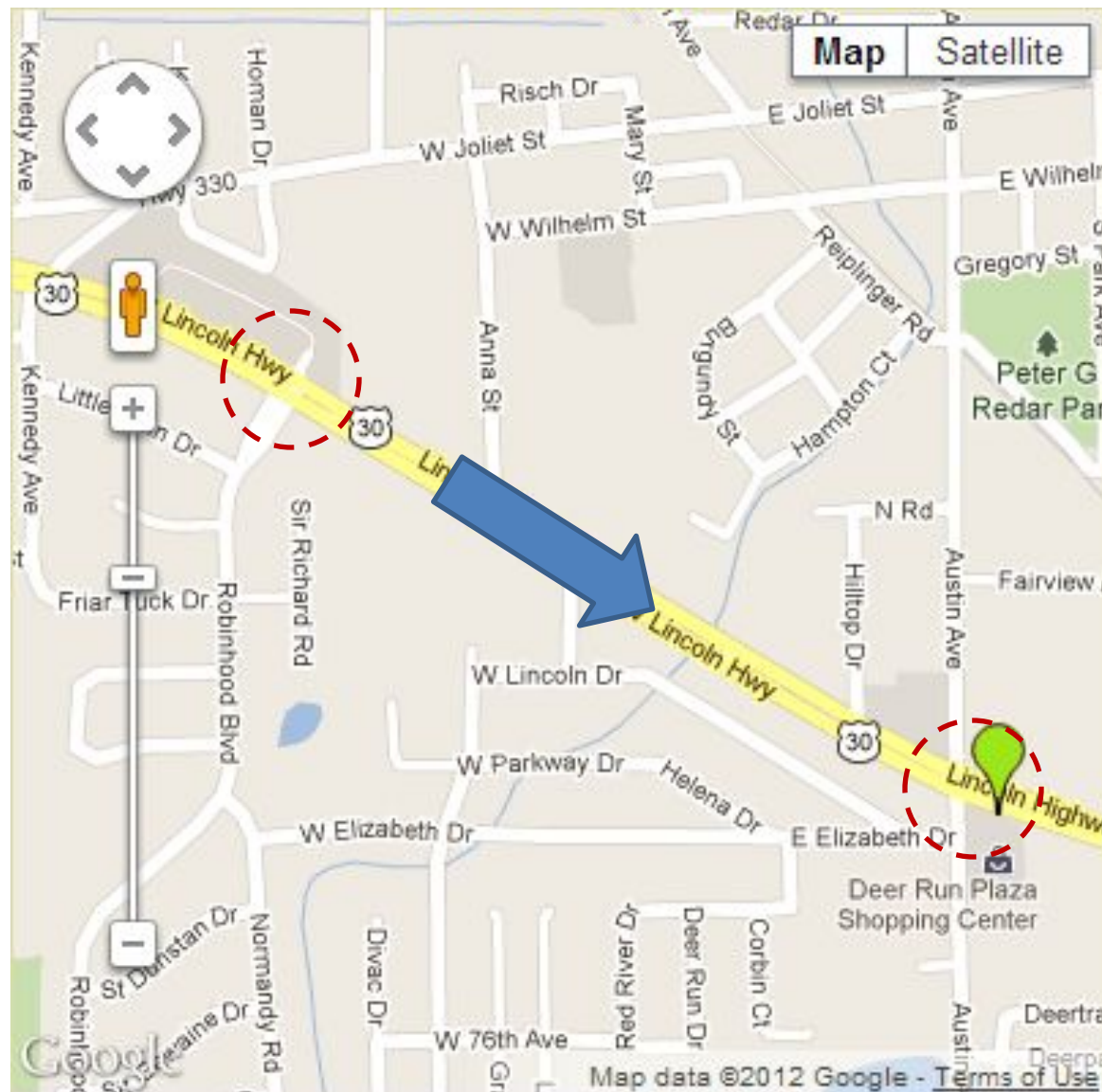
Austin EB PCD (coming from Adjacent System) – ADJUSTED

13,835 Arrivals on Green



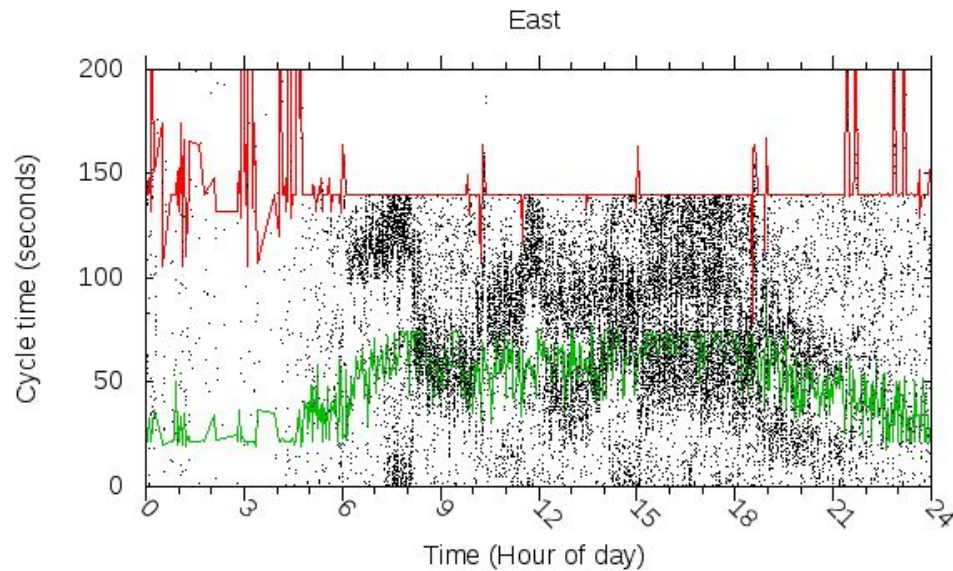
Robin Hood to Austin

Eastbound Map

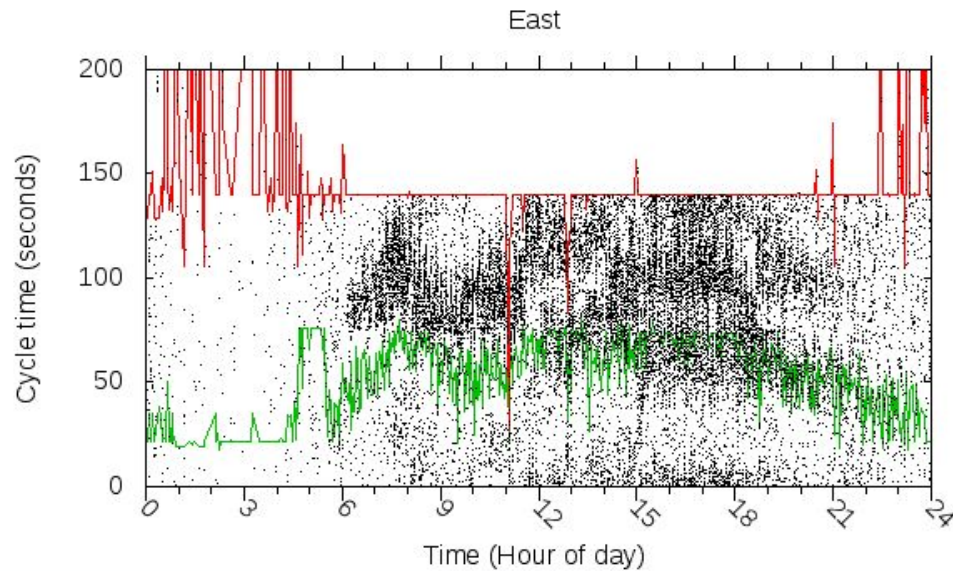


Austin EB PCD (coming from Adjacent System) – Before/After

February 6, 2012 (XX.X P.O.G) vs. February 13, 2012 (XX.X P.O.G)



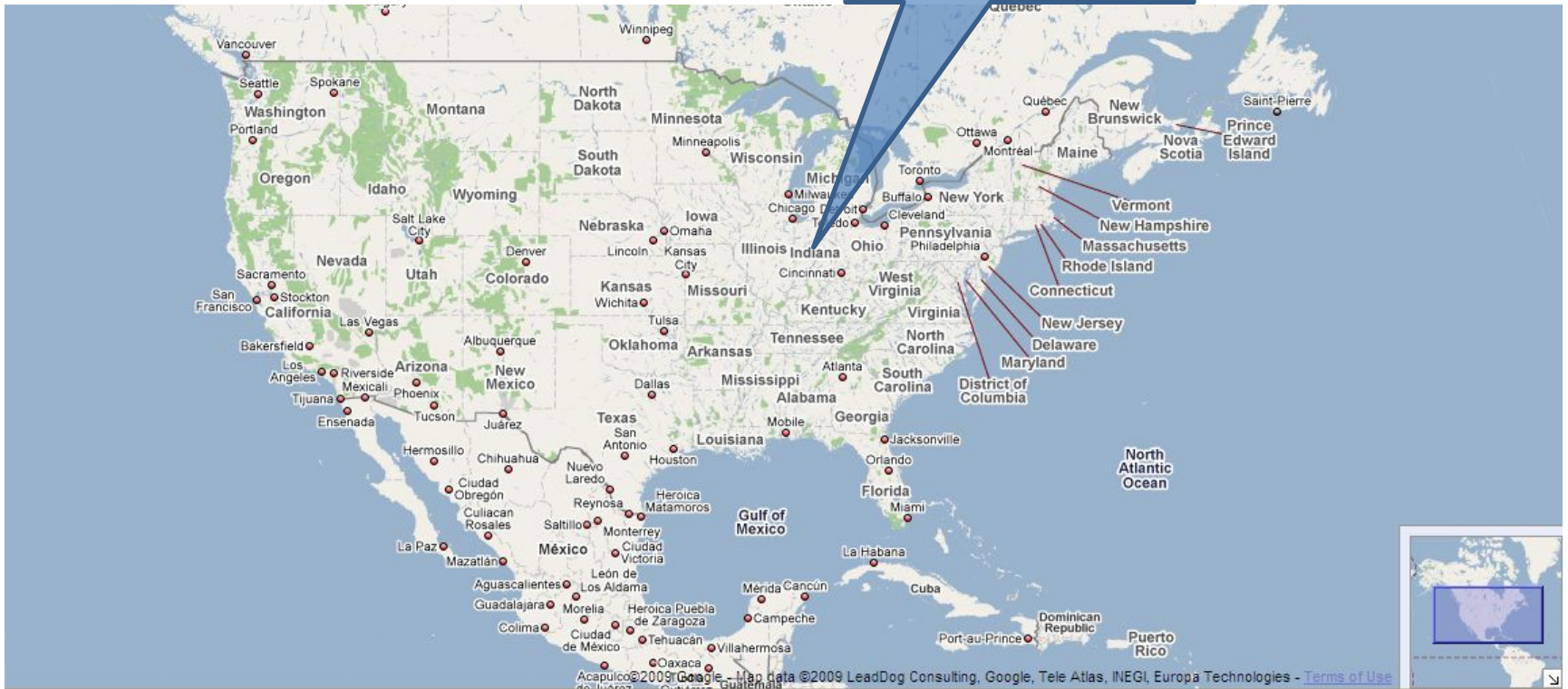
| FEBRUARY | | | | | | |
|----------|----|----|----|----|----|----|
| S | M | T | W | T | F | S |
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | | | |



| FEBRUARY | | | | | | |
|----------|----|----|----|----|----|----|
| 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 | | | |

- SR 37 Free

PURDUE
UNIVERSITY



Success for Purdue University is not how many students we produce, but the **IMPACT** those students have. Vendor & Agency collaboration are fundamental ingredients to my program.

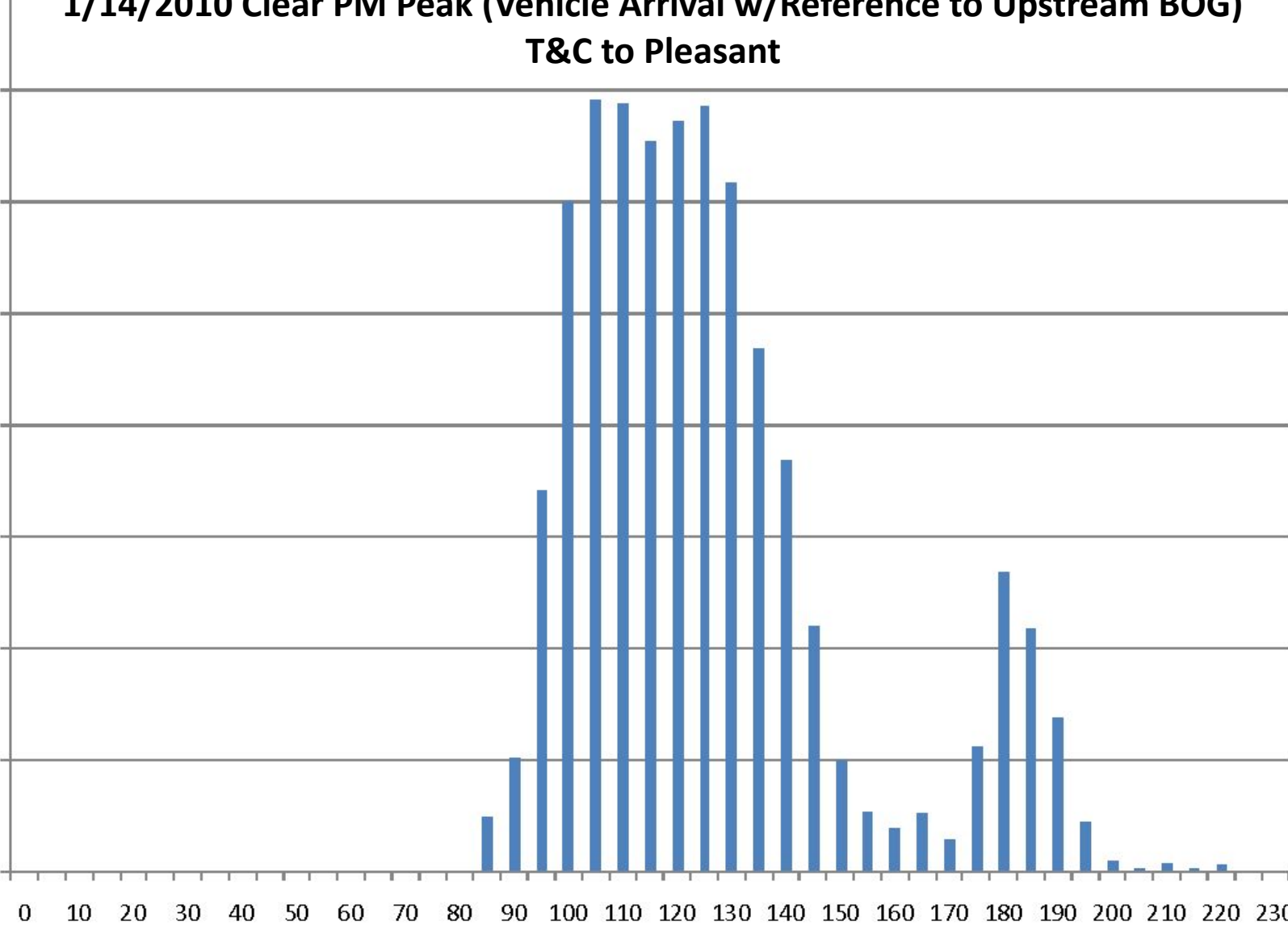
1/14/2010 Clear PM Peak (Vehicle Arrival w/Reference to Upstream BOG) T&C to Pleasant

Vehicles

400
350
300
250
200
150
100
50
0

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230

Travel Time (Seconds)



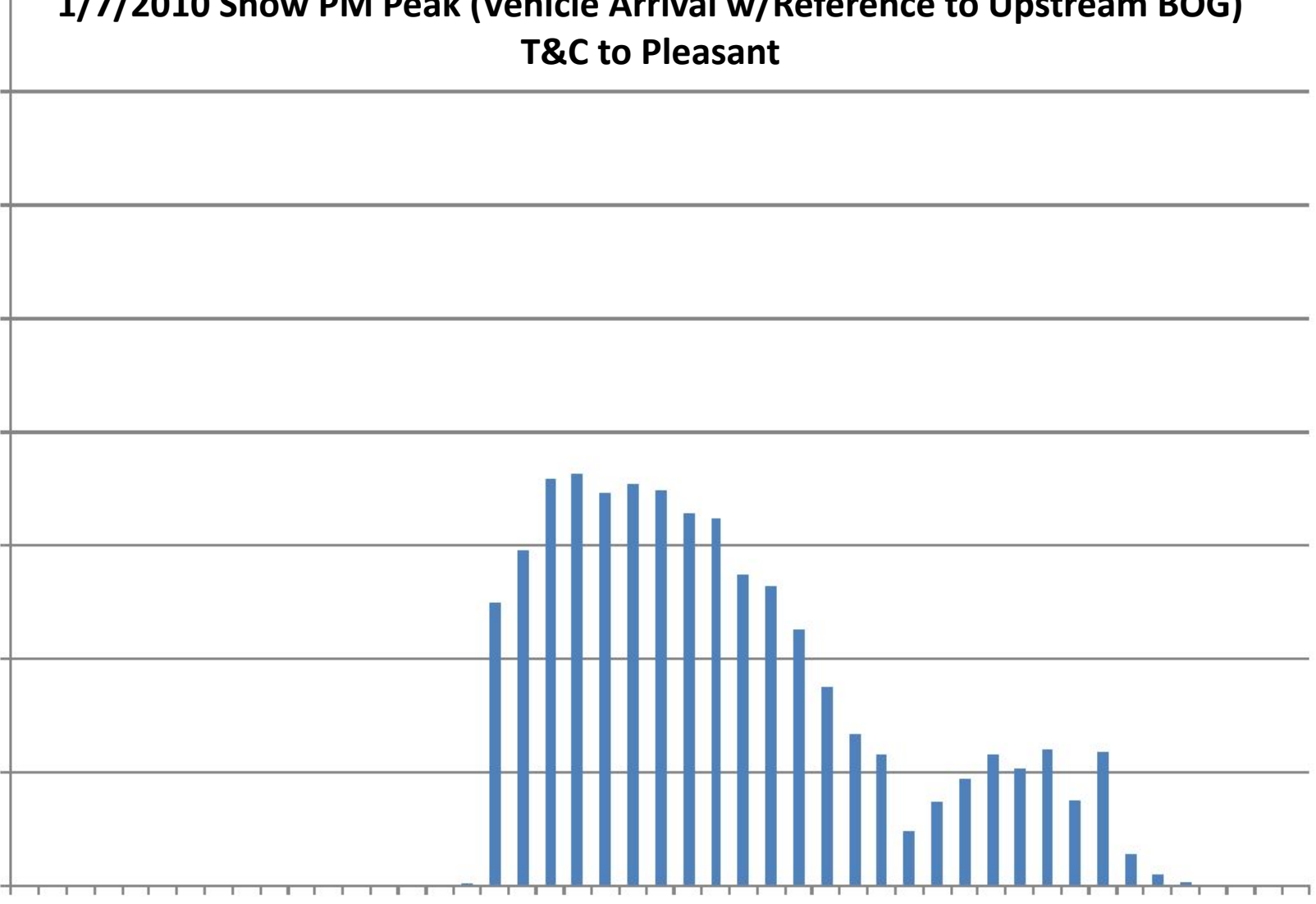
1/7/2010 Snow PM Peak (Vehicle Arrival w/Reference to Upstream BOG) T&C to Pleasant

Vehicles

400
350
300
250
200
150
100
50
0

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230

Travel Time (Seconds)



EXTRA

January 23 Observed

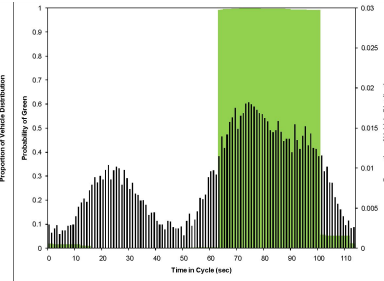
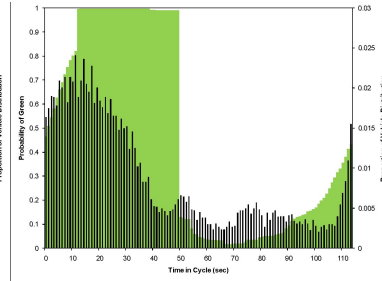
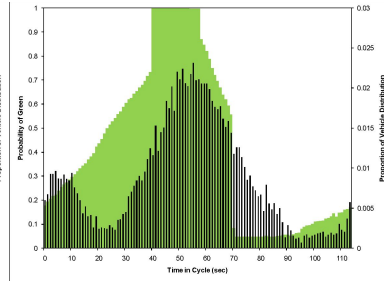
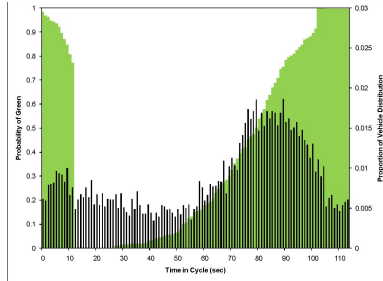
32/37

37/Pleasant

37/T&C

37/Greenfield

NB



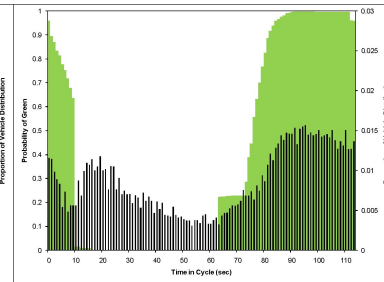
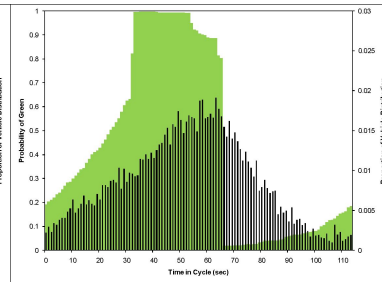
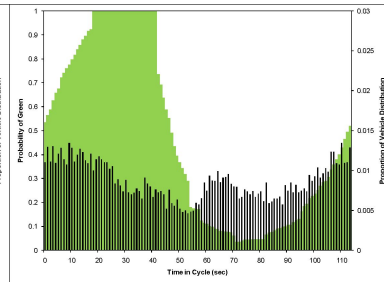
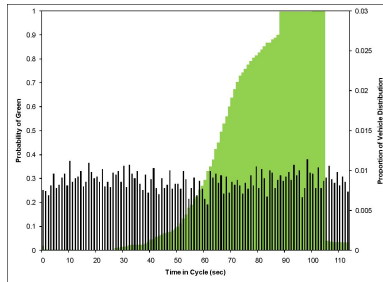
32/37

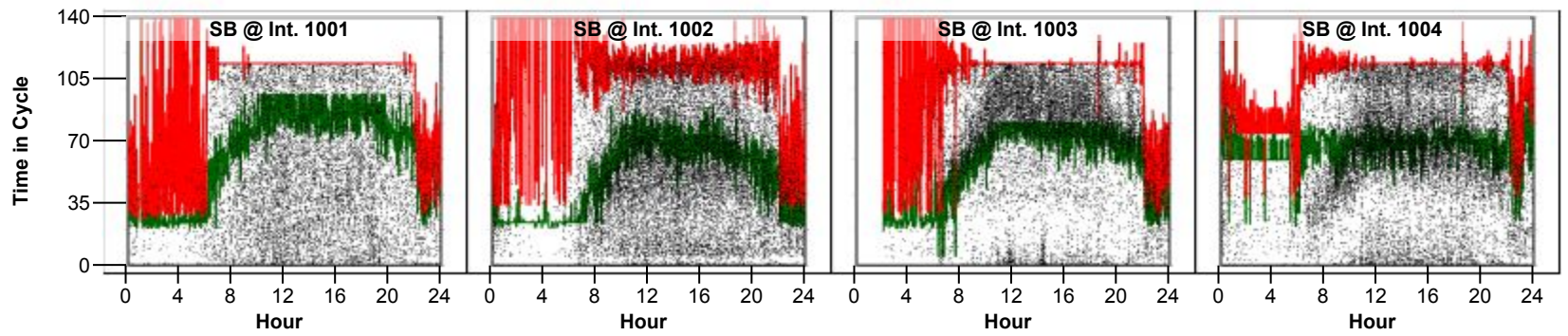
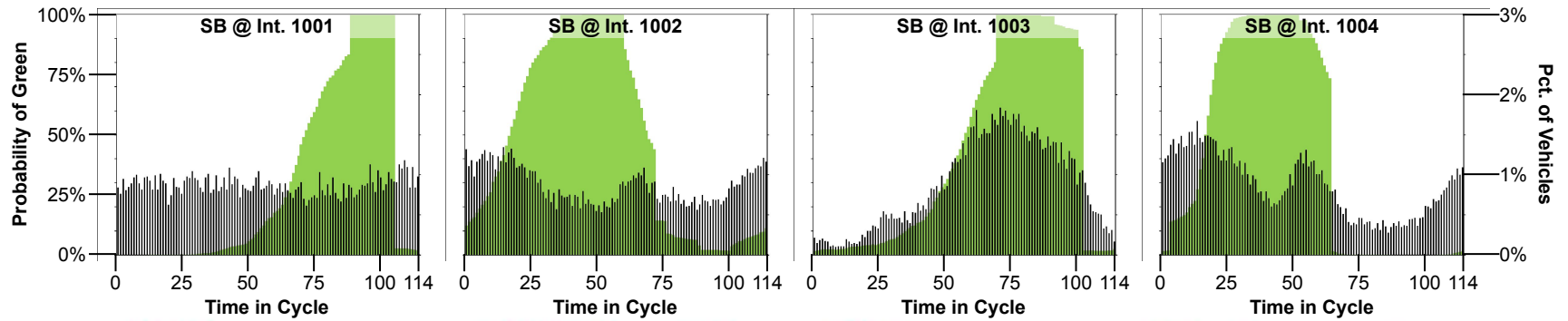
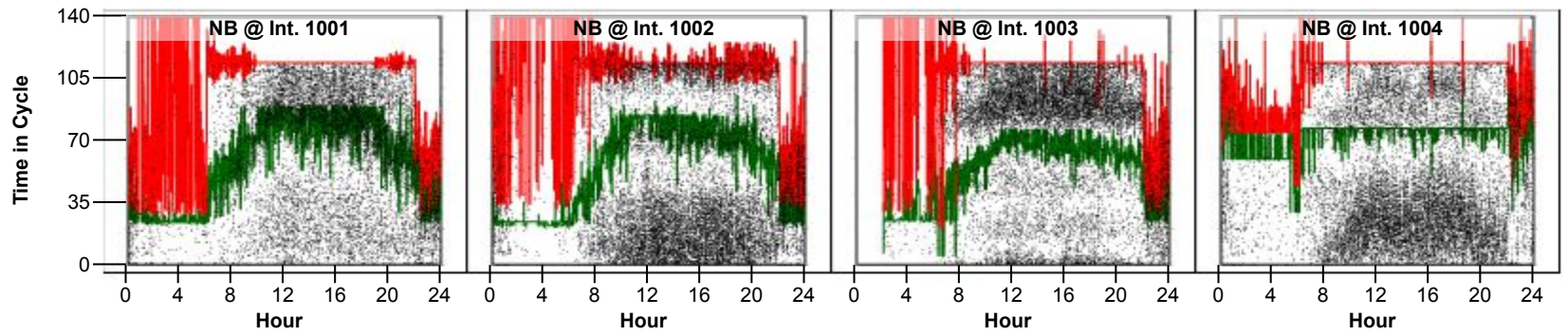
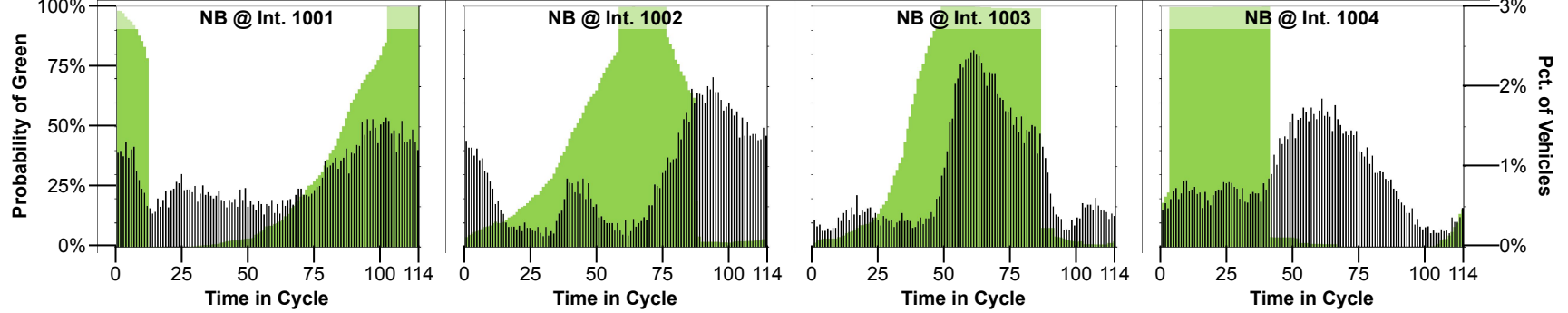
37/Pleasant

37/T&C

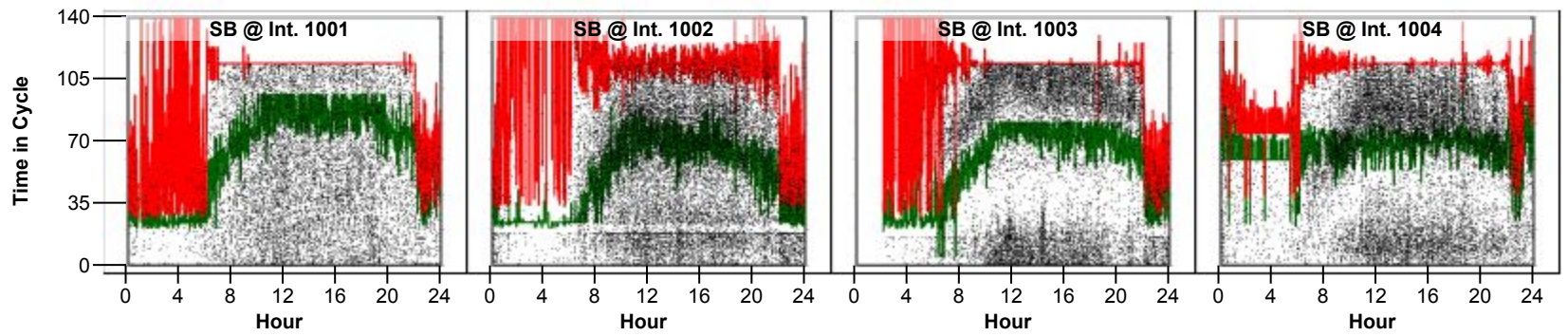
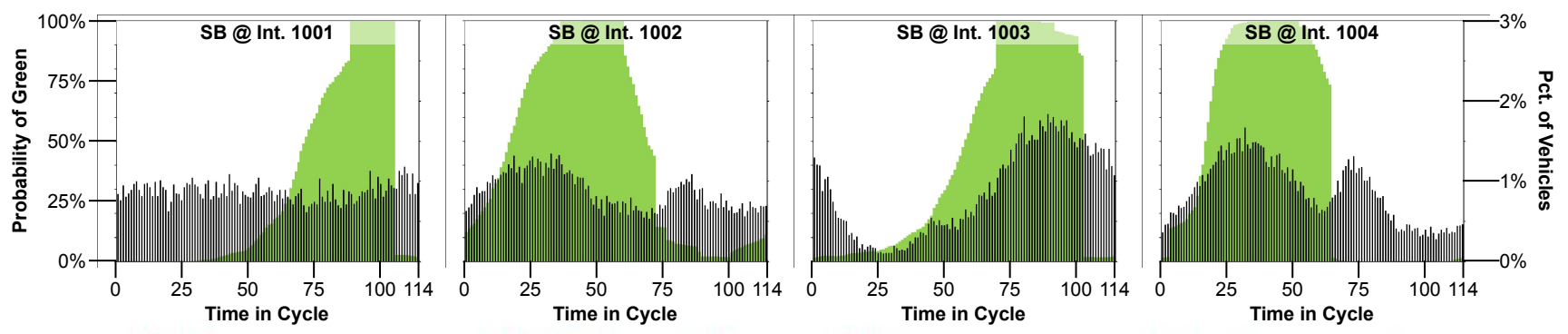
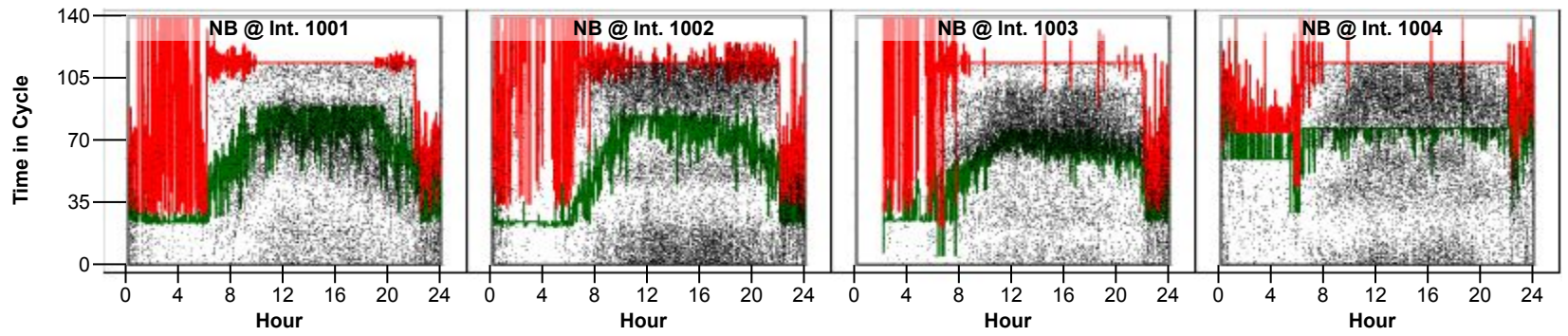
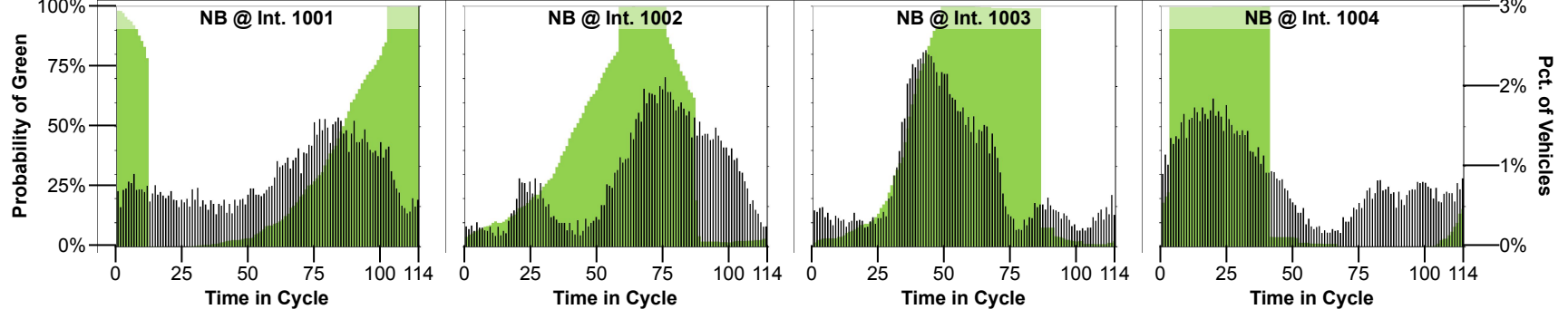
37/Greenfield

SB

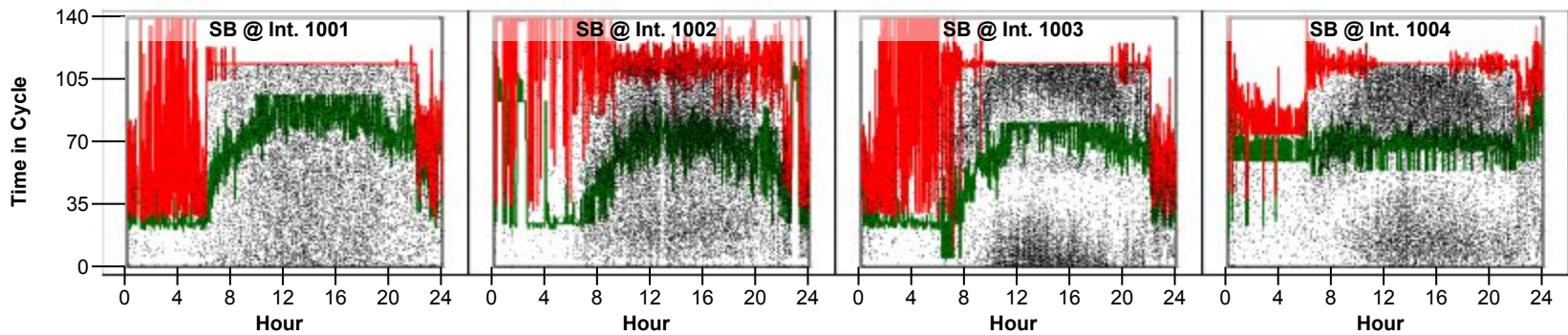
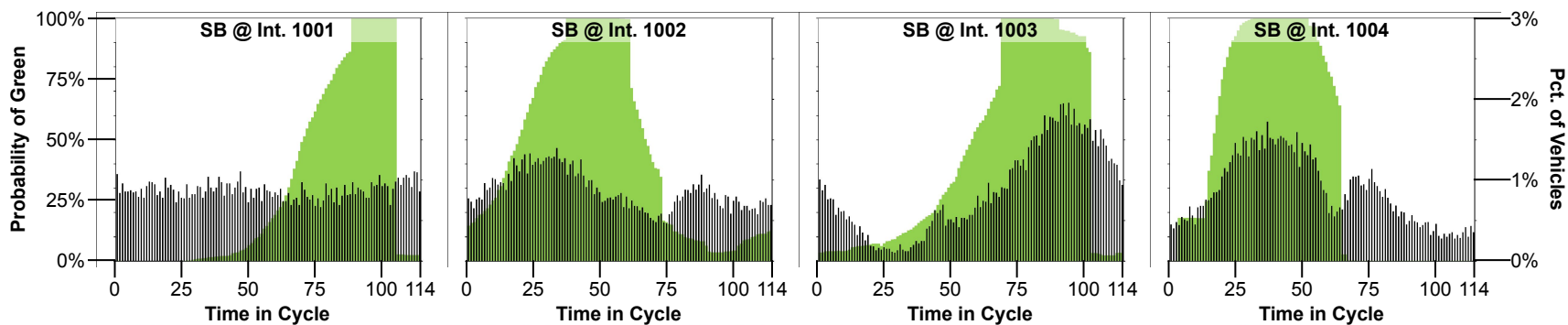
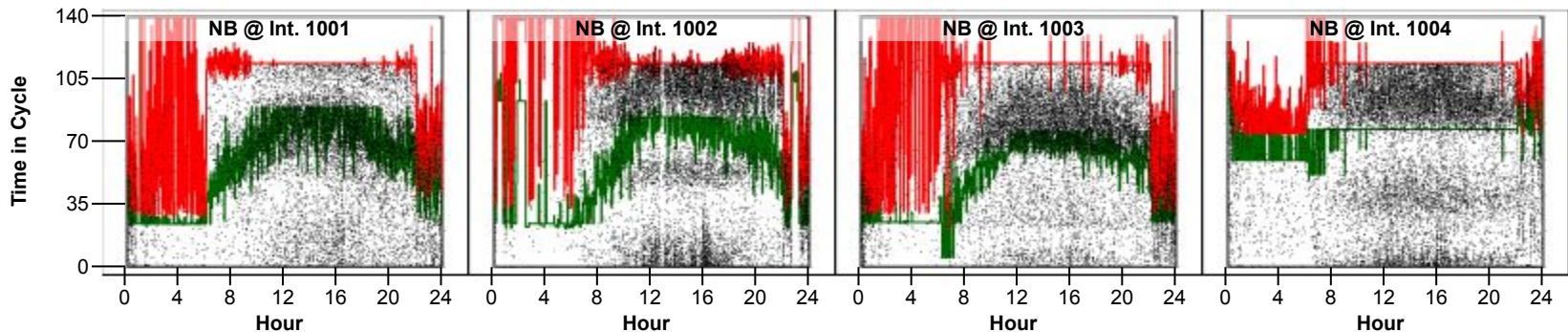
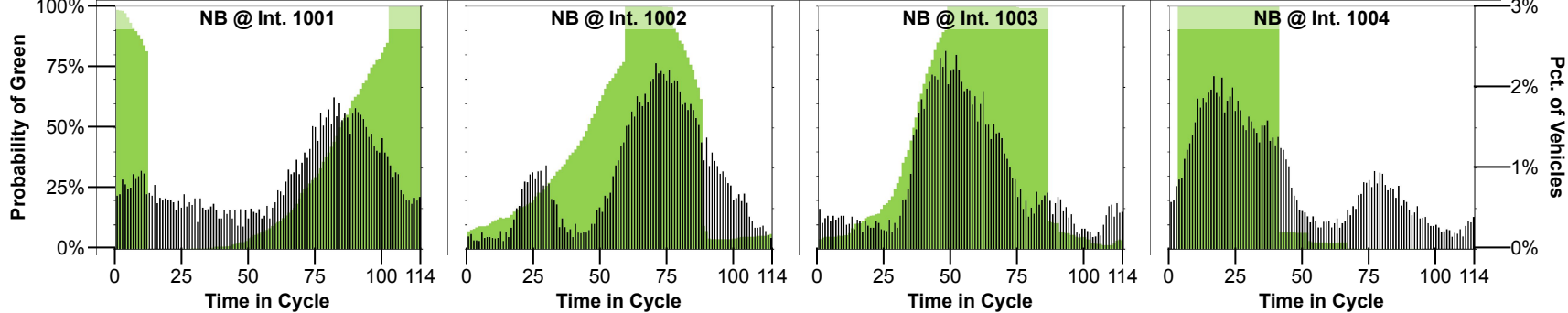




Predicted Optimized – June 6, 2009 Data

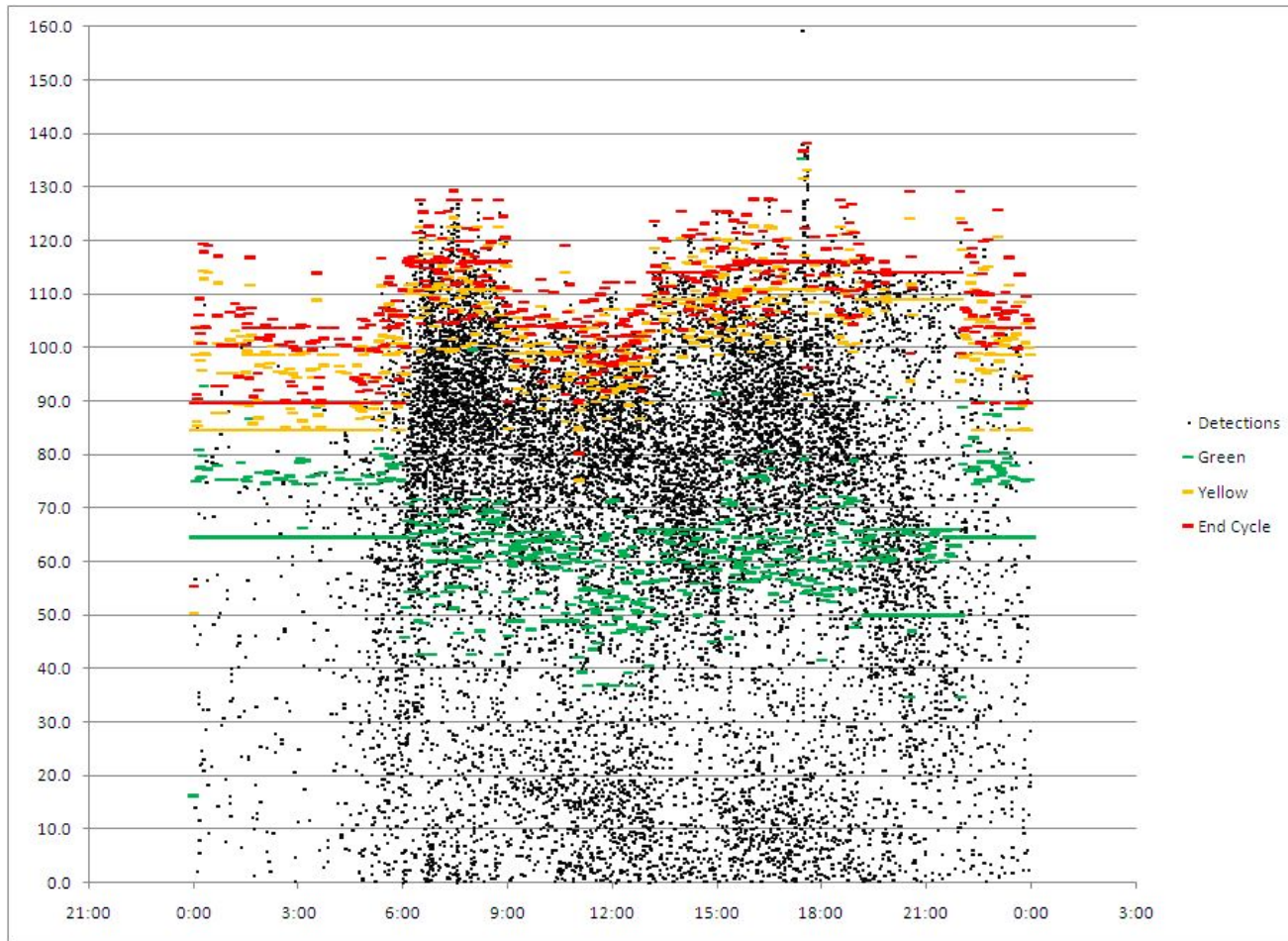


Observed (After Changes) – July 25, 2009

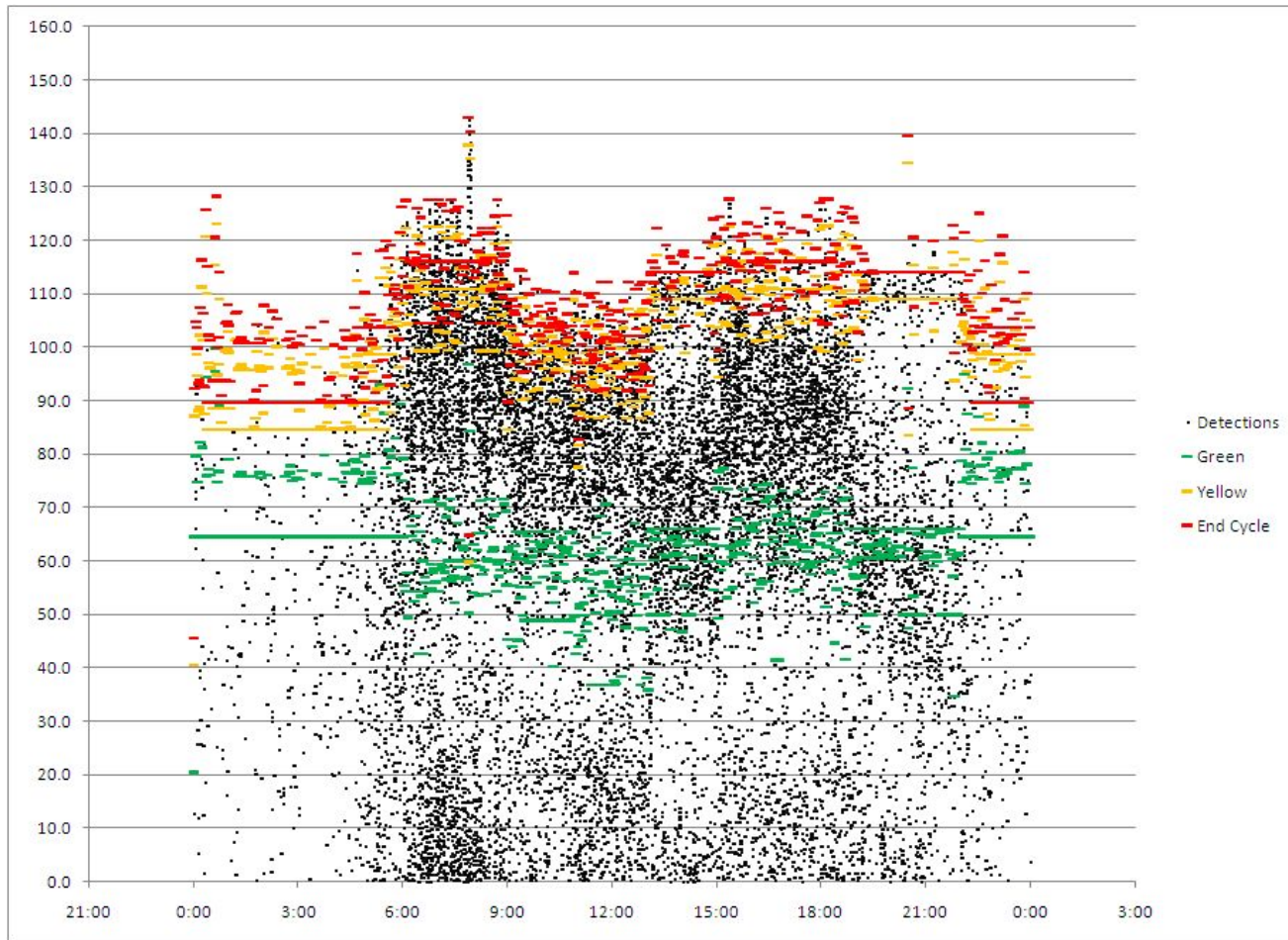


Audience Participation on Following Two Slides (Eye Doctor A/B)

SB on SR 37 on Jan 19 (Clear)

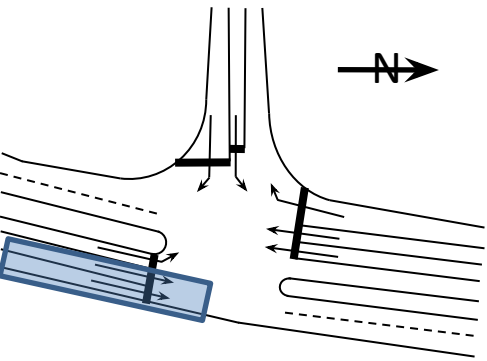


SB on SR 37 on Jan 26 (Snow)

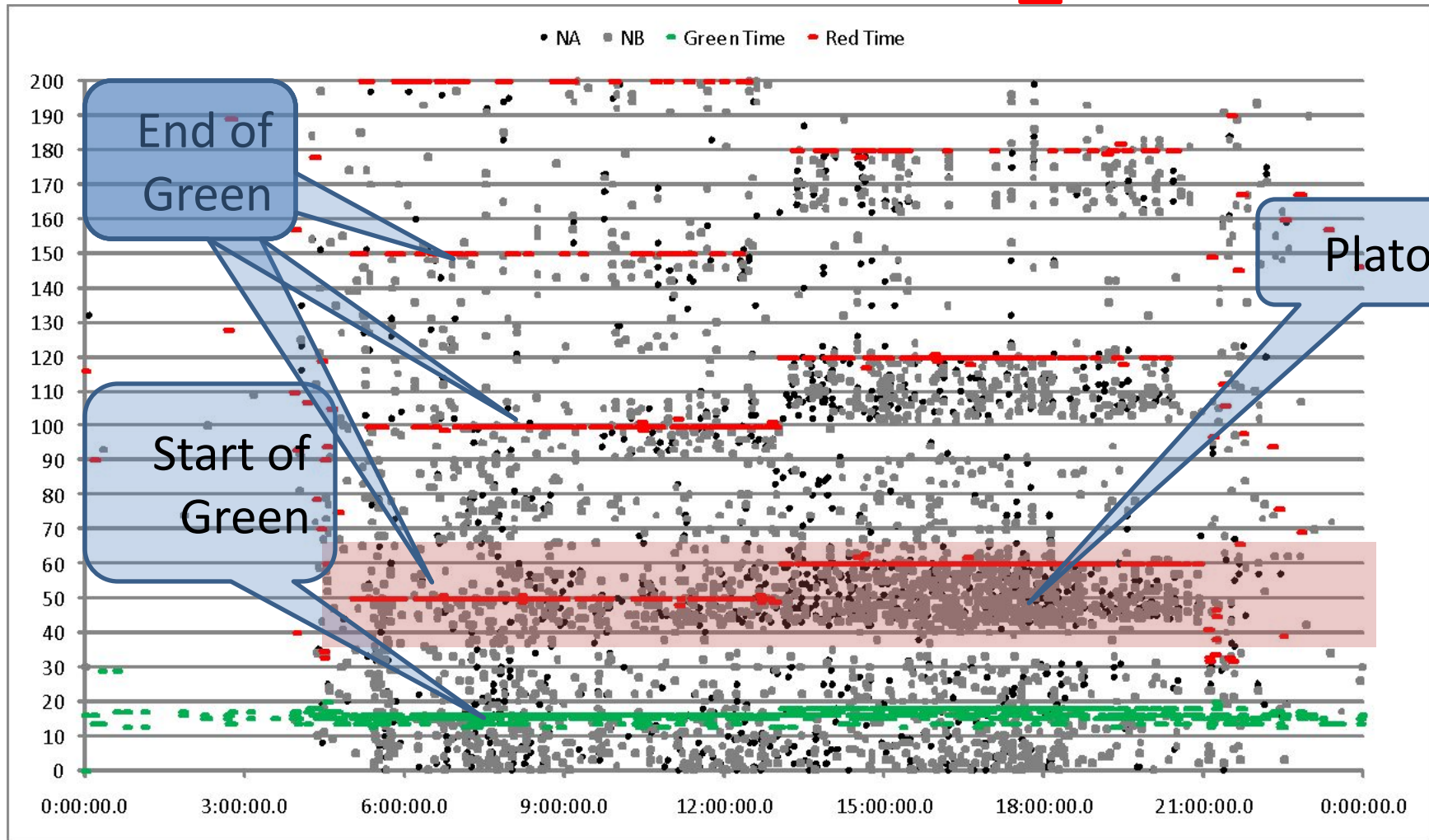
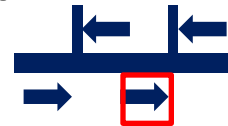
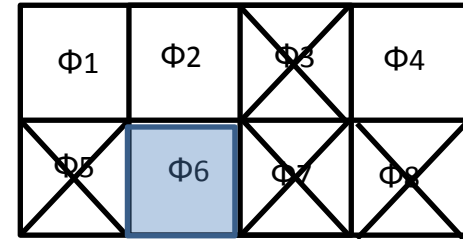


Purdue Coordination Diagrams as Changes Were Implemented

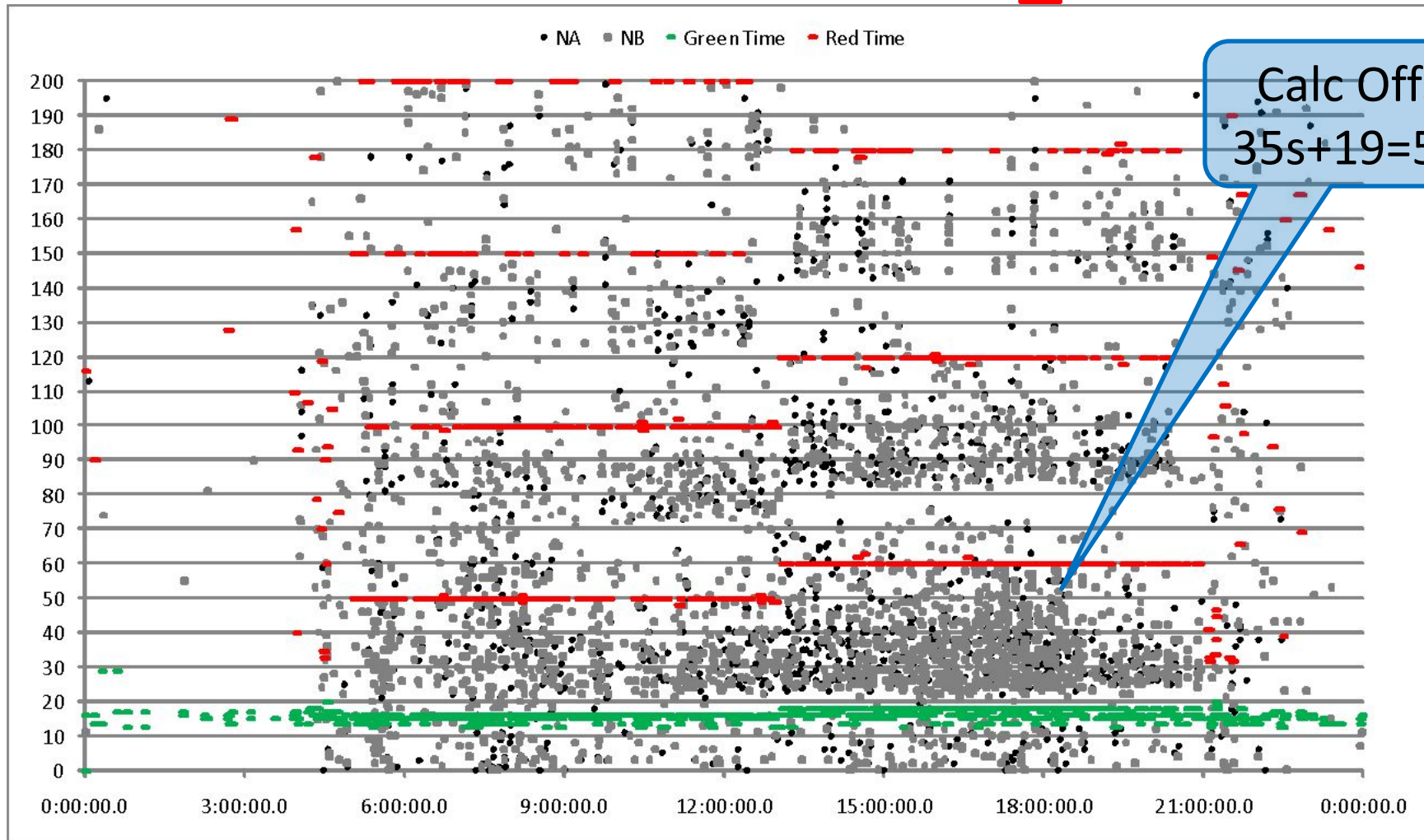
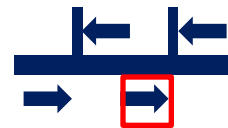
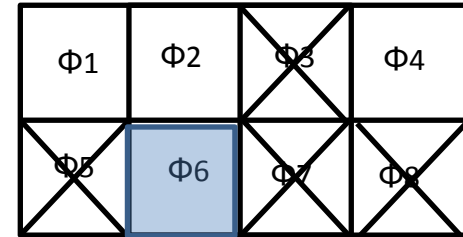
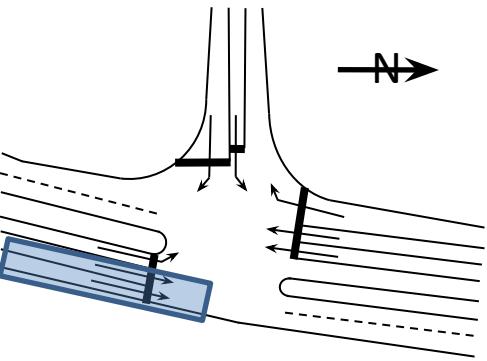
CR17 and Missouri
Elkhart County, IN
Ross Haseman

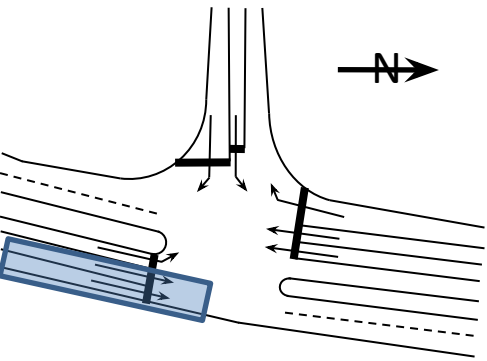


PPD Before Change, Phase 6, 02/17/09

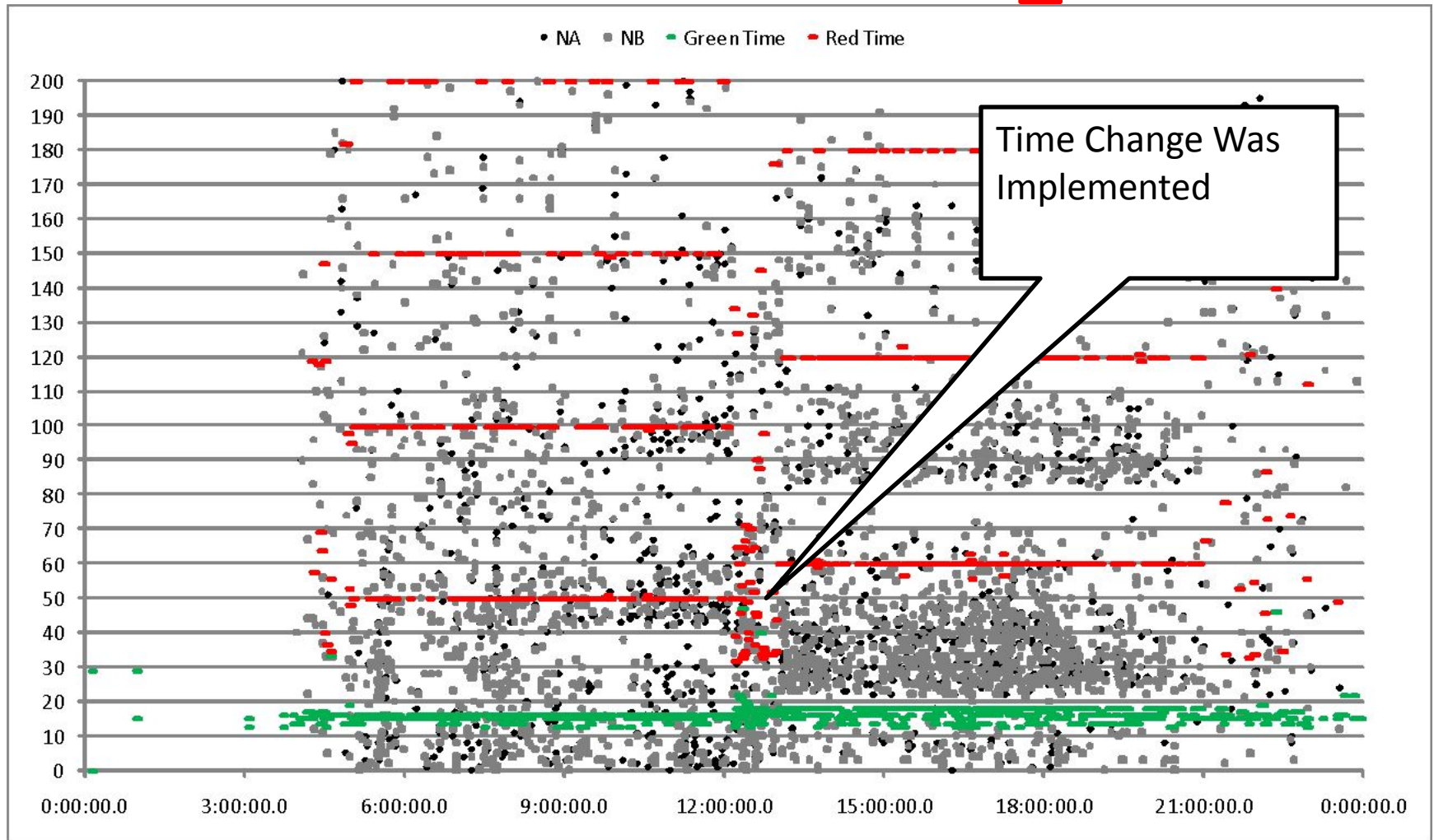
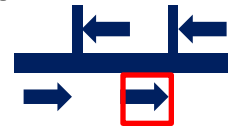
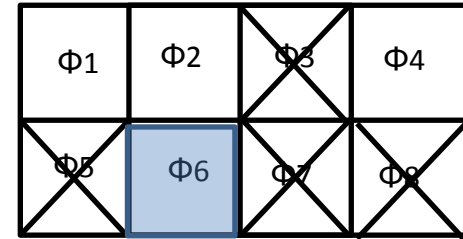


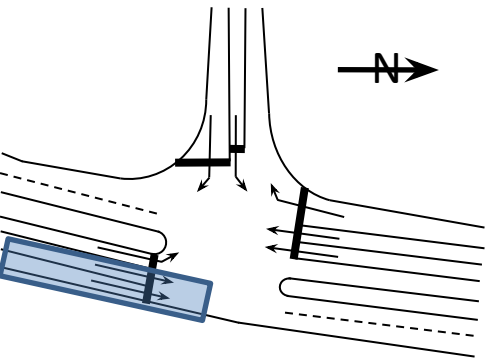
Predicted PPD After Change, Phase 6 02/17/09





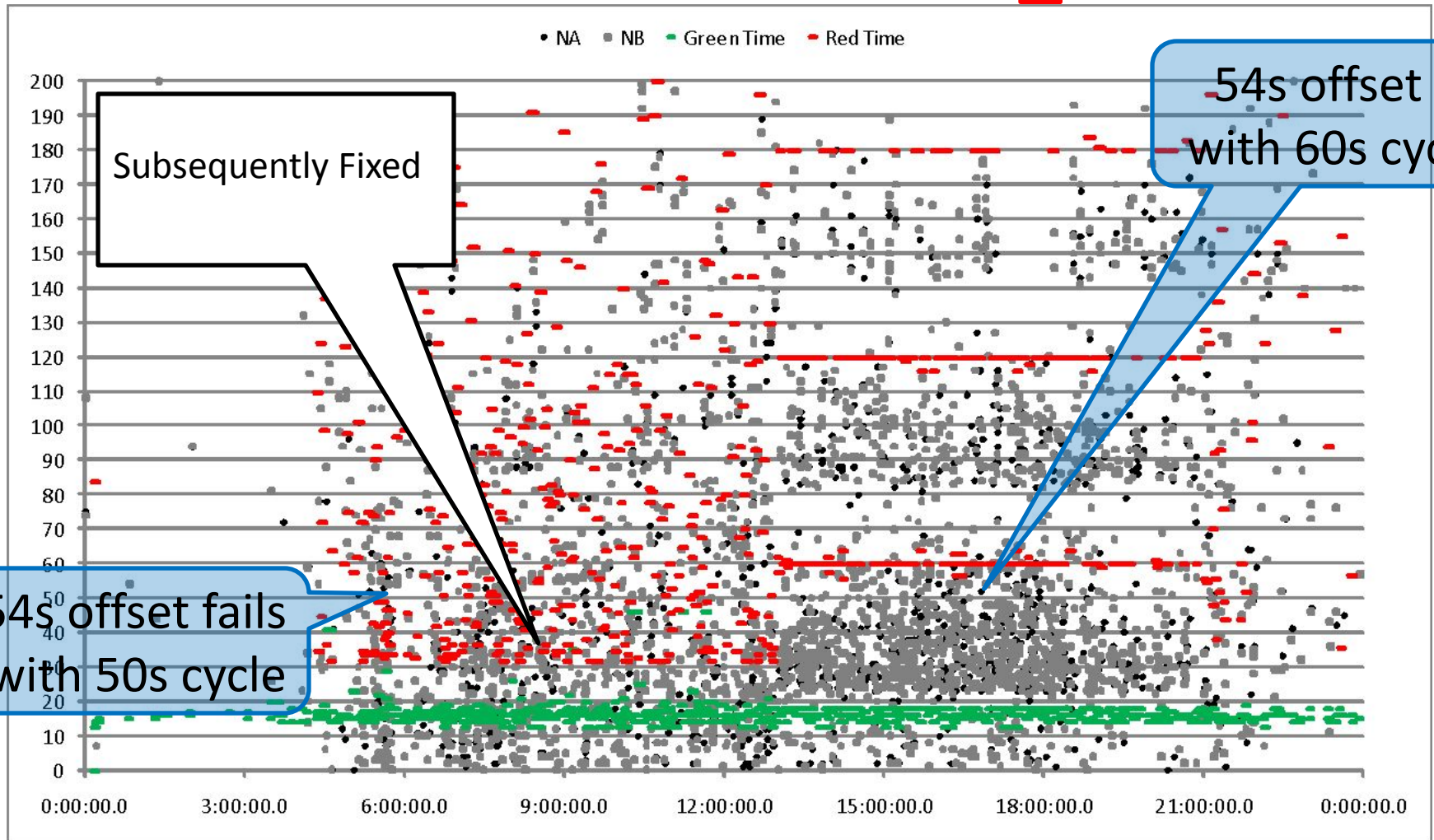
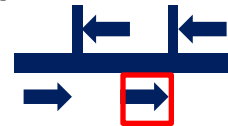
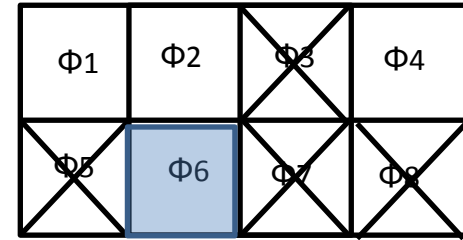
PPD After Change, Phase 6, 02/24/09

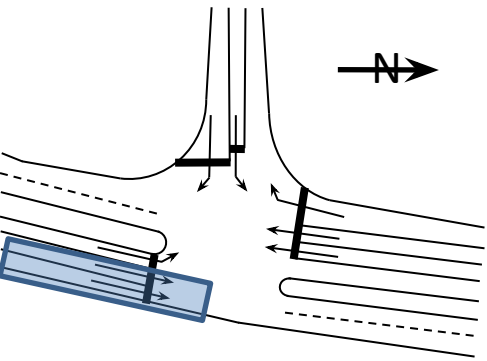




PPD

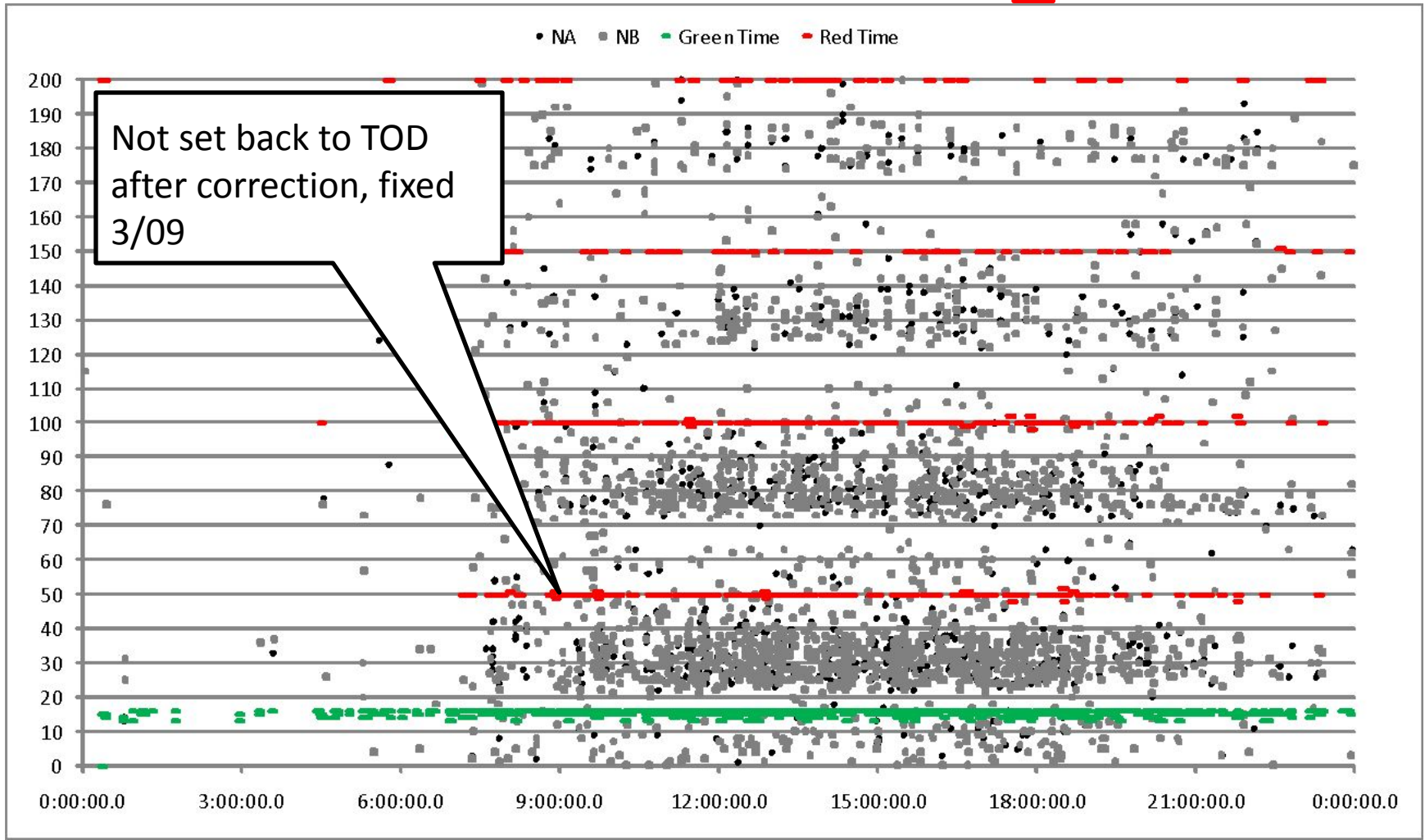
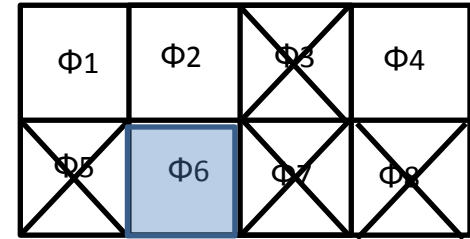
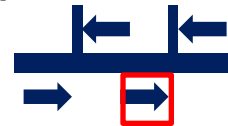
Phase 6, 02/25/09

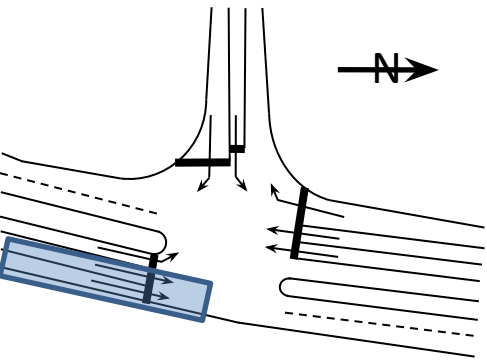




PPD

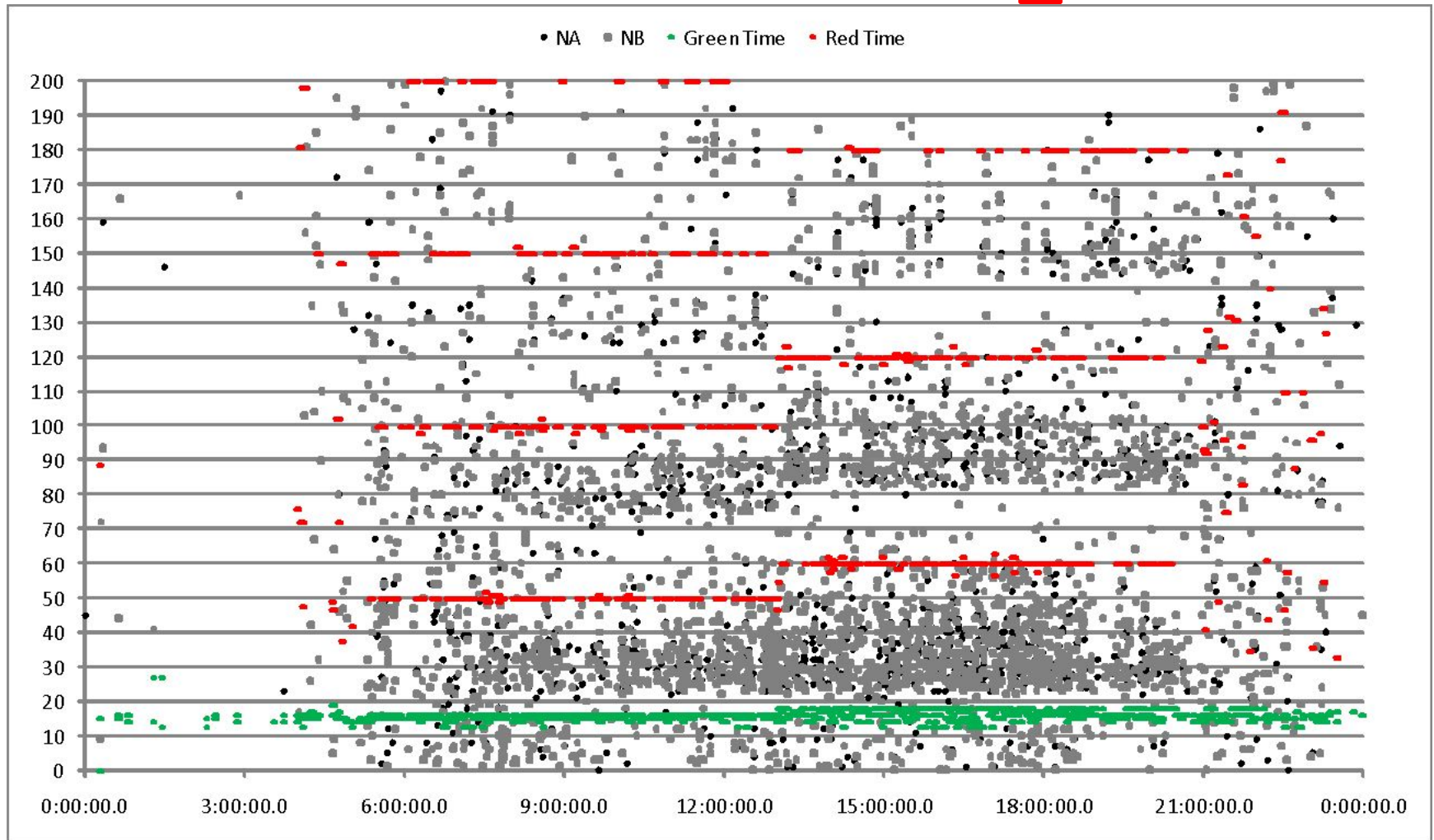
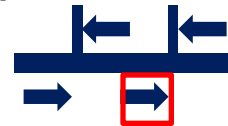
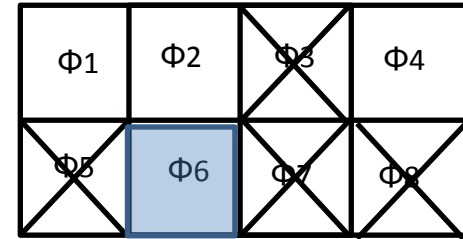
Phase 6, 03/07/09



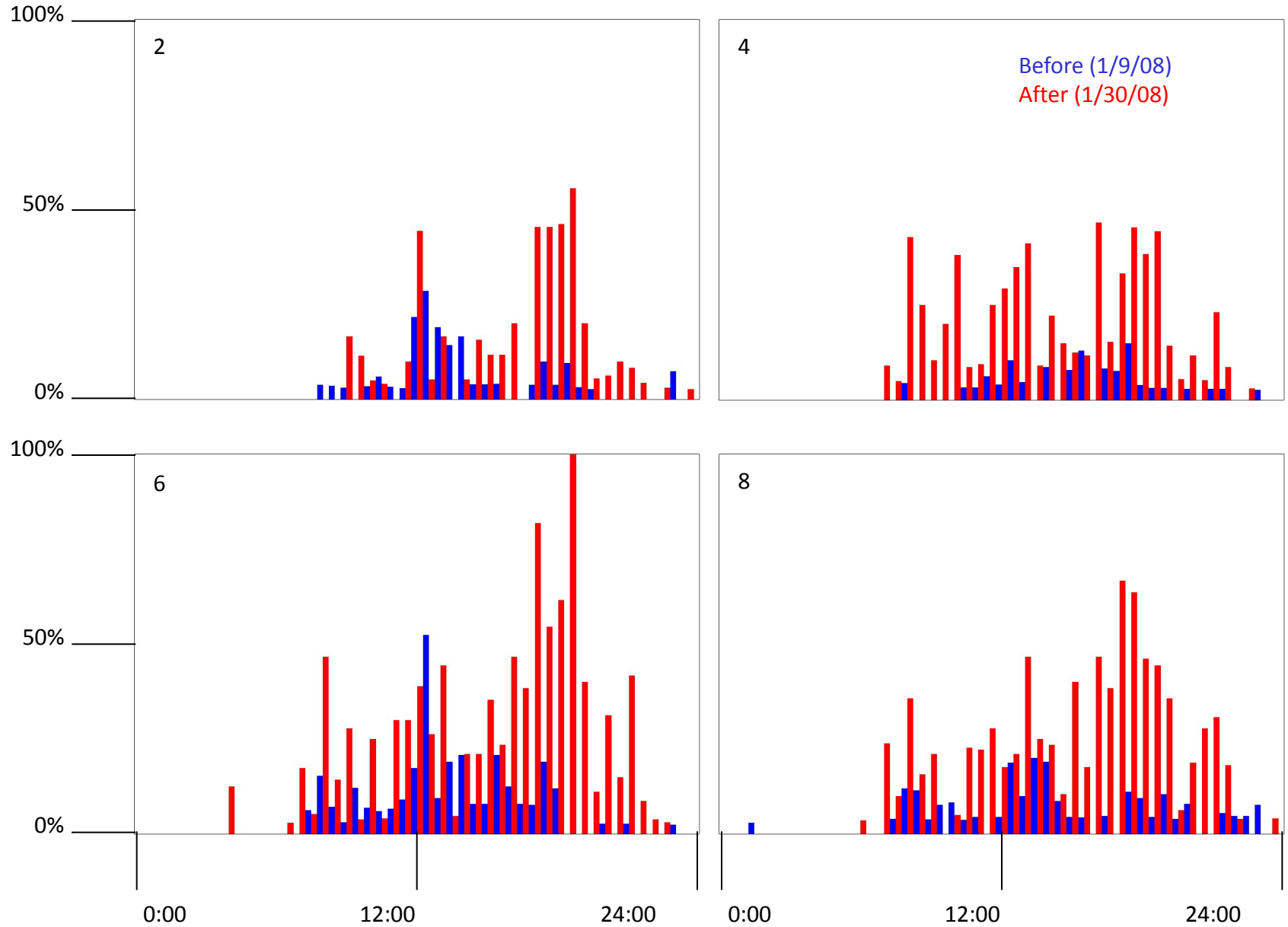


PPD

Phase 6, 03/20/09

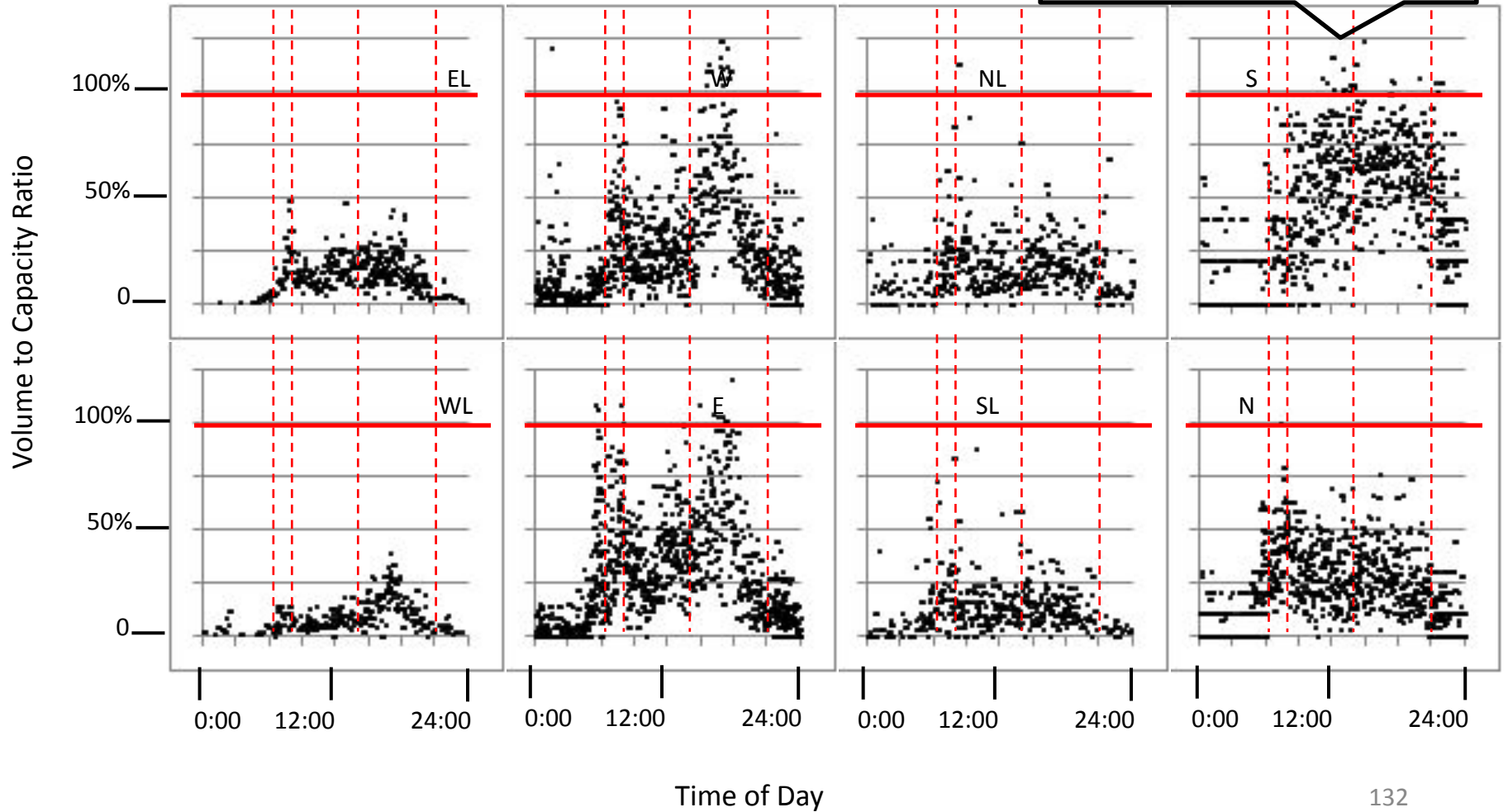


Percent of Cycles with Ped Phases, Wednesday



5. Are our green time allocations reasonable?

Southbound Could Use Some More Green Time



Methodology: Build From Measurable Quantities

$$d = d_1(PF) + d_2 + d_3$$

$$d_1 = \frac{0.5C \left(1 - \frac{g_i}{C}\right)^2}{(1 - \min(1, X_i)) \frac{g_i}{C}}$$

Uniform Delay

g = green time (s)

C = cycle length (s)

X = volume to capacity ratio

Measurable Quantities

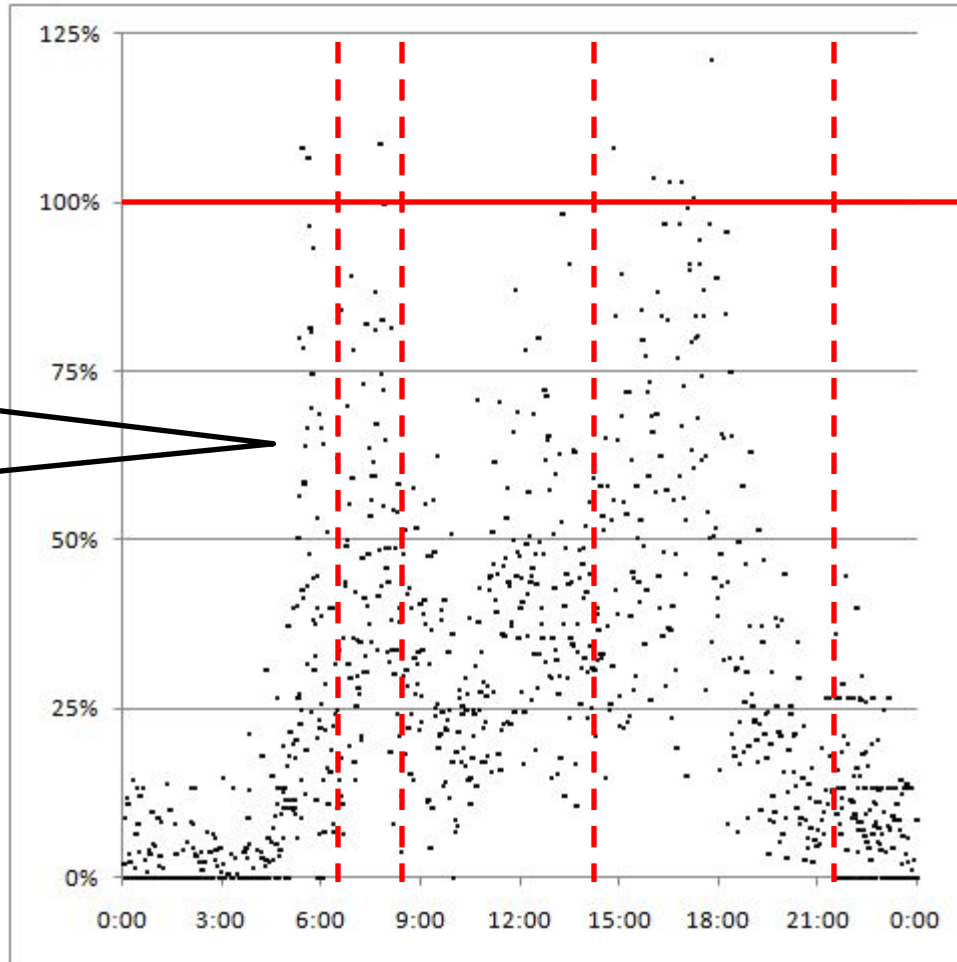
$$X_i = \frac{v C}{s g_i}$$

Volume to Capacity Ratio

v = flow rate (veh/h)

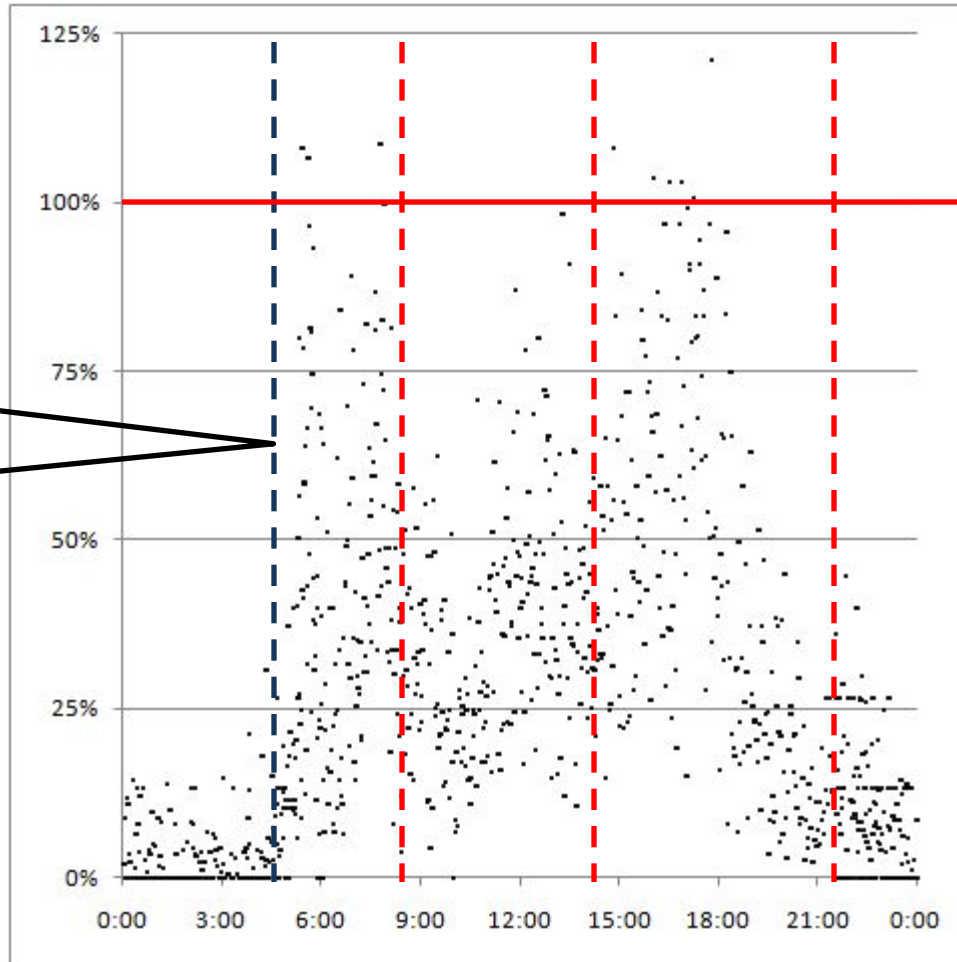
s = saturation flow rate (veh/h)

Eastbound V/C Ratios



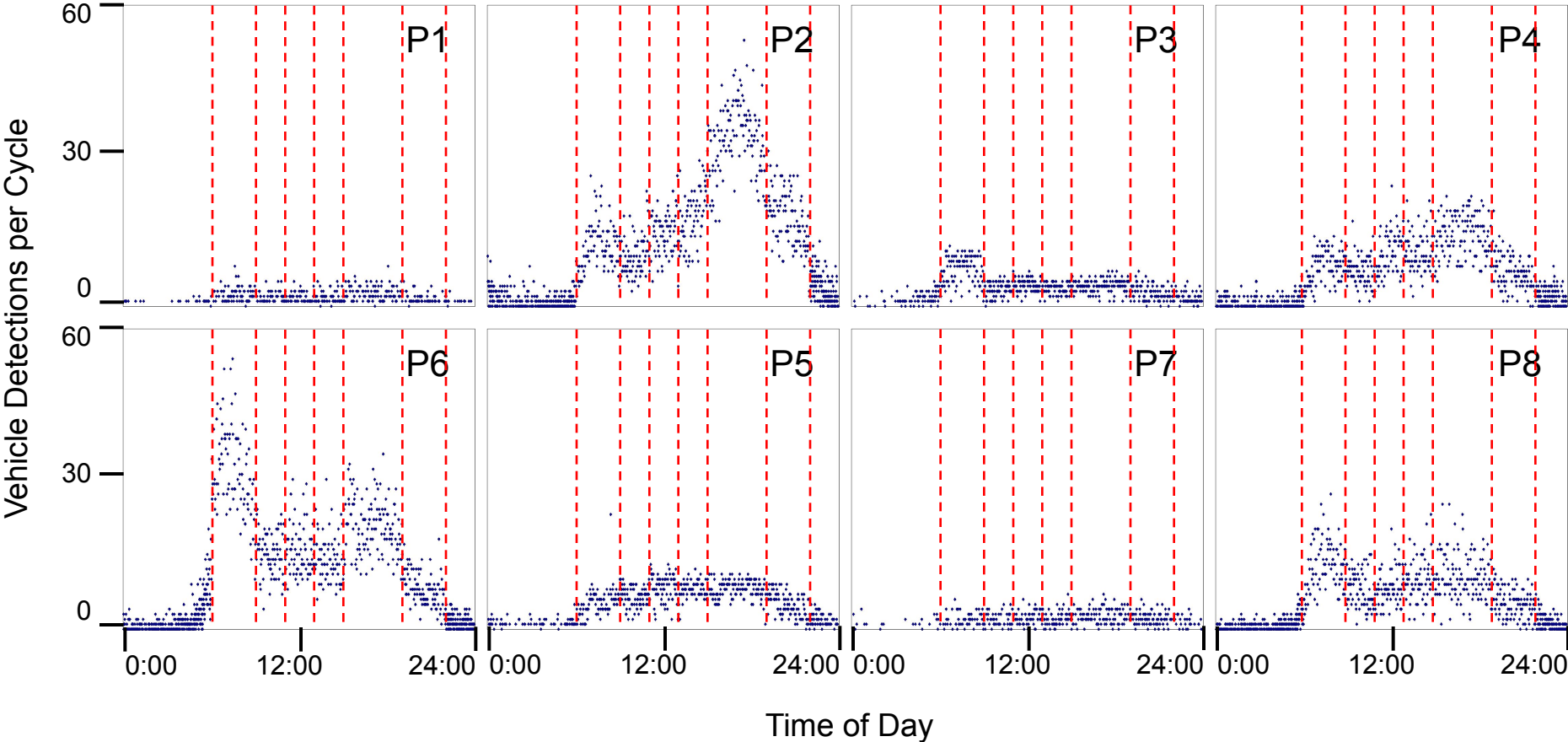
Morning TOD
Plan Should
Start Earlier

Eastbound V/C Ratios

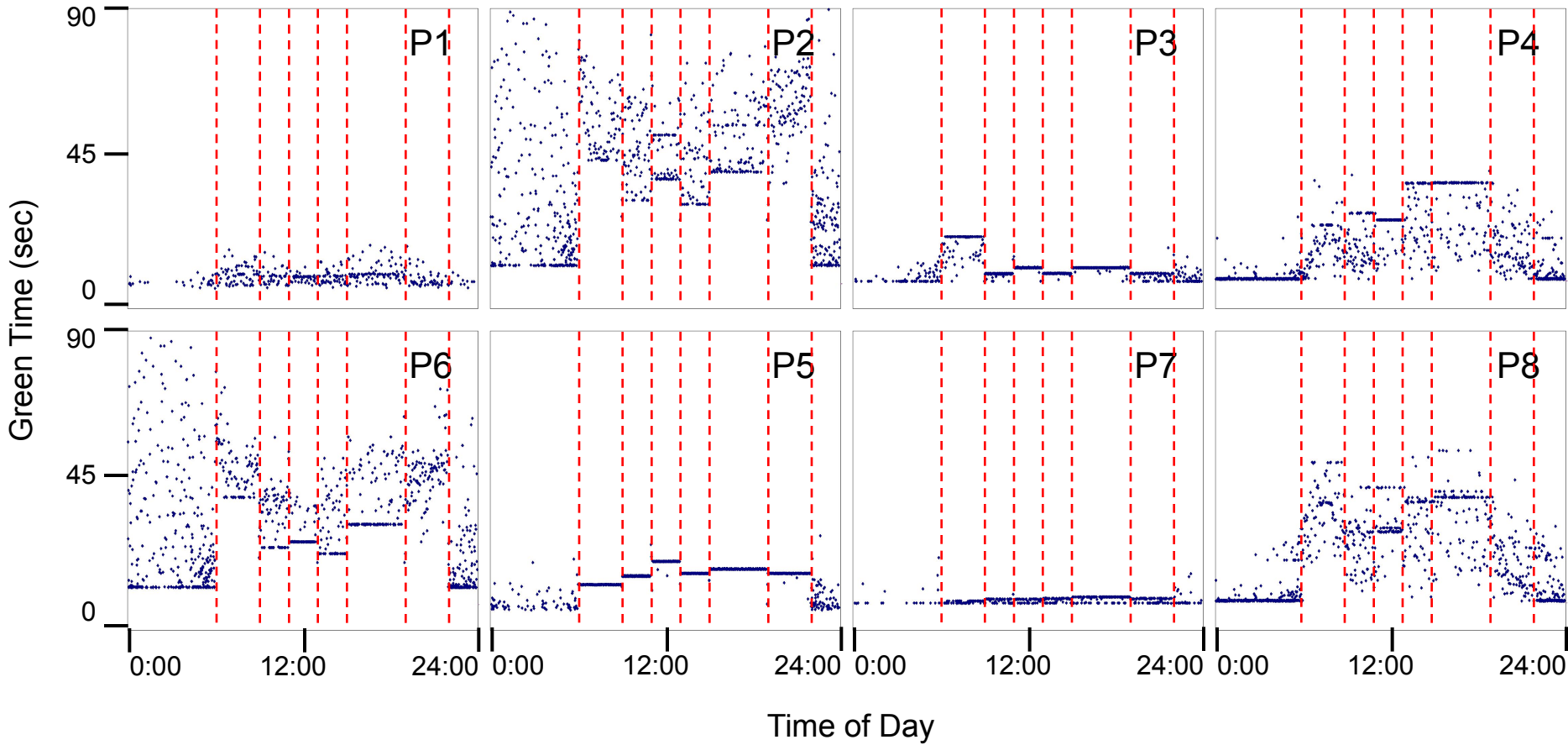


Morning TOD
Plan Should
Start Earlier

24 Hour Counts by phase...dependent upon Cycle

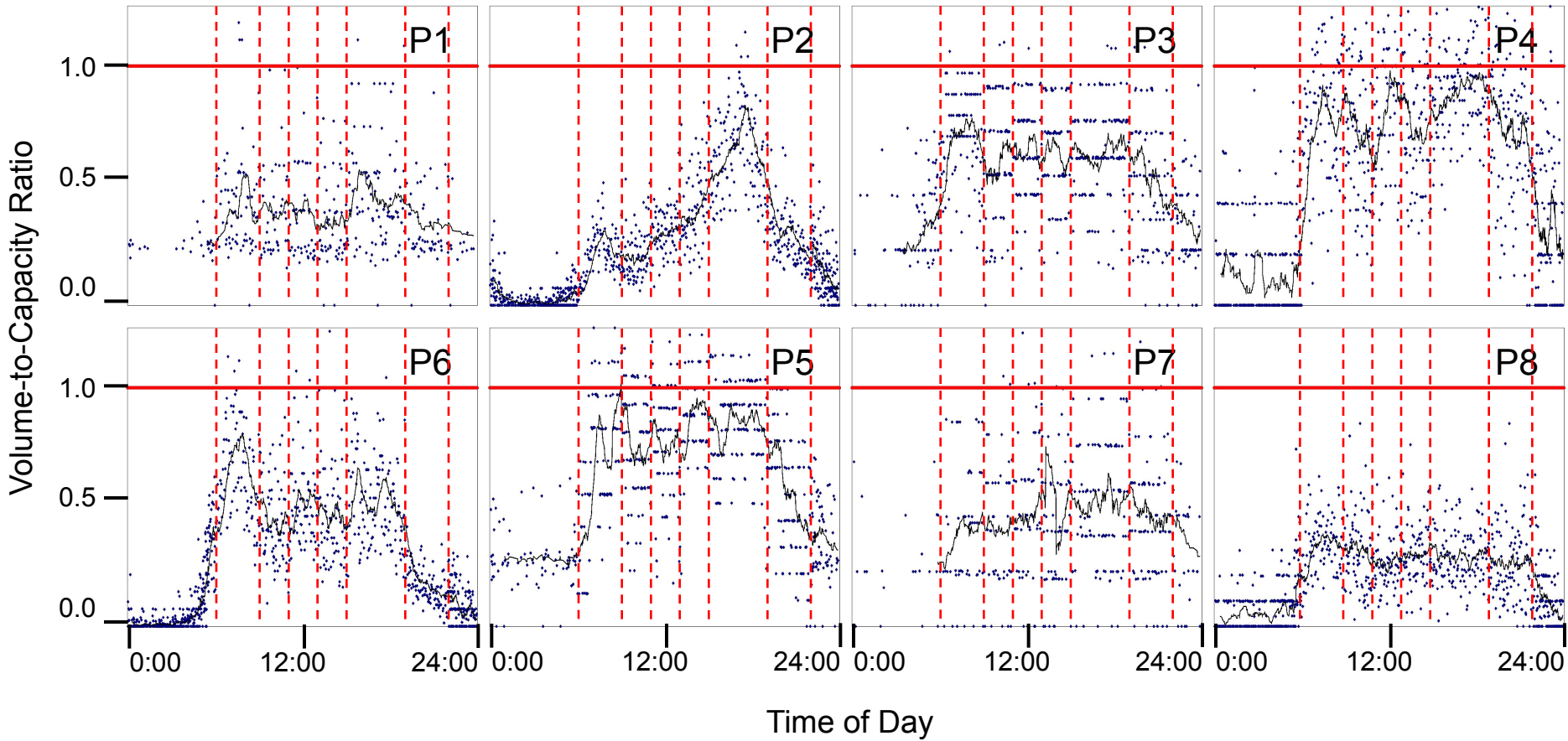


24 Hour Green Time by phase



$$C_{\text{actual}} = \frac{g_a}{C} \times s$$

V/C Ratios by Phase, 24 Hours



24-Hour Plot of Intersection Saturation

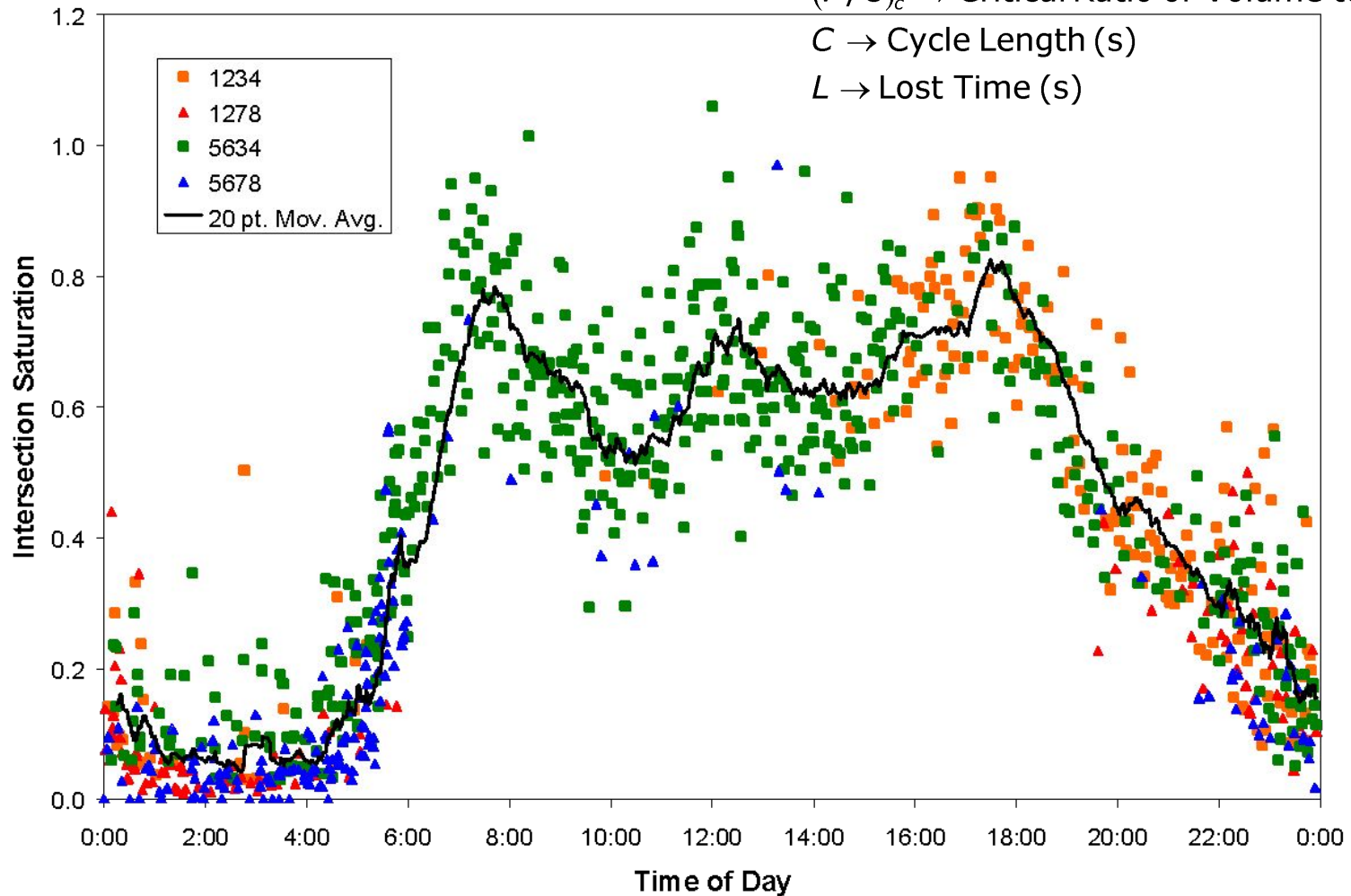
Showing Critical Path

$$X_c = \sum_i (v/s)_{ci} \left(\frac{C}{C-L} \right)$$

$(v/s)_c \rightarrow$ Critical Ratio of Volume to Saturation

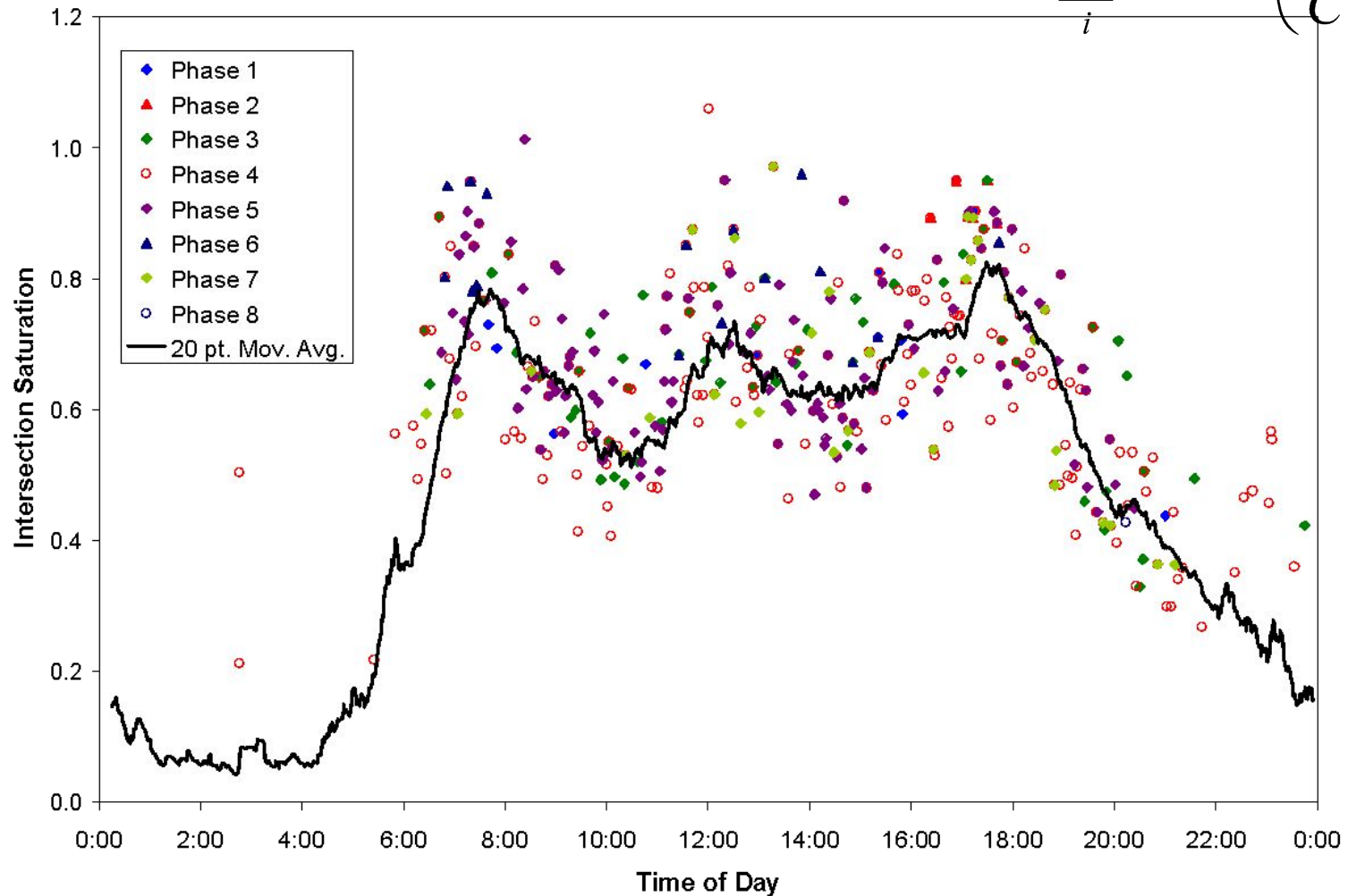
$C \rightarrow$ Cycle Length (s)

$L \rightarrow$ Lost Time (s)



24-Hour Plot of Intersection Saturation With Split Failures Indicated

$$X_c = \sum_i (v/s)_{ci} \left(\frac{C}{C-L} \right)$$



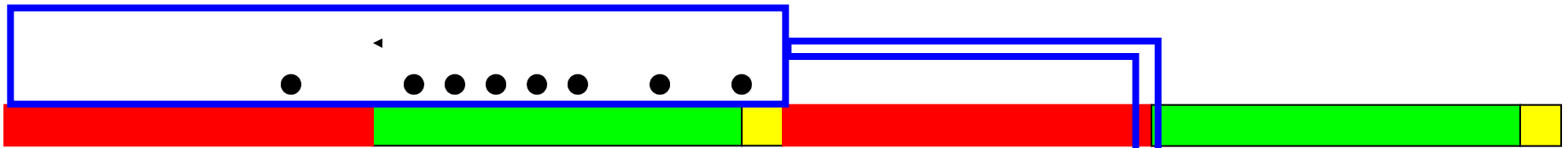
Thursday, September 24, 2009

Manufacturers, Vendors:

As you are aware, we have held several meetings involving vendors and other stakeholders over the past 3 years to obtain industry input on how we can update our procurement specification to be consistent with emerging national standards and most effectively leverage technology improvements. We are grateful for the strong participation from both the local suppliers as well as the national experts our local suppliers have brought to Indiana for those meetings. As a result of that input, INDOT is pleased to announce that it will begin migration to the next generation NTCIP traffic signal controllers. We also anticipate an important component of next generation controller will be the incorporation of event based performance measures that are consistent with the emerging recommendations from the National Cooperative Research Program (NCHRP) 3-79a.

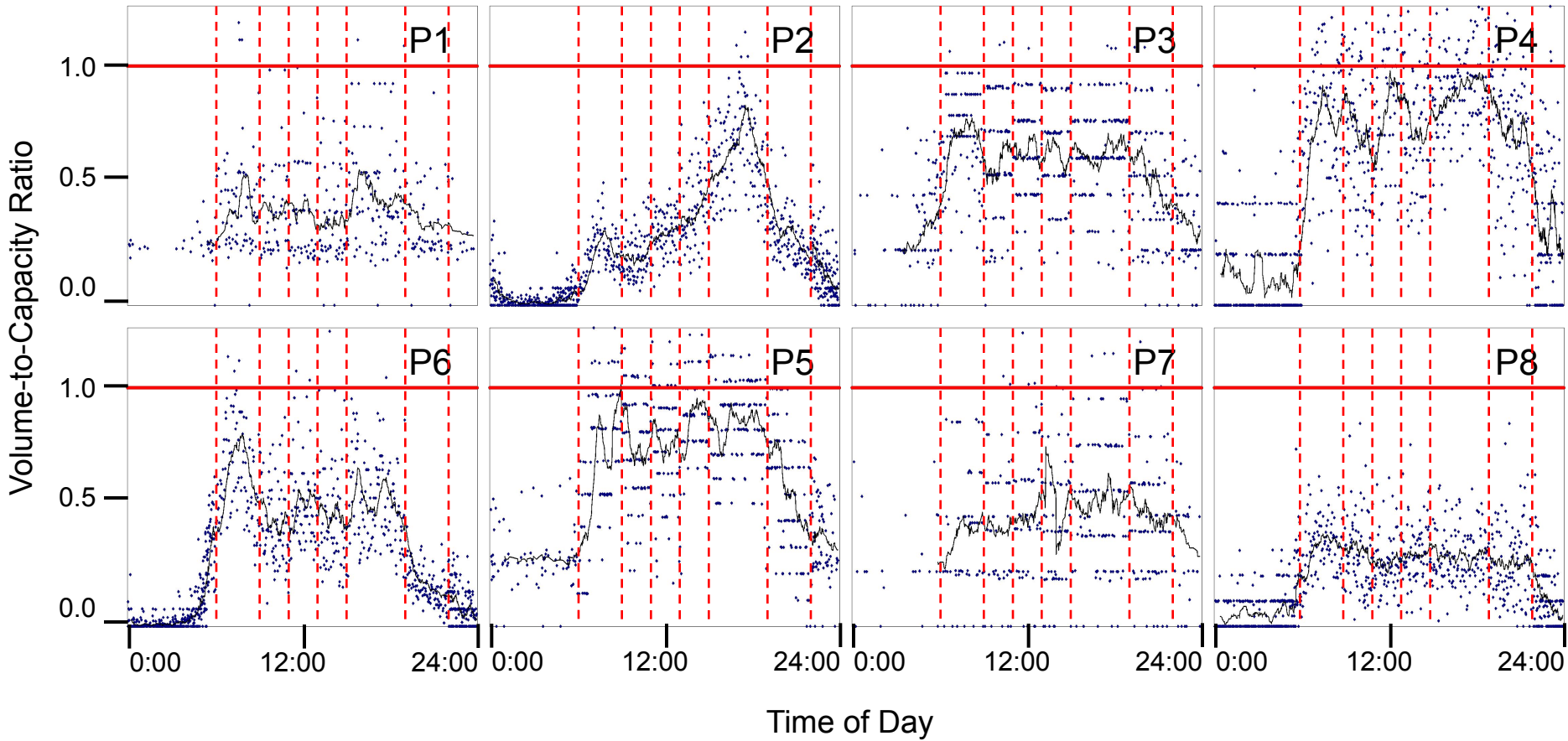
Over the next few months INDOT will be inviting you to participate in activities that will assist us in drafting new procurement specifications that will be used for procuring future traffic control equipment supporting both NTCIP objects and event based performance measures. These specifications will also be the basis of internal Indiana Test Methods and procedures used in placing controllers on INDOT's list of approved materials. It is our intent to have this specification in place for project lettings by mid 2010. At that time only controllers compliant with this new specification will be eligible to be provided on INDOT contracts.

Cycle Based Calculations



$$\left(\frac{v}{c}\right)_l = \frac{q_g}{\left[s_l * \left(\frac{g_l}{C}\right) \right]} = \frac{(v_l * C)}{(s_l * g_l)}$$

V/C Ratios by Phase, 24 Hours



Number of Split Failures

- Split failures are defined as cycles where the phase was not able to adequately serve its demand volume
- Can be roughly defined as when the V/C ratio is above 1.0

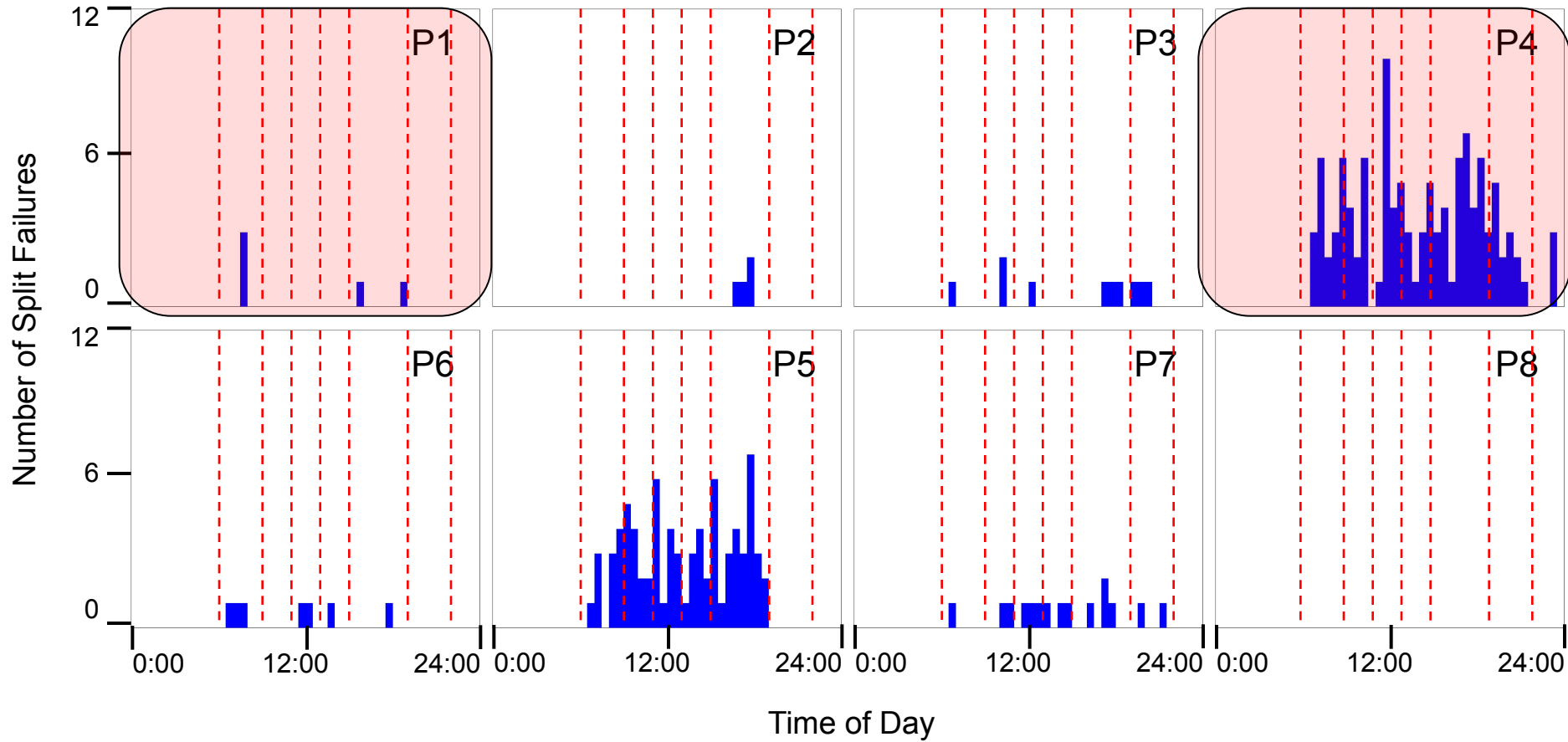


$V/C = 0.55$

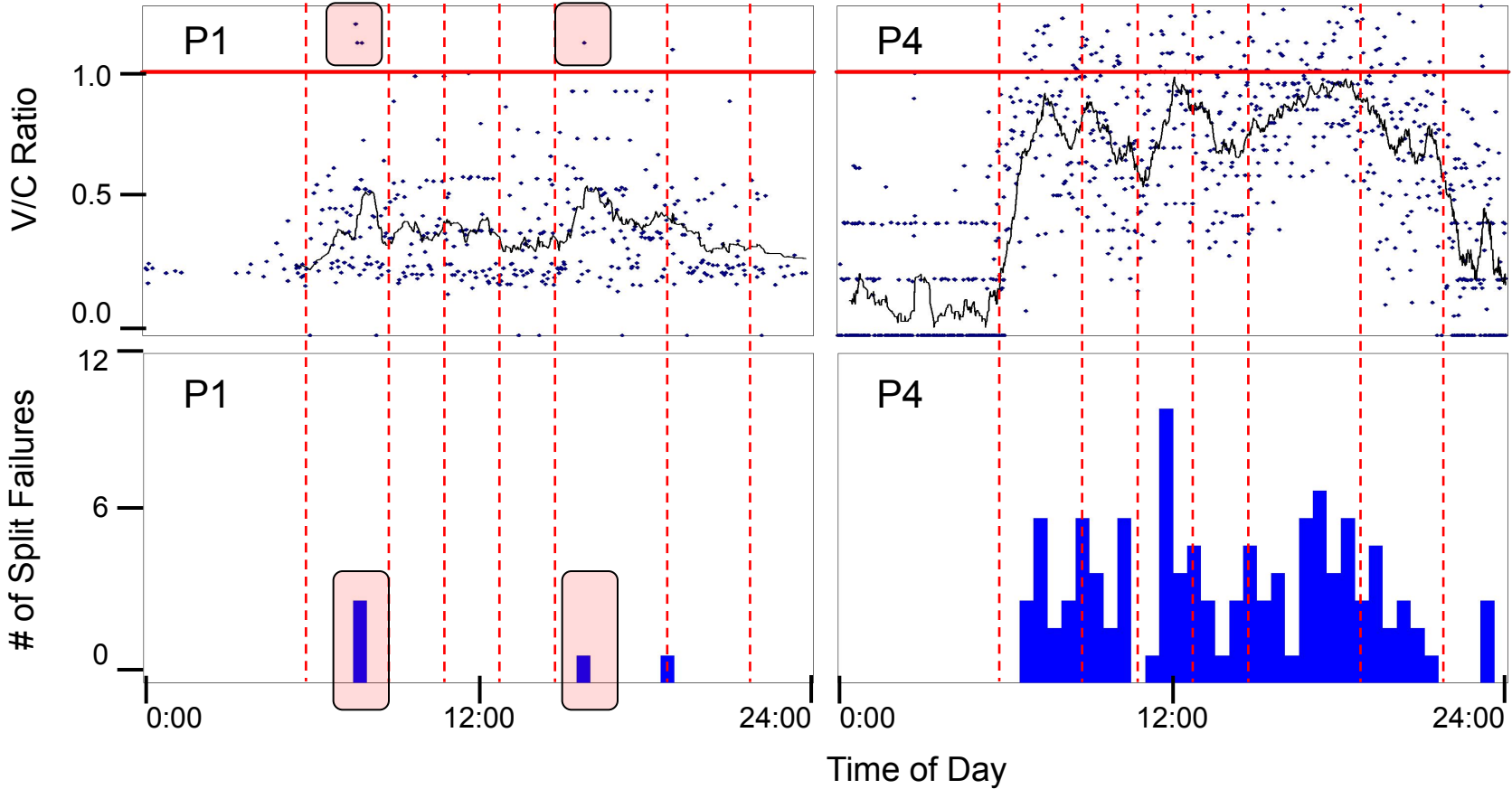


$V/C = 1.25$

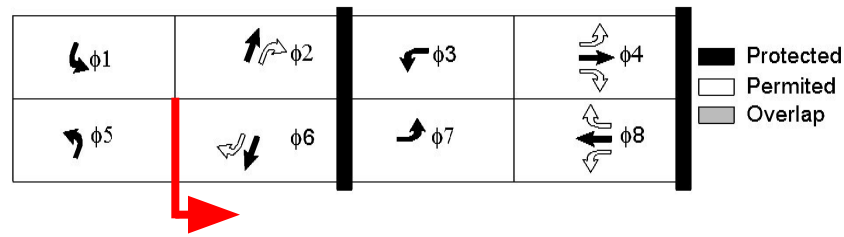
Number of Split Failures, 30-minute Bins



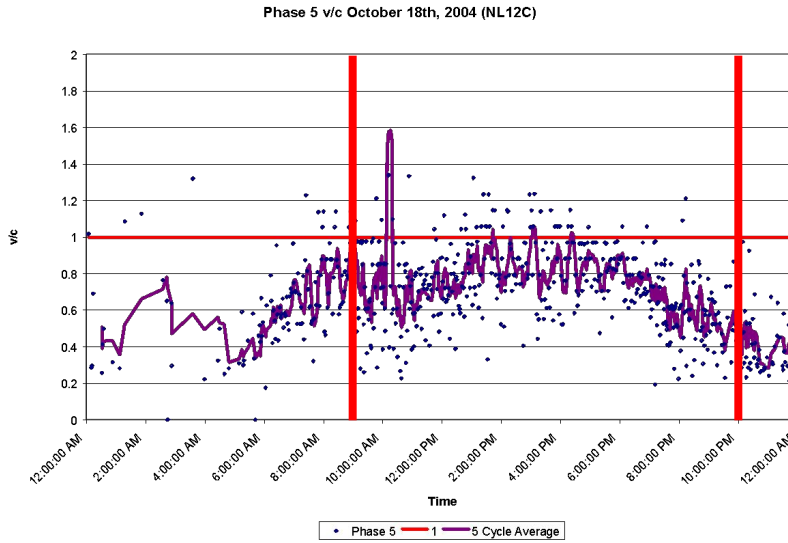
Number of Split Failures by Hour – Phases 1, 4



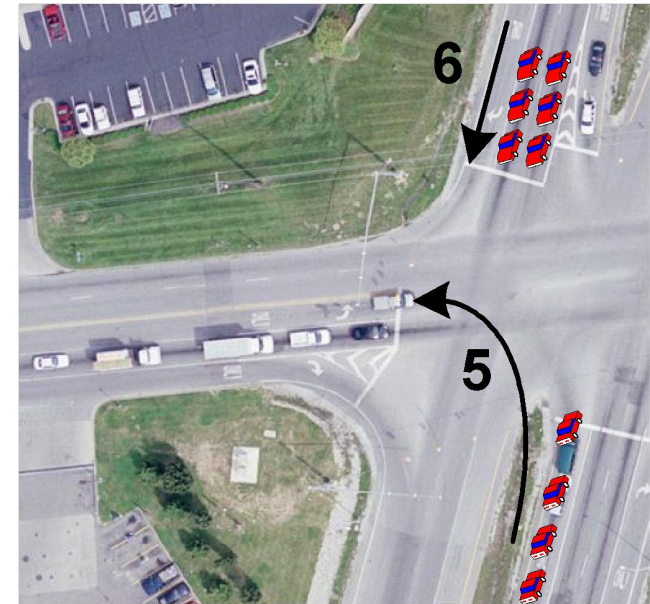
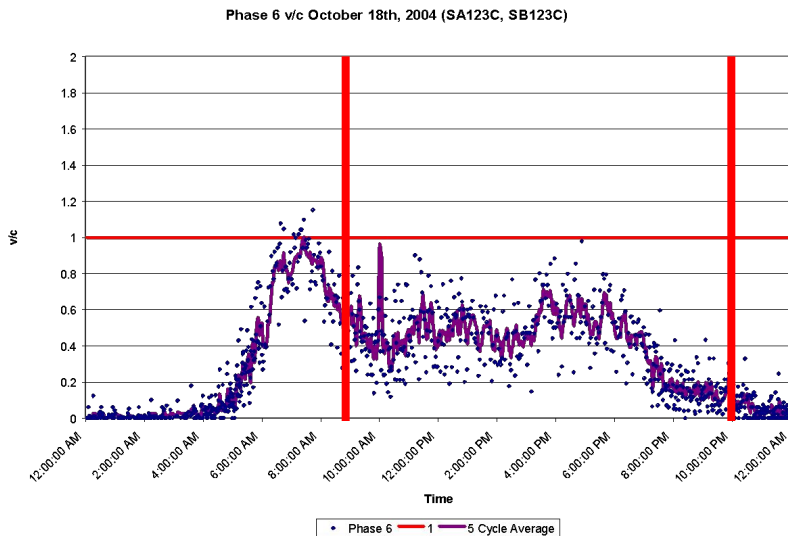
October 18th, 2004



Phase
5



Phase
6

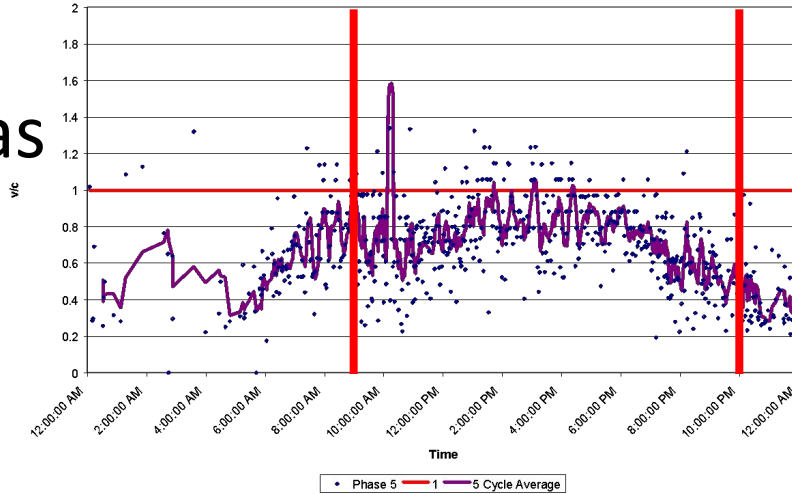


Split reallocation

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |

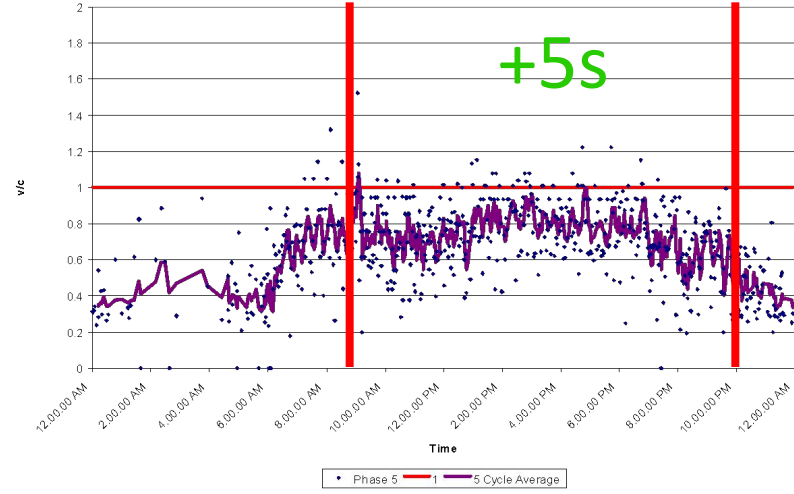
October 18th

Phase 5 v/c October 18th, 2004 (NL12C)



October 26th

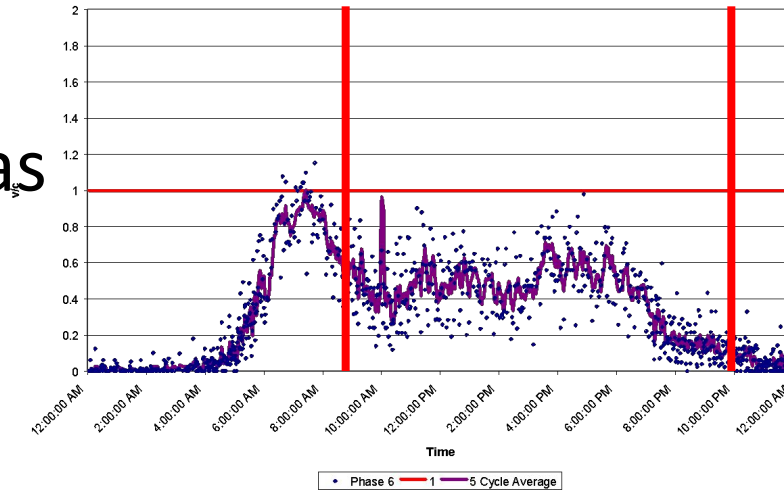
Phase 5 v/c October 26th, 2004 (NL12C)



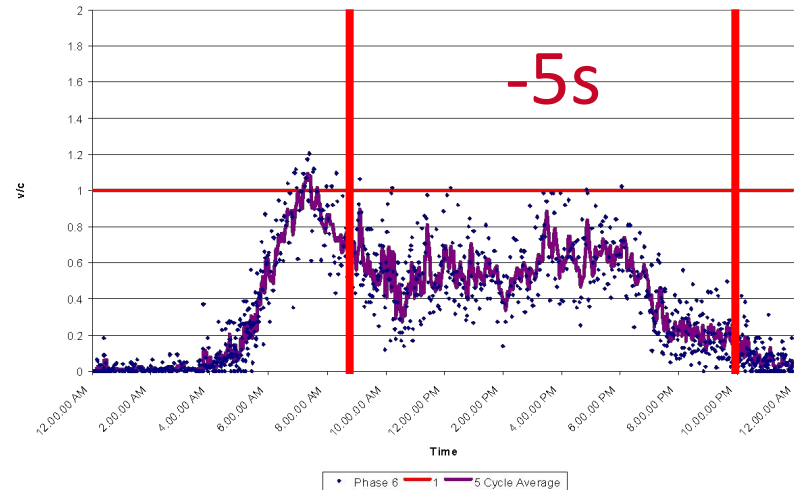
Phase 5

Phase 6

Phase 6 v/c October 18th, 2004 (SA123C, SB123C)



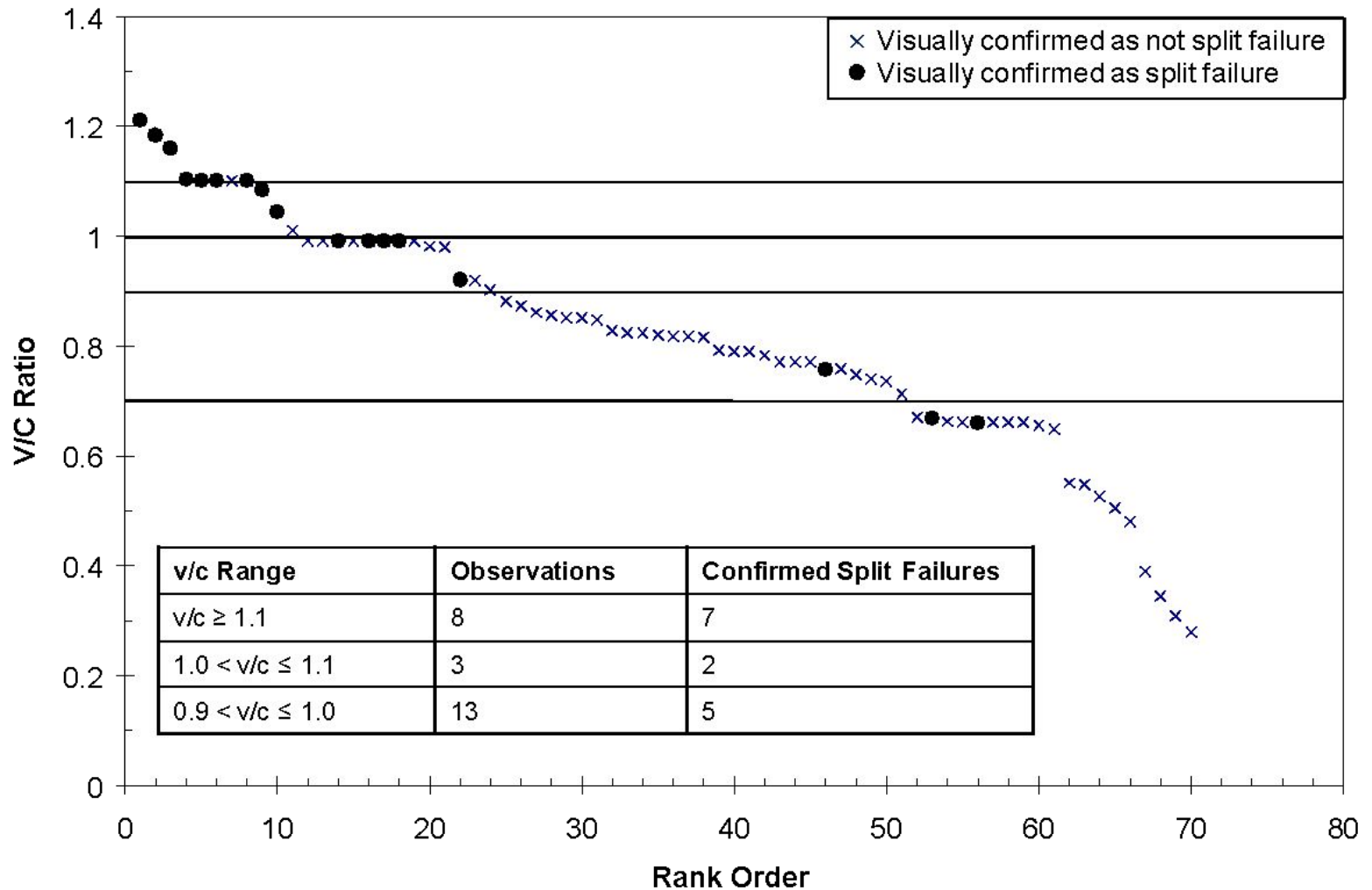
Phase 6 v/c October 26th, 2004 (SA123C, SB123C)



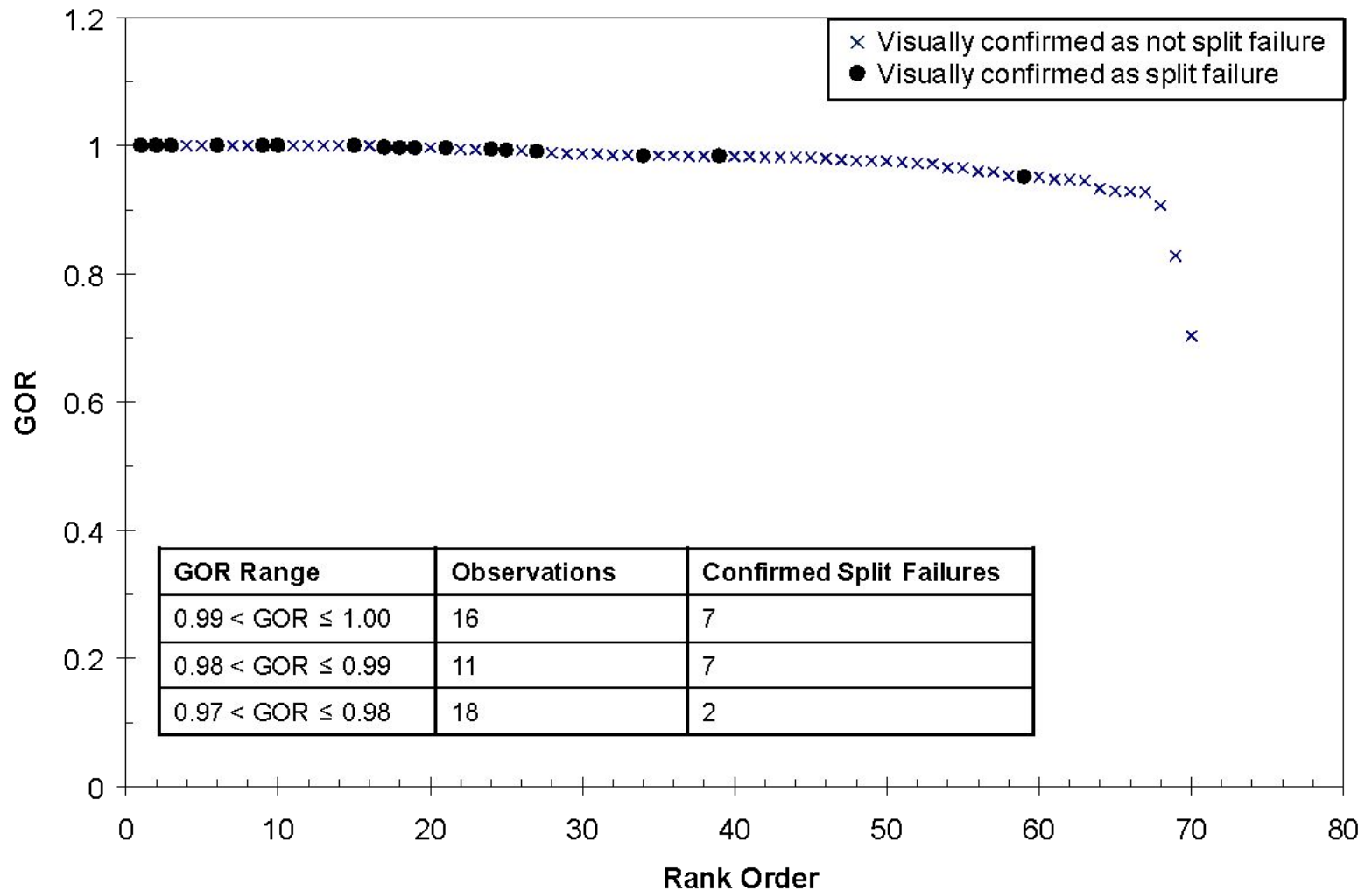
Impact of 5s reallocation on Split Failures

| Timing Plan | Duration of Operation | Split Failures (Before) | Number of Phases (Before) | Split Failures (After) | Number of Phases (After) |
|--------------------|------------------------------|--------------------------------|----------------------------------|-------------------------------|---------------------------------|
| AM Peak | 3 hr | 5 | 84 | 5 | 87 |
| Mid Day | 2 hr | 1 | 74 | 0 | 74 |
| PM Peak | 4.5 hr | 16 | 131 | 9 | 131 |
| Off Peak | 5.5 hr | 17 | 223 | 5 | 226 |

Split Failures (v/c)



Split Failures (GOR)



Intersection Saturation, X_c

- The degree to which the capacity of the entire intersection is being utilized.

$$X_c = \sum_i (v / s)_{ci} \left(\frac{C}{C - L} \right)$$

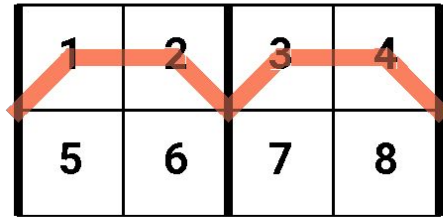
$(v / s)_c \rightarrow$ Critical Ratio of Volume to Saturation

$C \rightarrow$ Cycle Length (s)

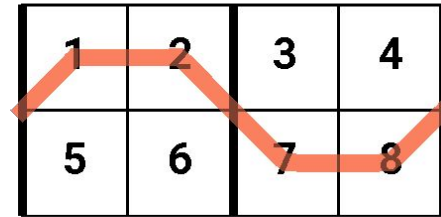
$L \rightarrow$ Lost Time (s)

X_c for Dual-Ring, Eight Phase Case

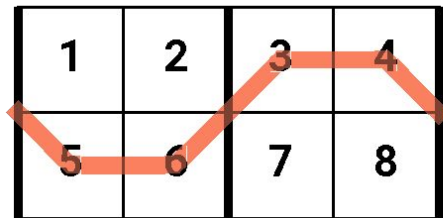
$$X_c = \left[\text{Max} \left(\frac{V_1 + V_2}{s}, \frac{V_5 + V_6}{s} \right) + \text{Max} \left(\frac{V_3 + V_4}{s}, \frac{V_7 + V_8}{s} \right) \right] \left(\frac{C}{C-L} \right)$$



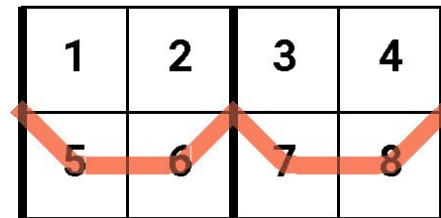
(a) Critical Path 1234



(b) Critical Path 1278



(c) Critical Path 5634

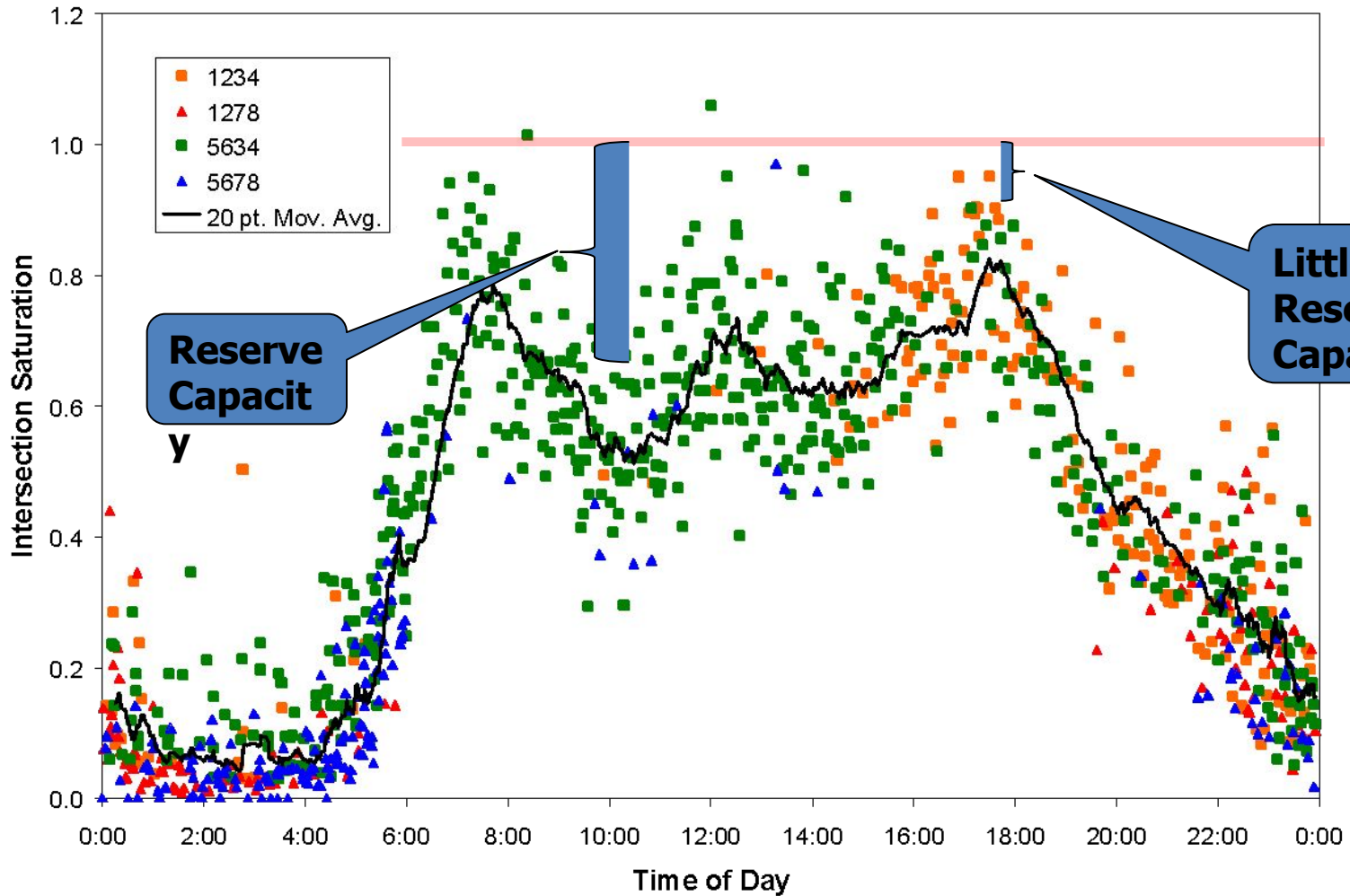


(d) Critical Path 5678

Intersection Saturation

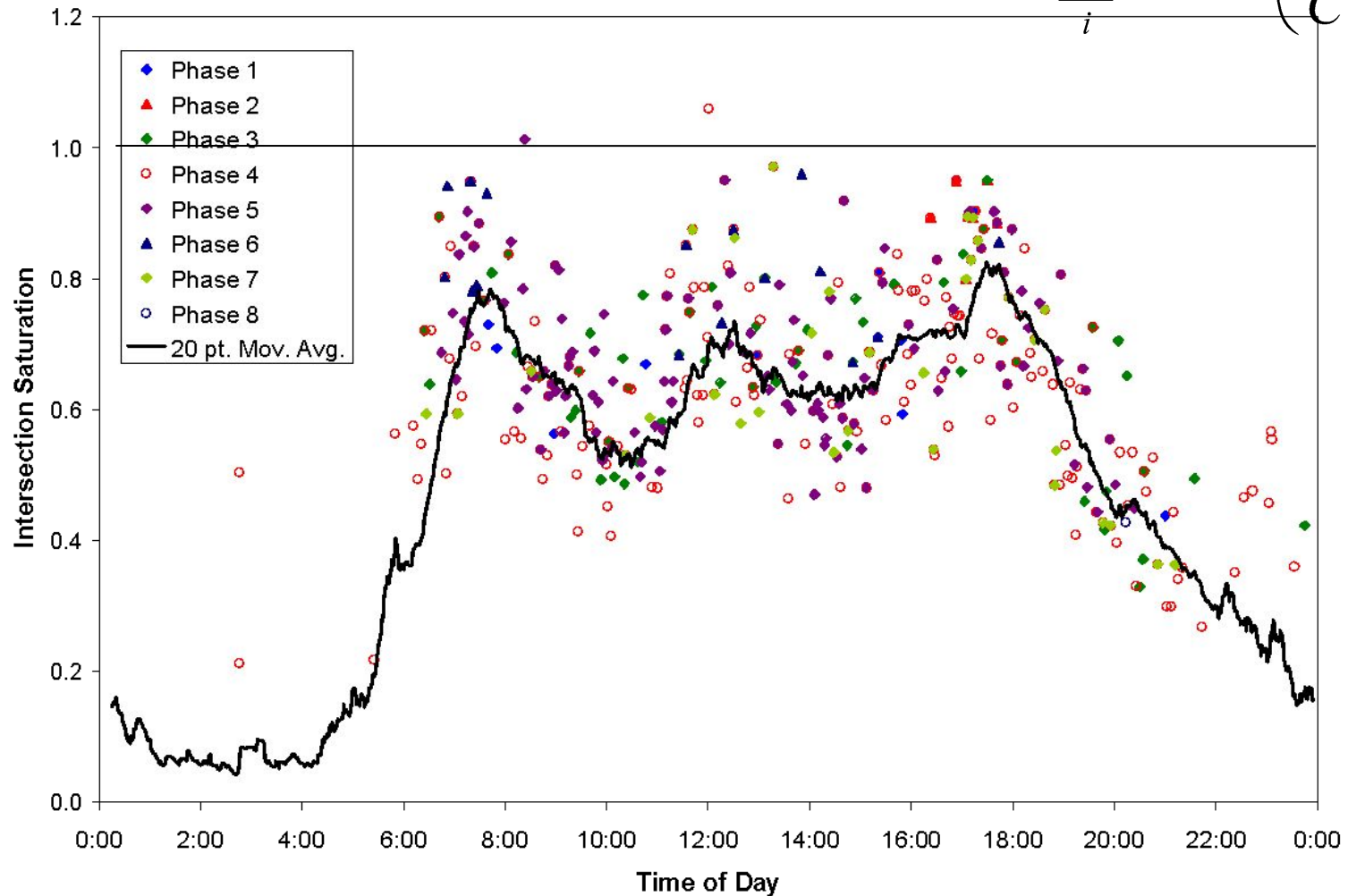
$$X_c = \sum_i (v / s)_{ci} \left(\frac{C}{C - L} \right)$$

$(v / s)_c \rightarrow$ Critical Ratio of Volume to Saturation
 $C \rightarrow$ Cycle Length (s)
 $L \rightarrow$ Lost Time (s)



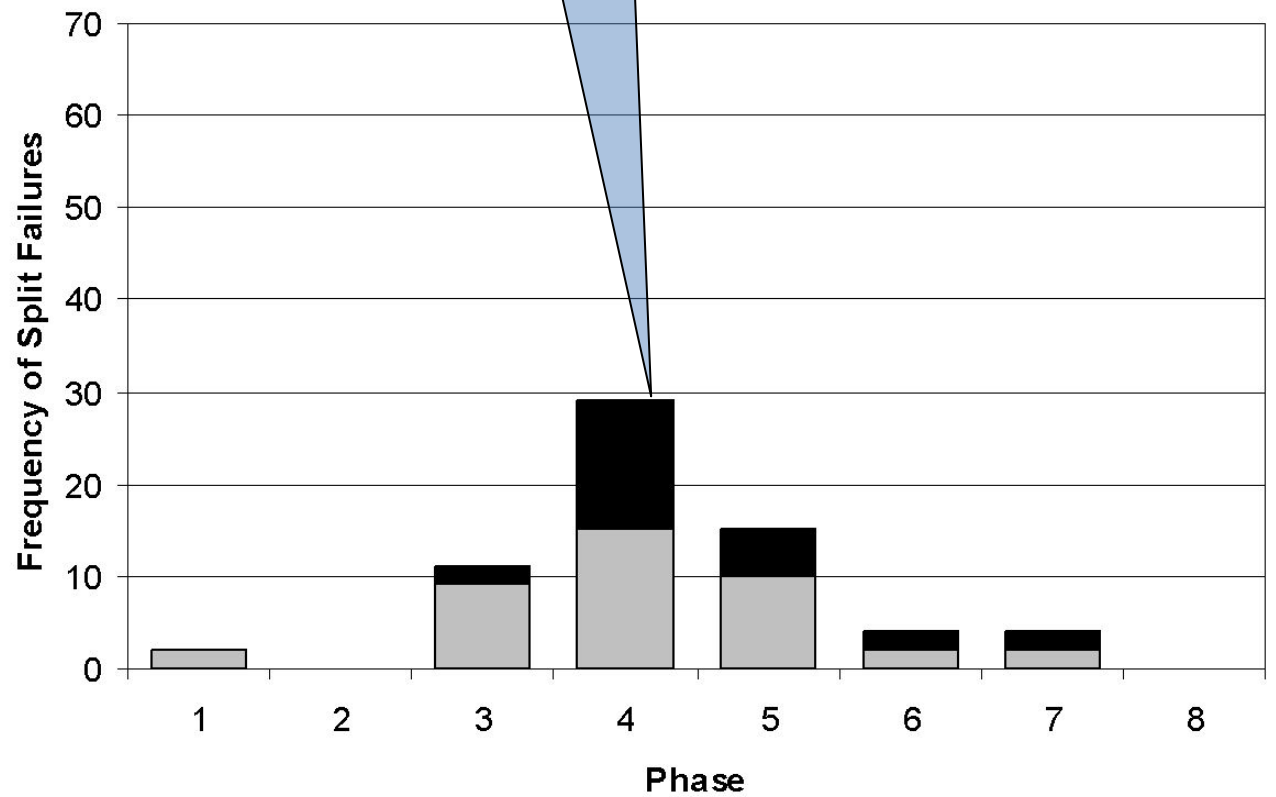
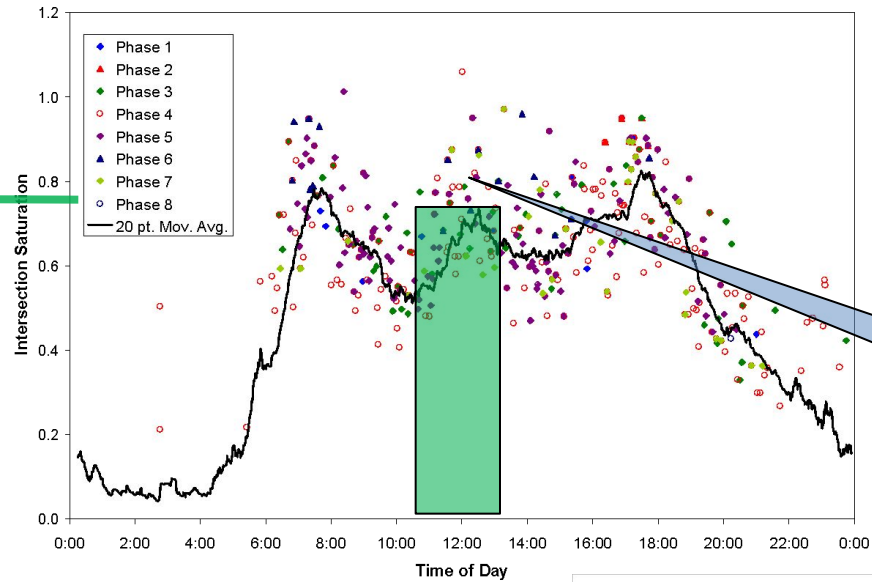
24-Hour Plot of Intersection Saturation With Split Failures Indicated

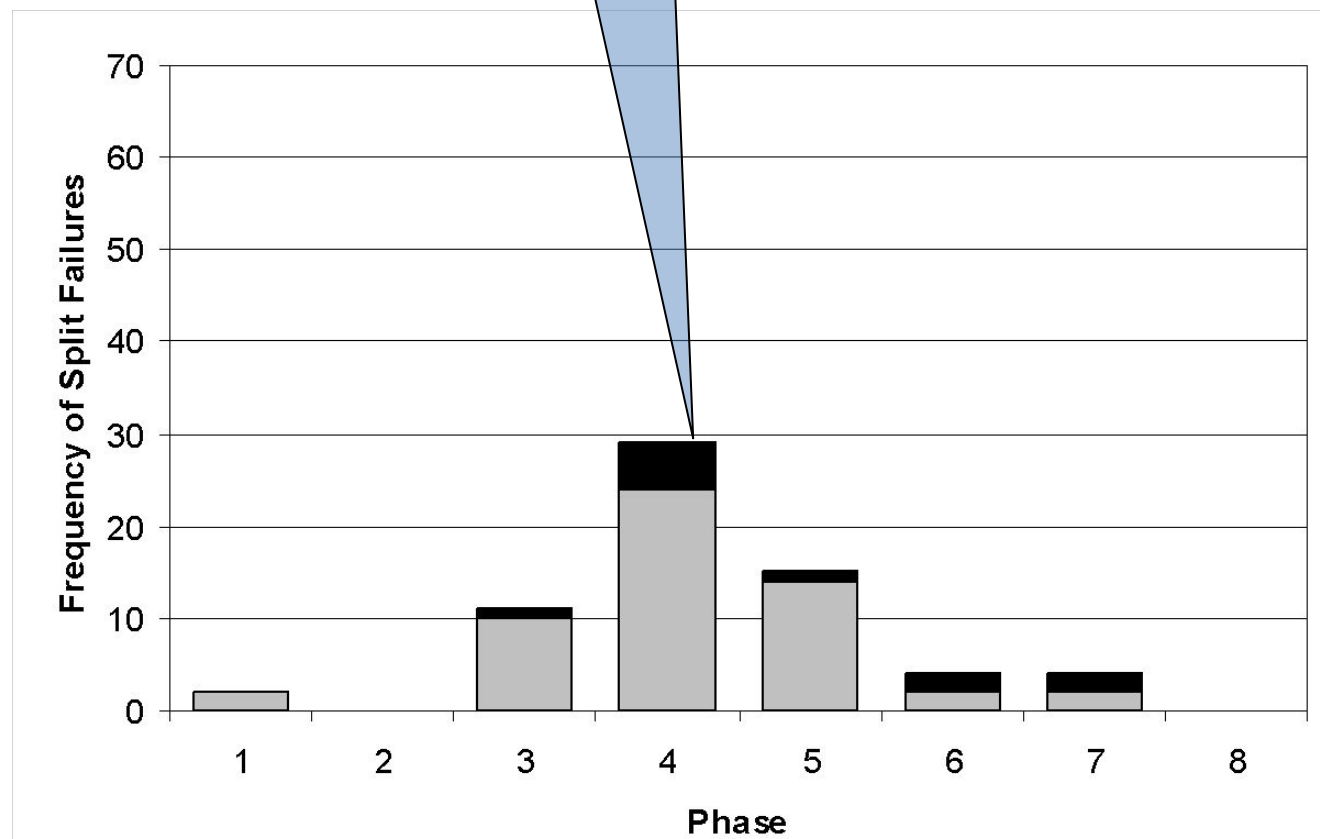
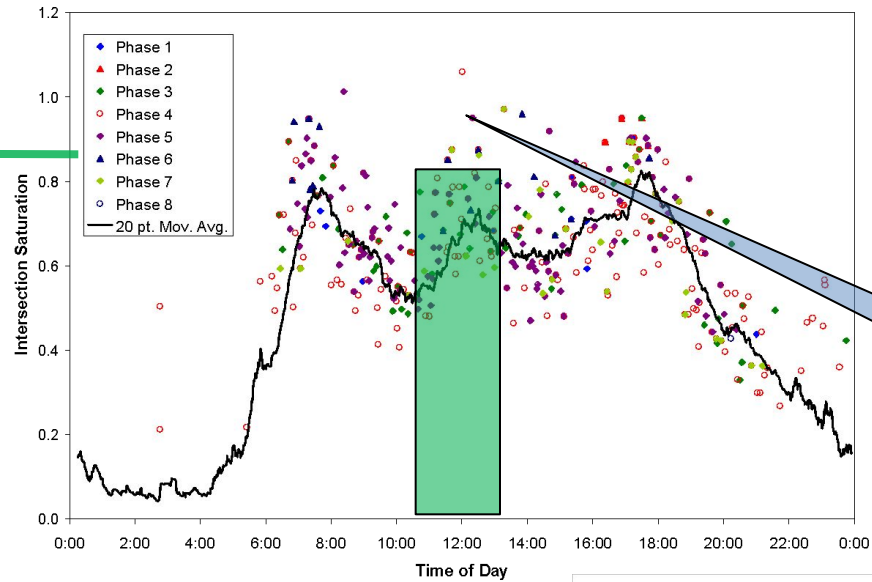
$$X_c = \sum_i (v/s)_{ci} \left(\frac{C}{C-L} \right)$$



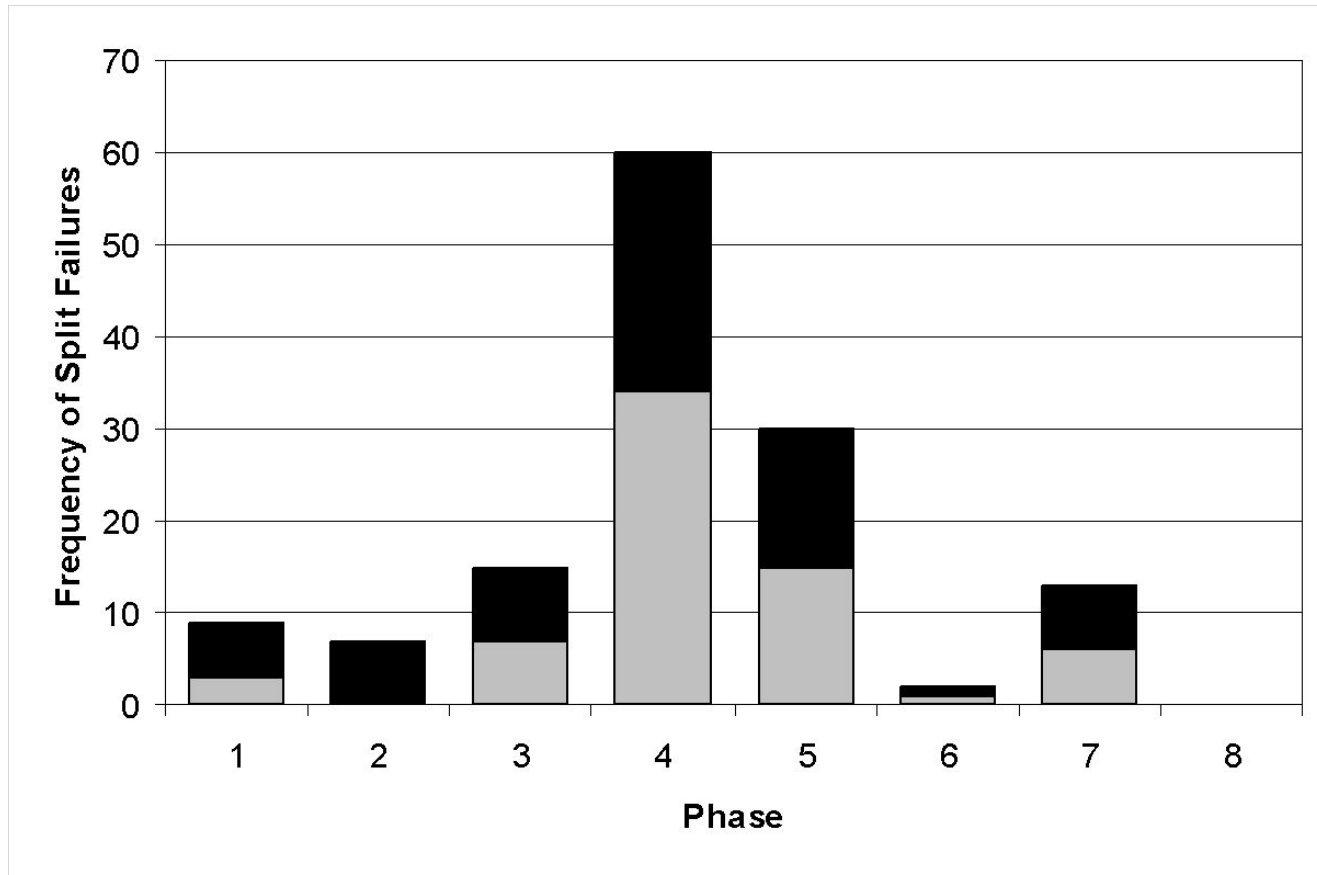
Addressing Split Failures

- $X_c < 1.0$ suggests that there is spare capacity in the intersection.
- For example, we may consider $X_c = 0.75$ as the cutoff point for cycles to be considered easily “correctable” with adjusted splits.

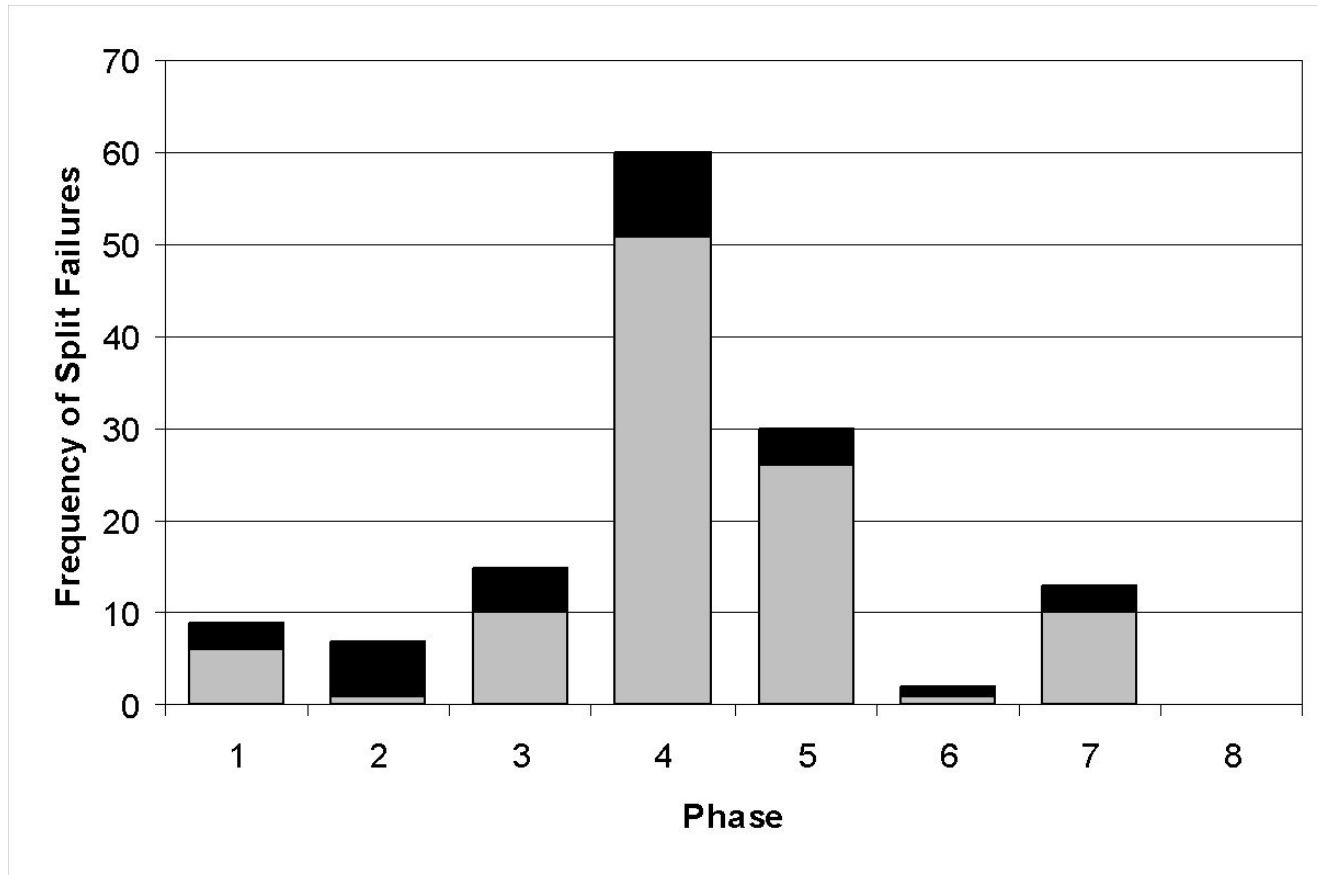




3:00 PM—7:00 PM, ($X_c=0.75$)



3:00 PM—7:00 PM, ($X_c=0.85$)



Modeling vs. Measuring

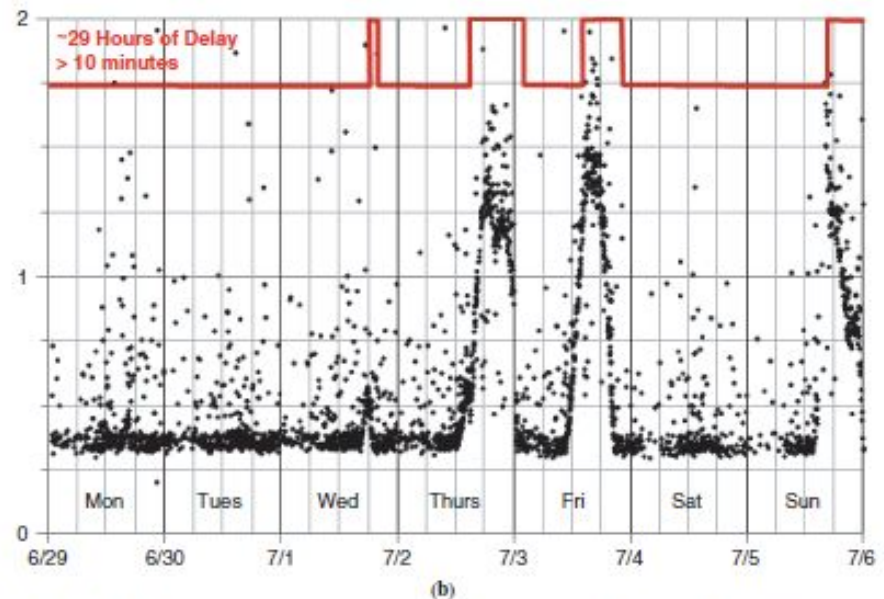
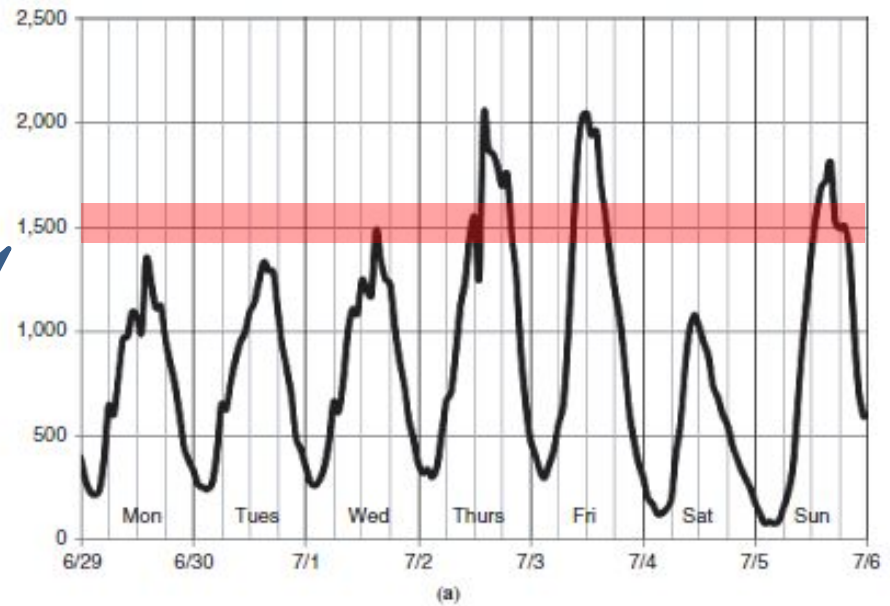
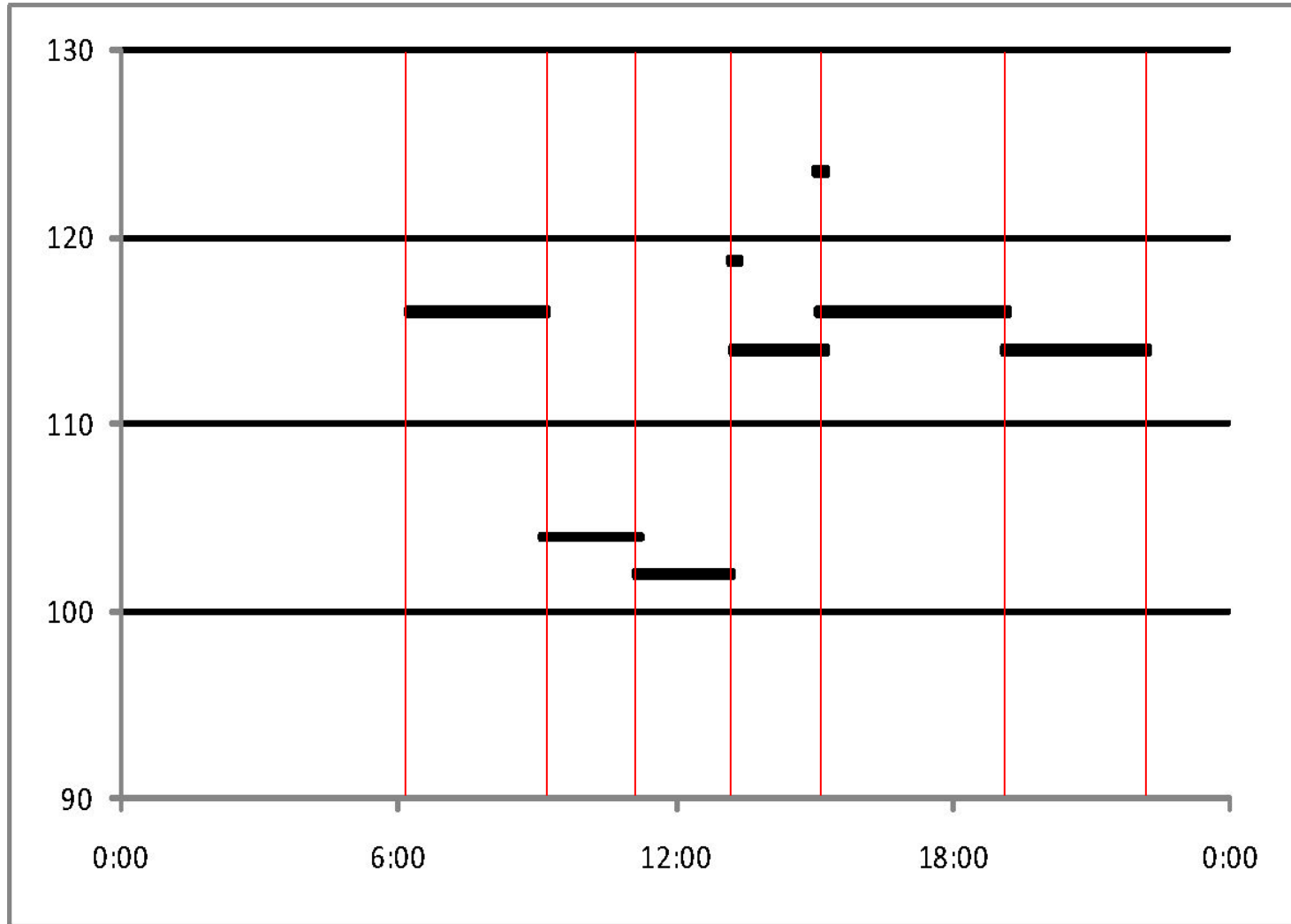


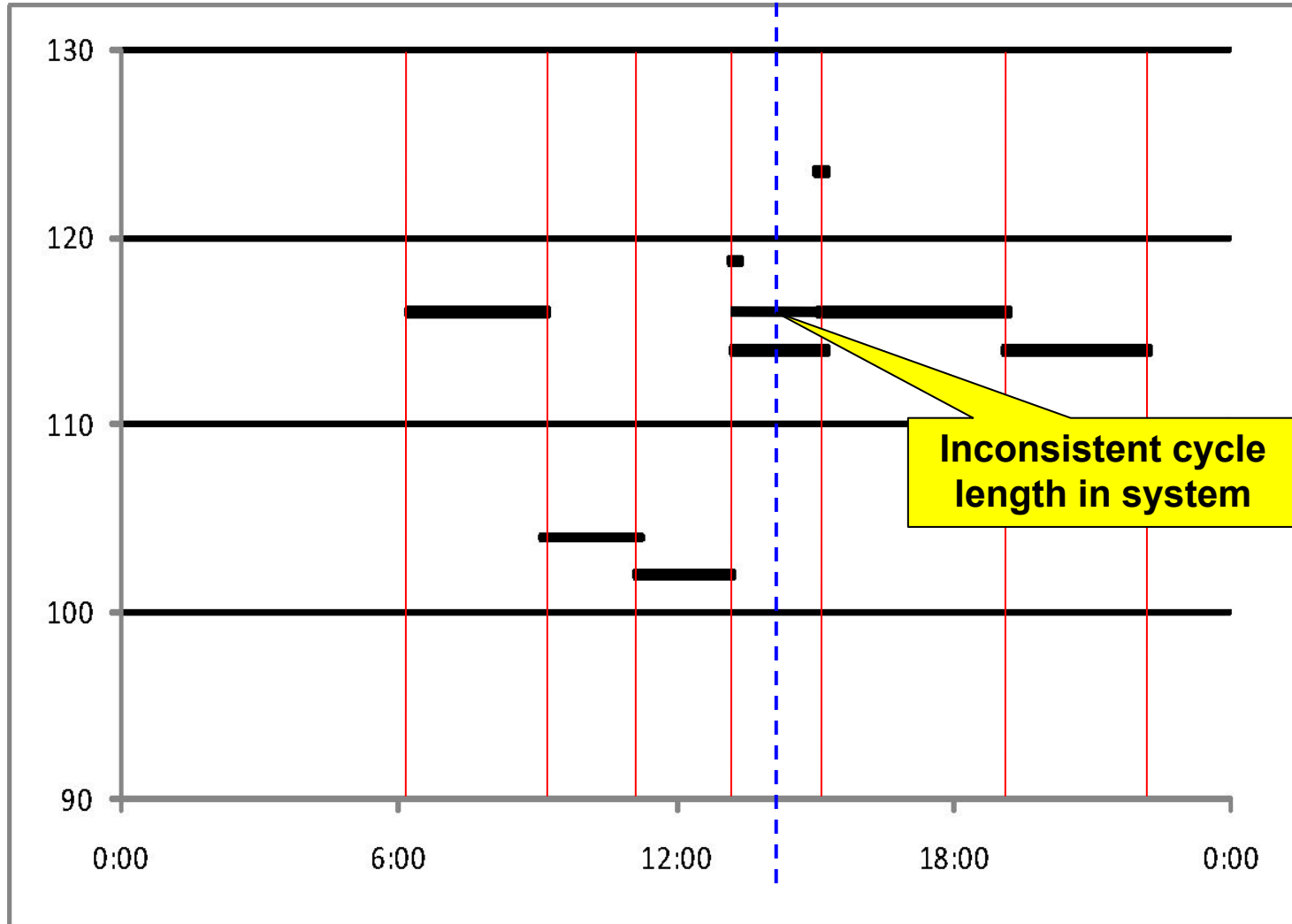
FIGURE 5 Traffic volumes and travel times along I-65 from June 29 to July 5, 2009: (a) northbound flow rates (vph) at MM 186 on I-65 and (b) northbound travel time (h) from MM 217.8 to MM 241.1.

1. Cycle Length



VCR Scheduling Evaluation

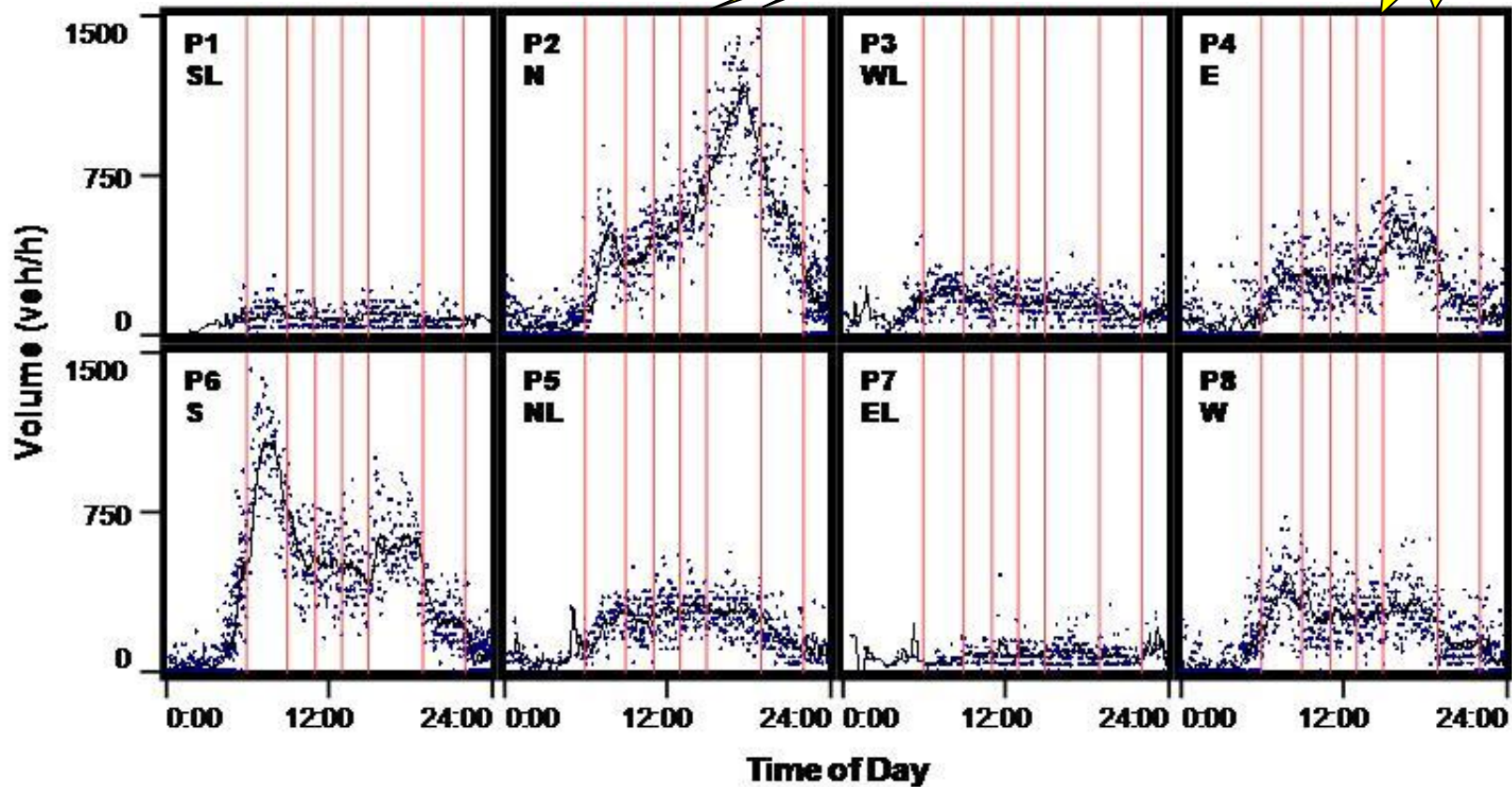
1. Cycle Length (Mismatch)



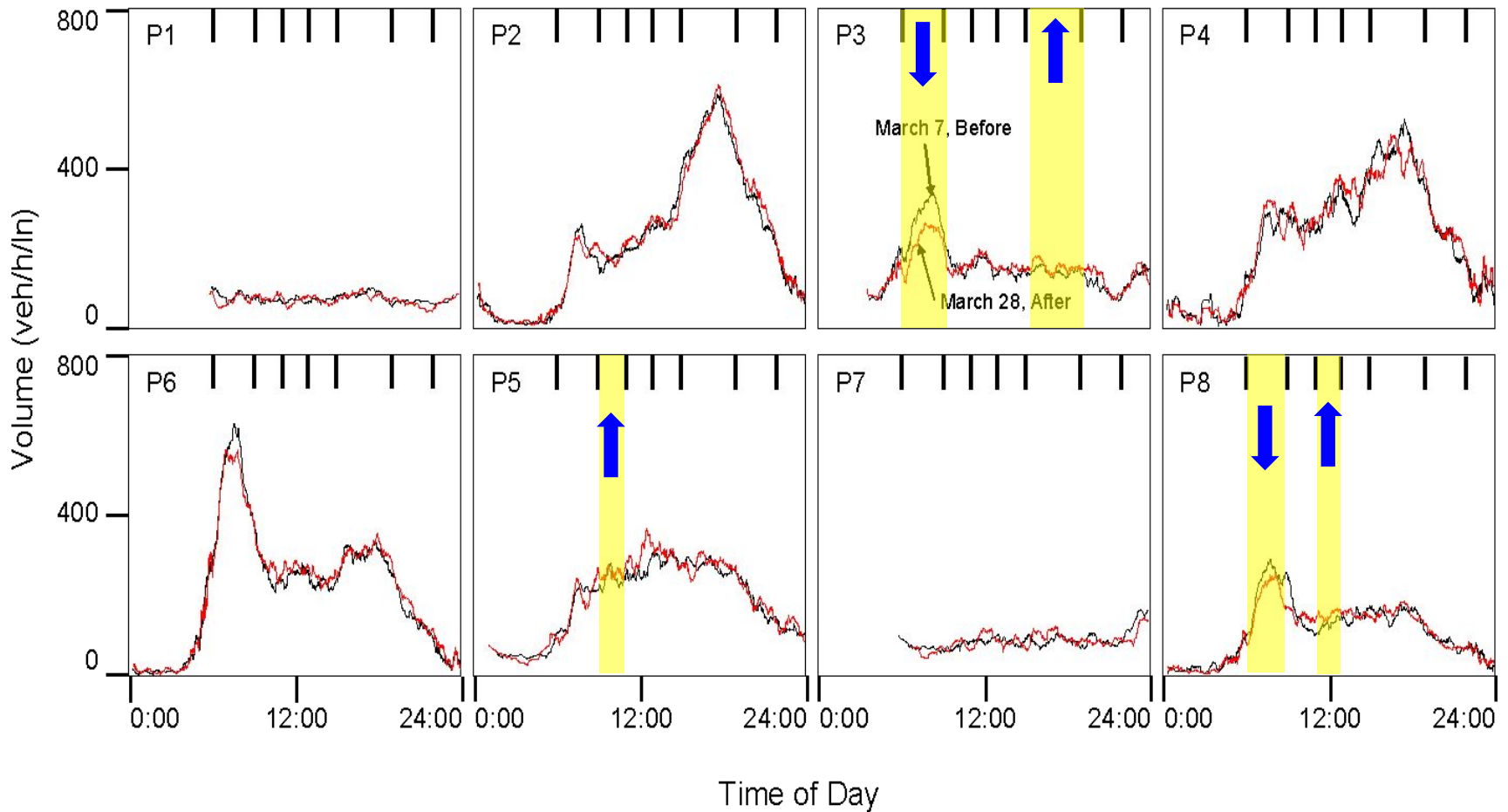
VCR Scheduling Evaluation

2. Equivalent Hourly Flow Rate

Are TOD breakpoints in appropriate locations?



Volume Comparison (Jim Larson)

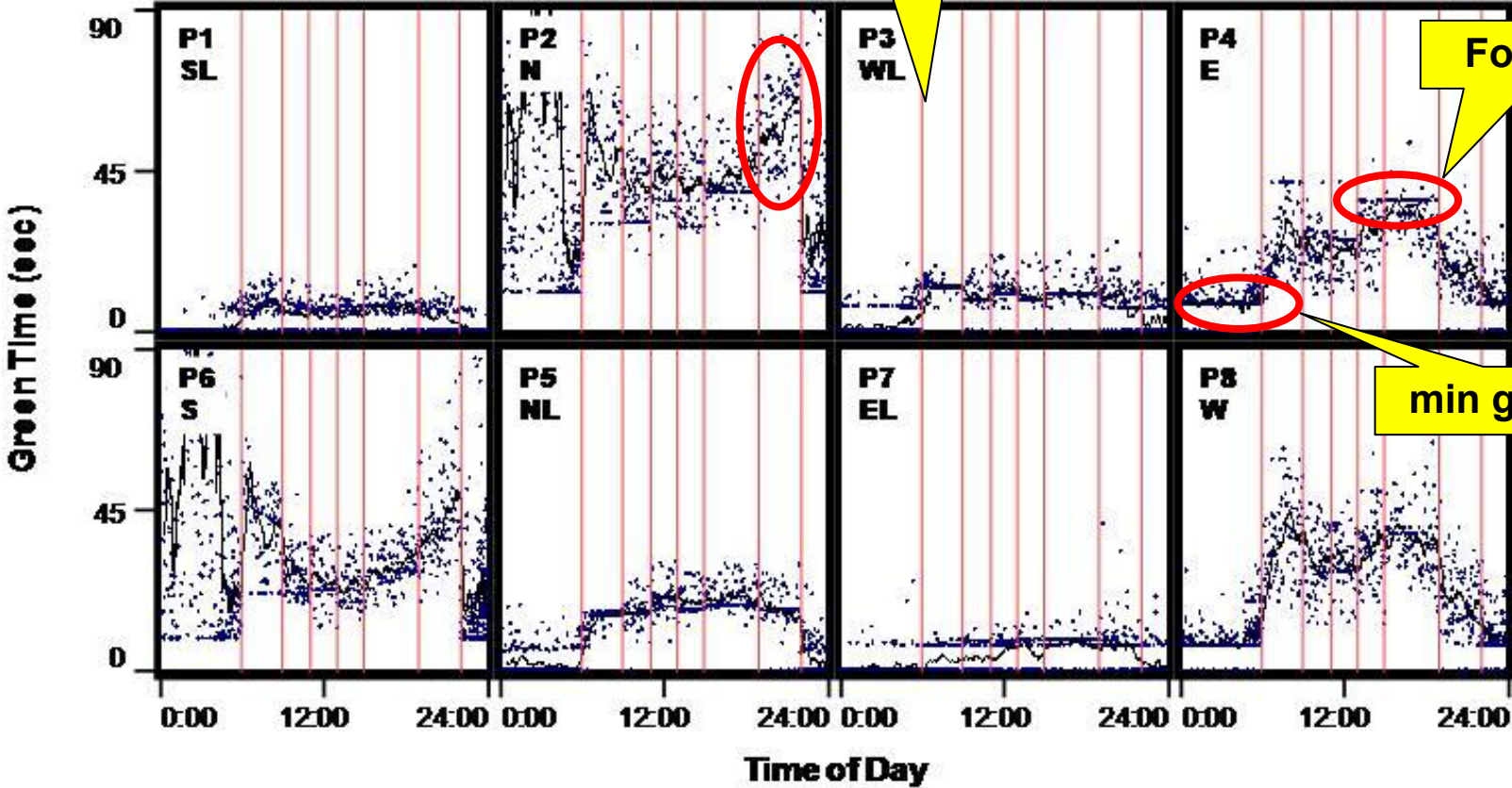


3. Green Time

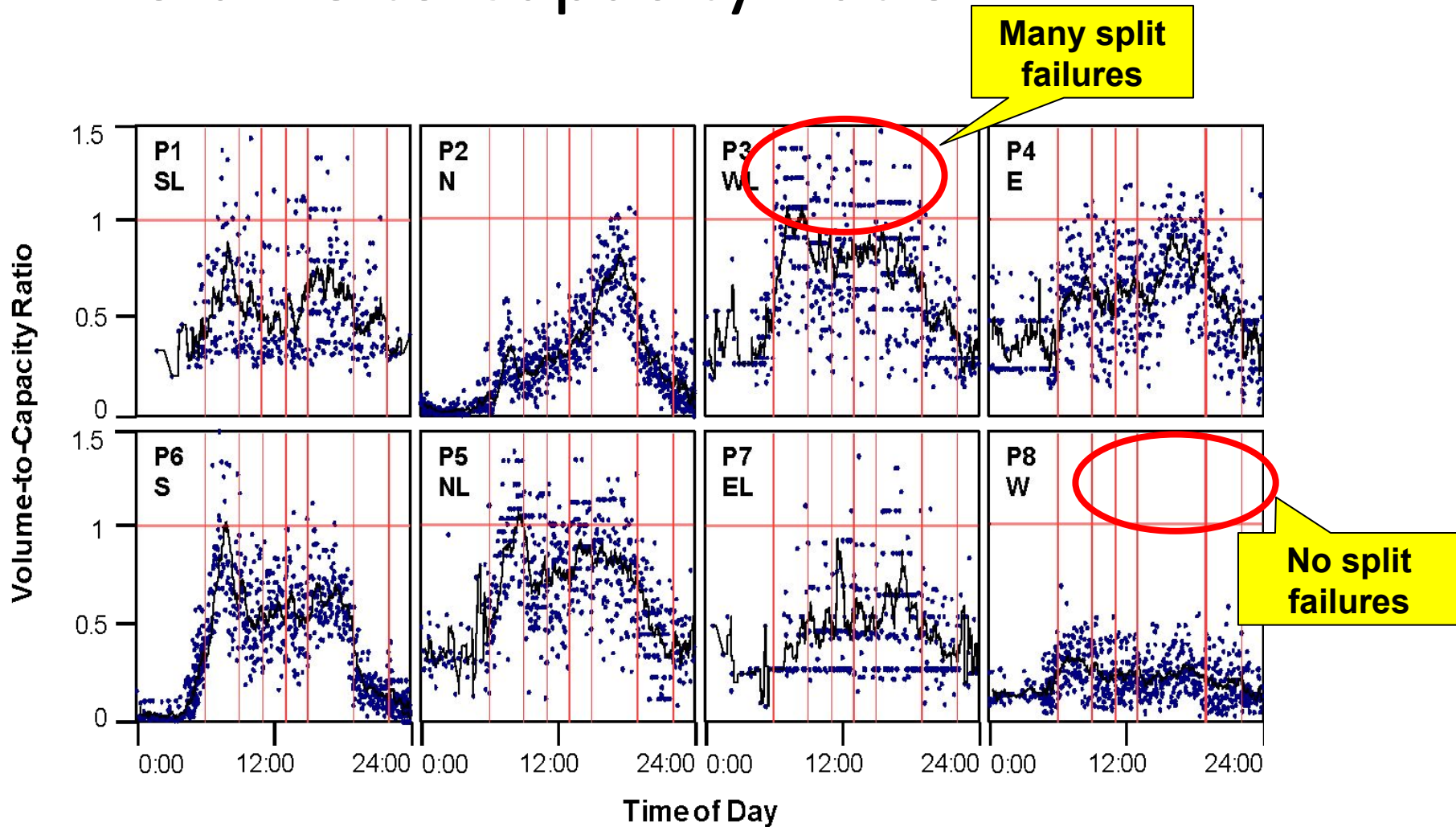
Early return

Force off

min green

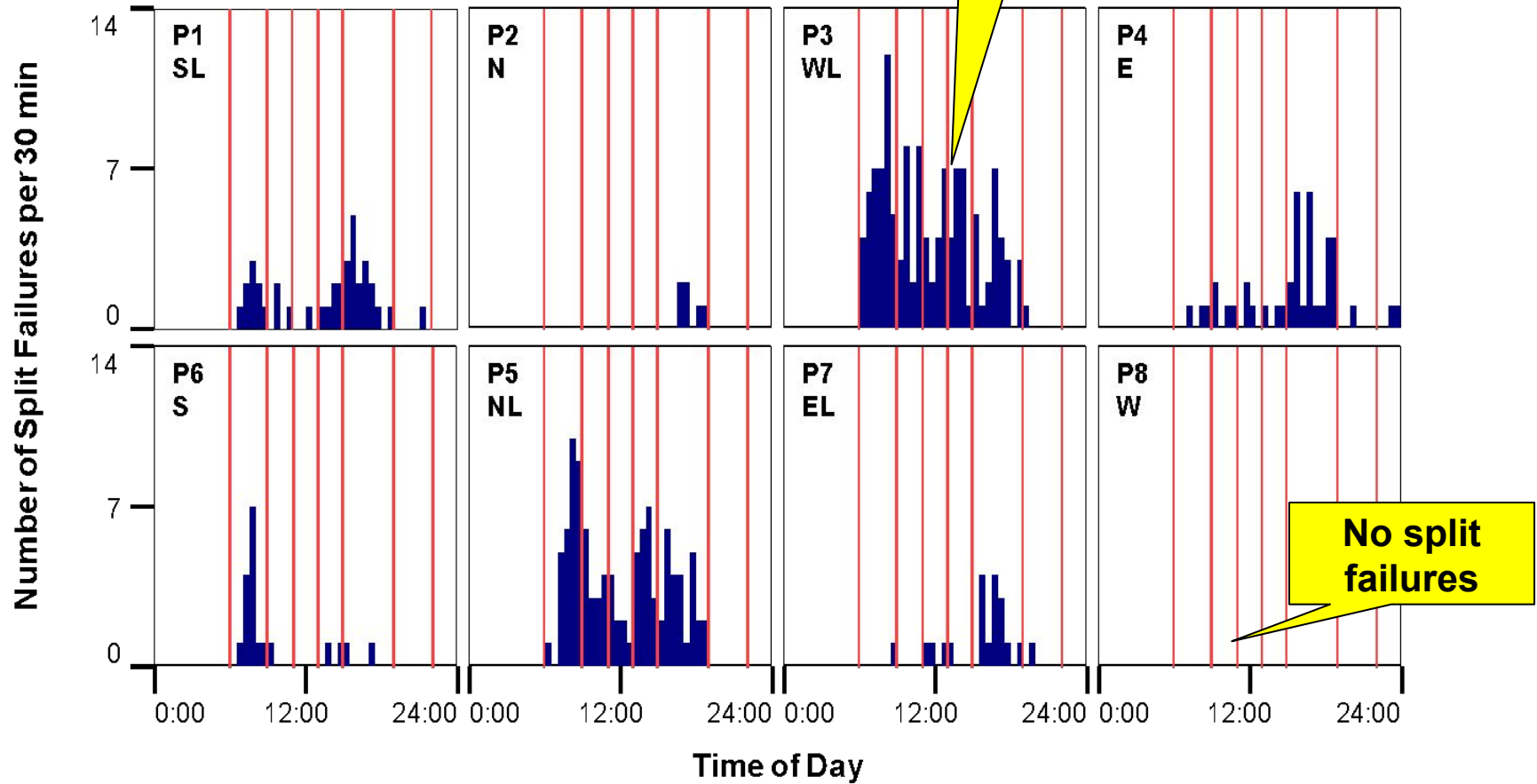


4. Volume to Capacity Ratio



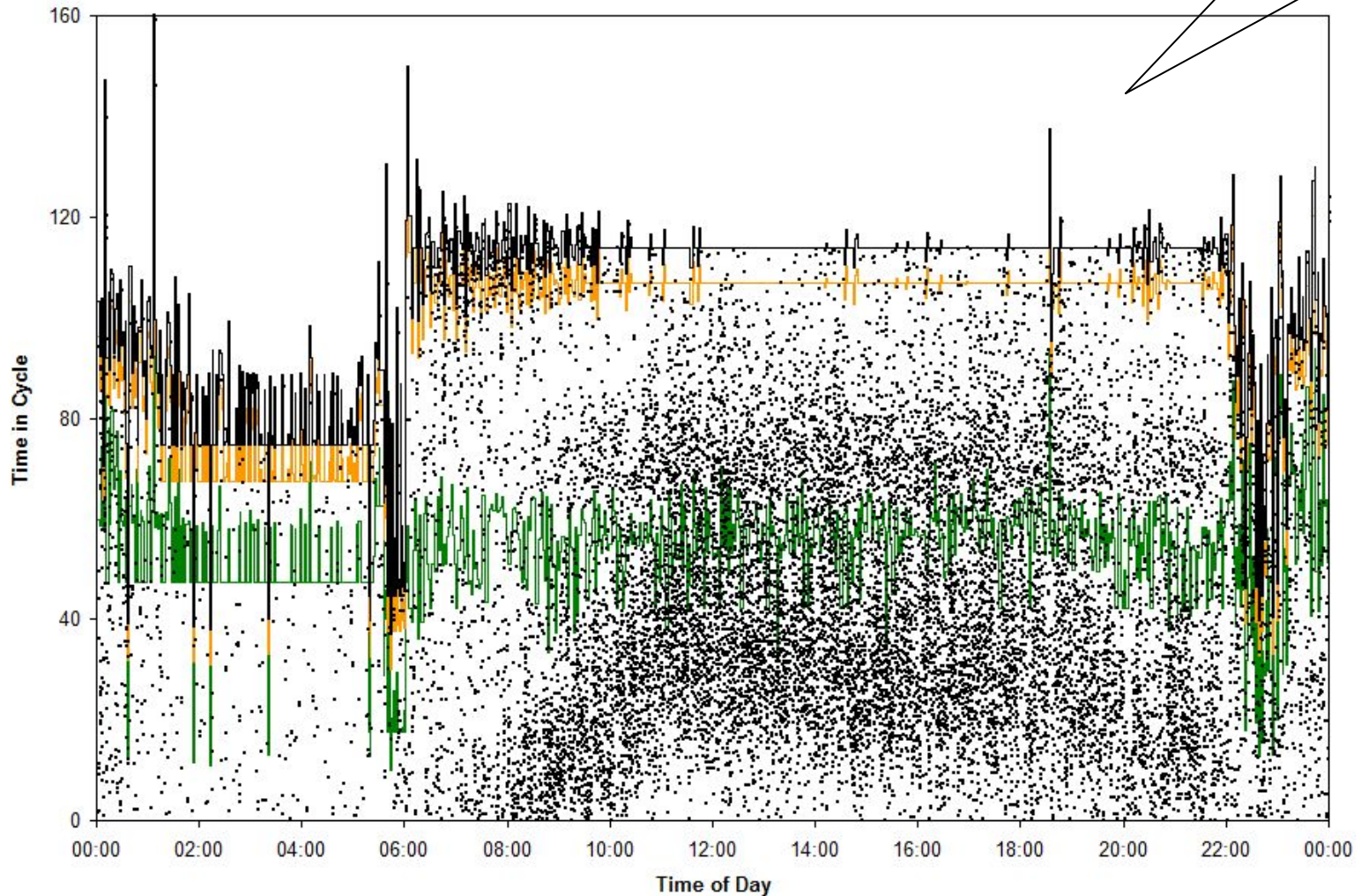
5. Split Failures Per Half Hour

- Number of times that $v/c > 1$

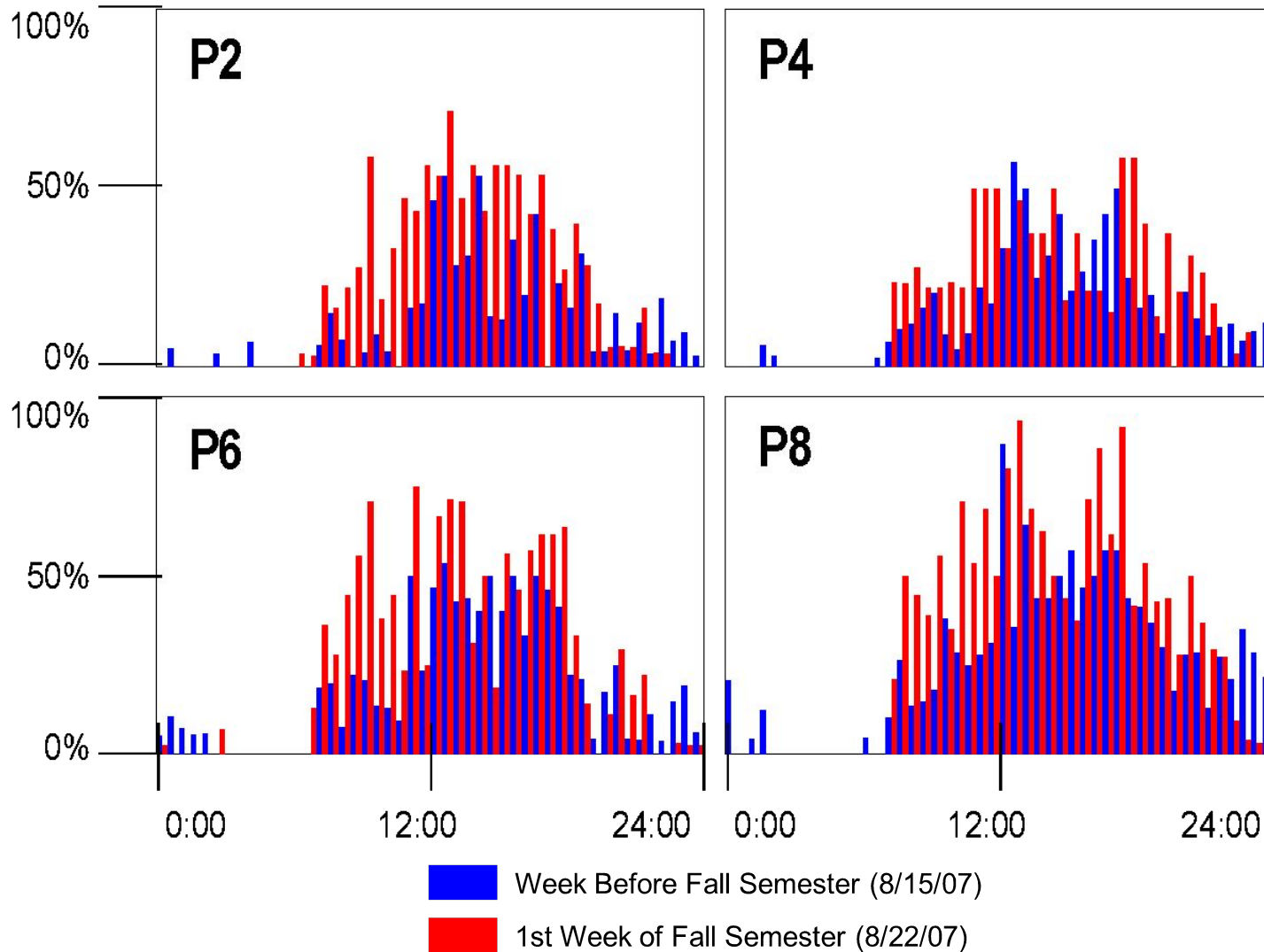


6. Purdue Coordination Diagram (PCD)

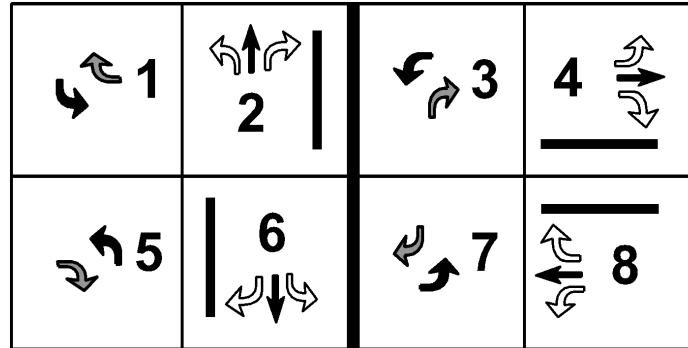
Extensive Detail
in subsequent
section



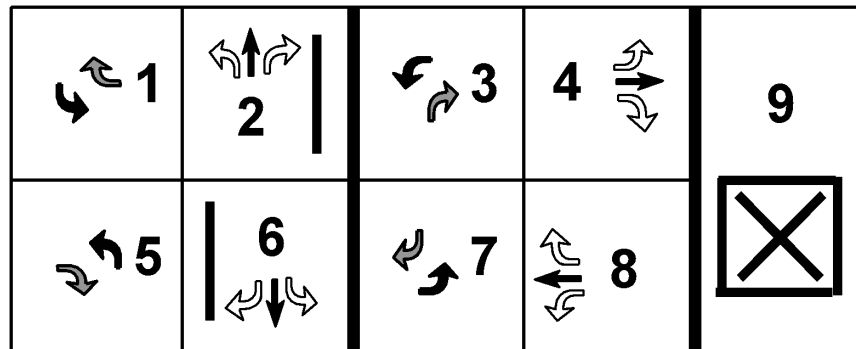
7. Percentage of Phases with Pedestrians



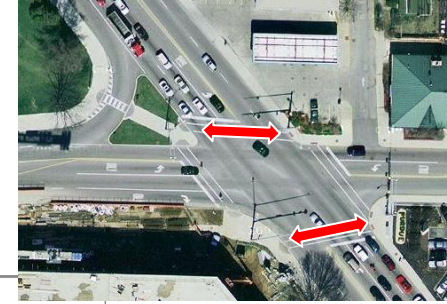
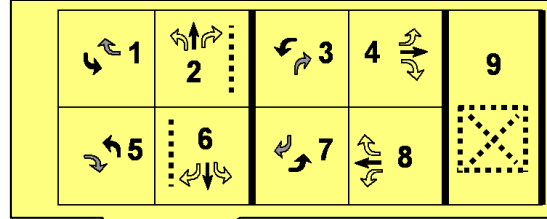
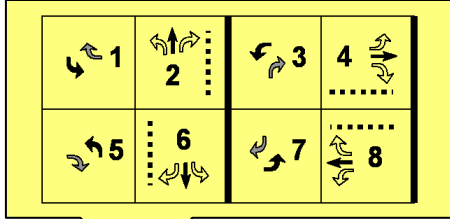
Pedestrian Phasing



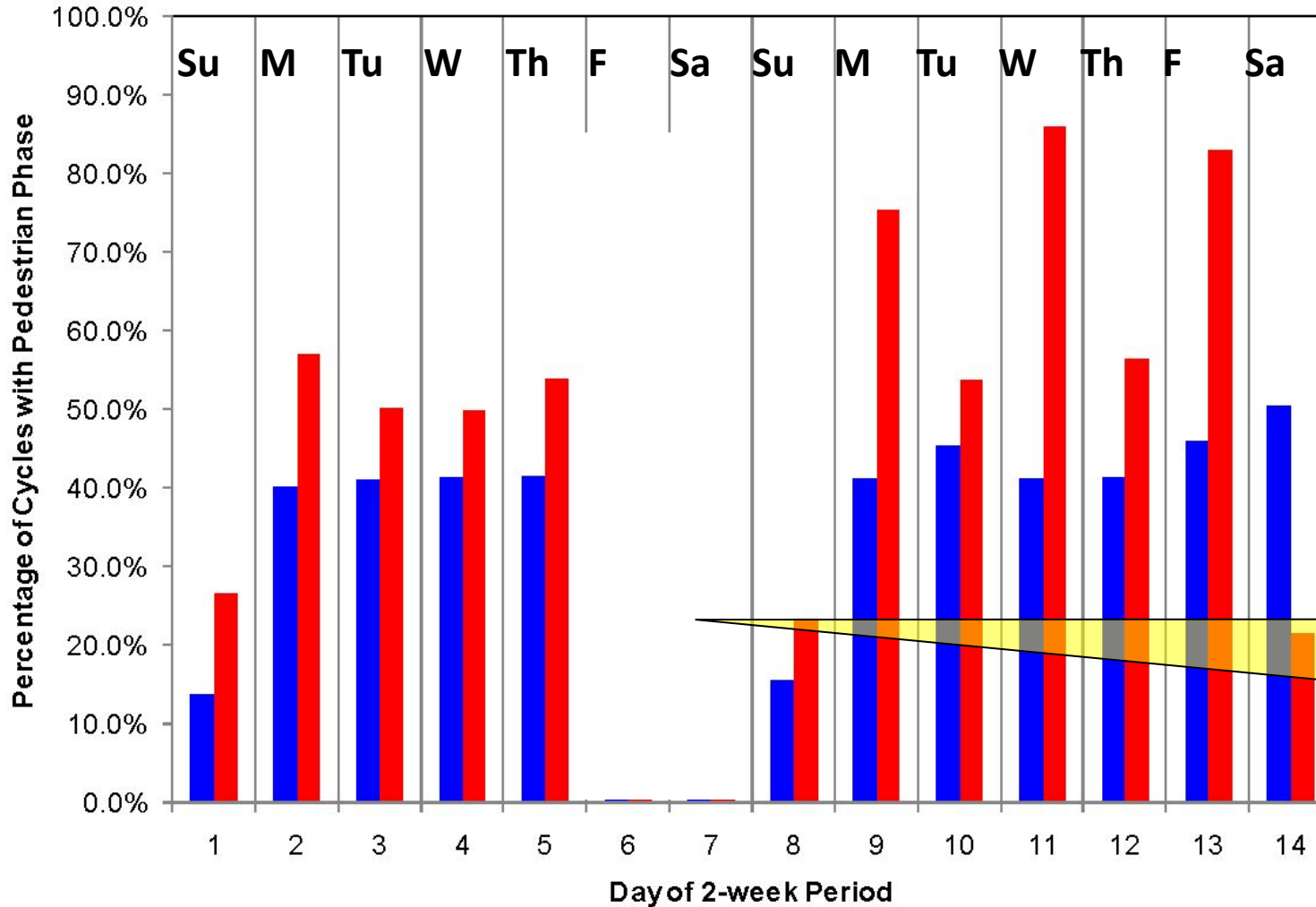
Concurrent Ped 4/8



Exclusive Ped Phase "9"



■ November 2008 (Conventional Ped Phases) ■ November 2009 (Exclusive Ped Phase)

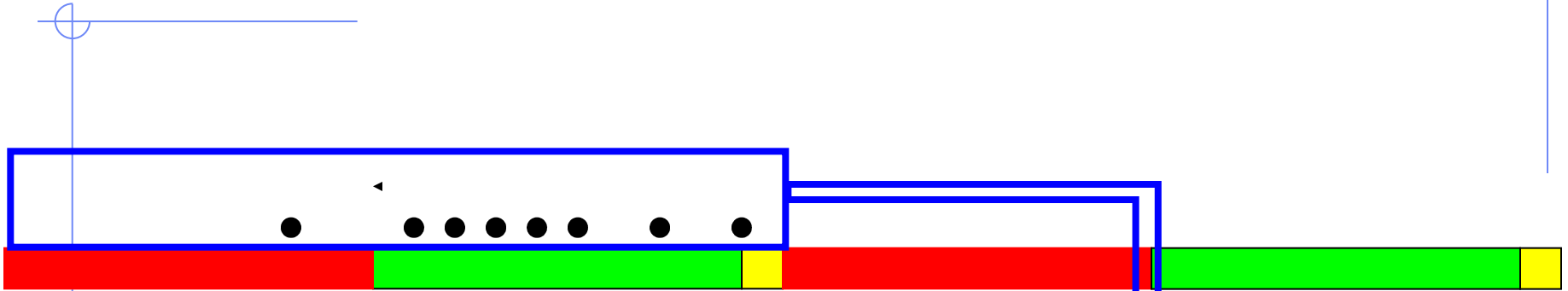


0600-
2100

Missing data 11/13 and 11/14 (days 5/6 in BEFORE)

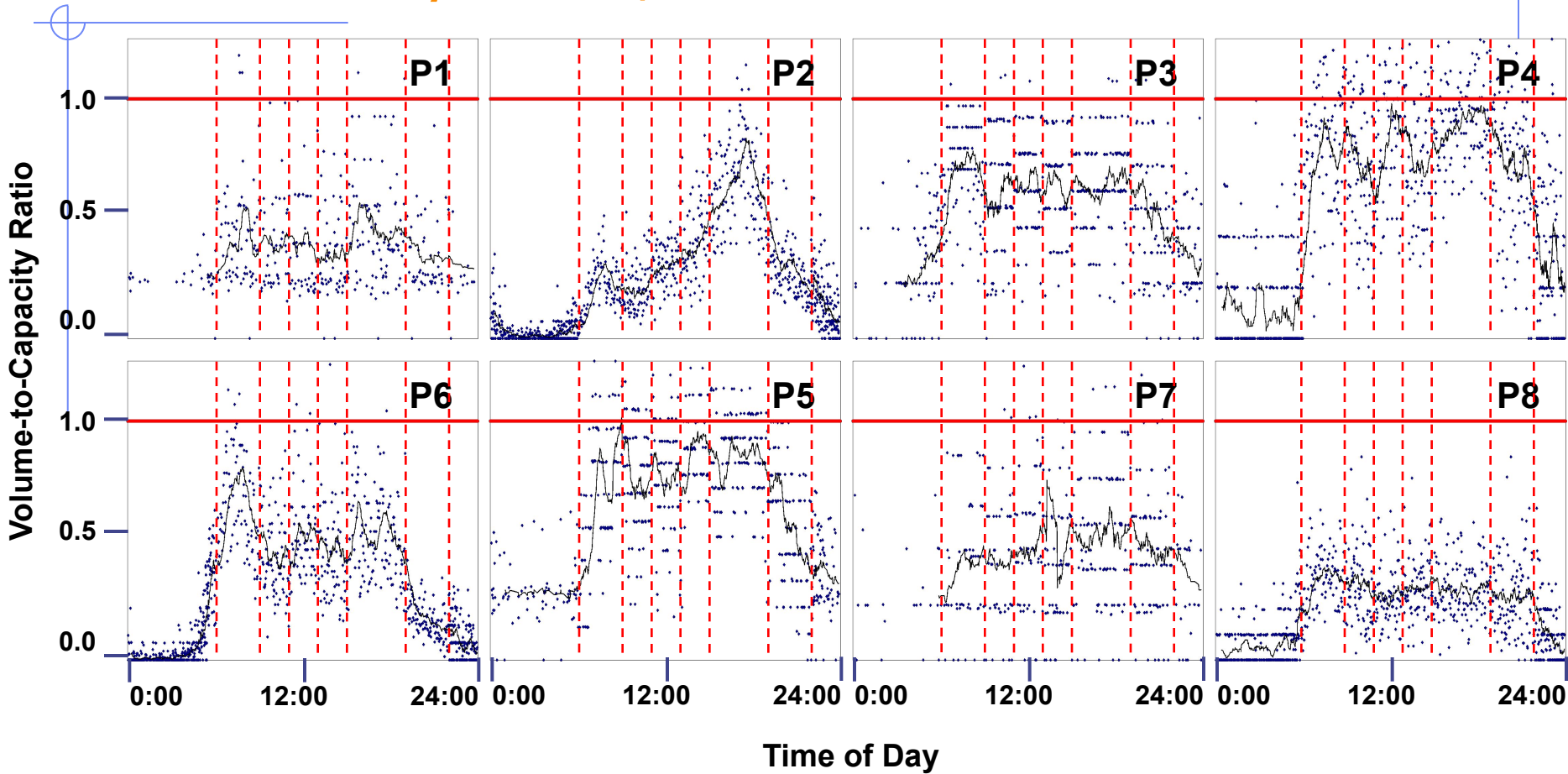
Flow Profiles

Cycle Based Calculations

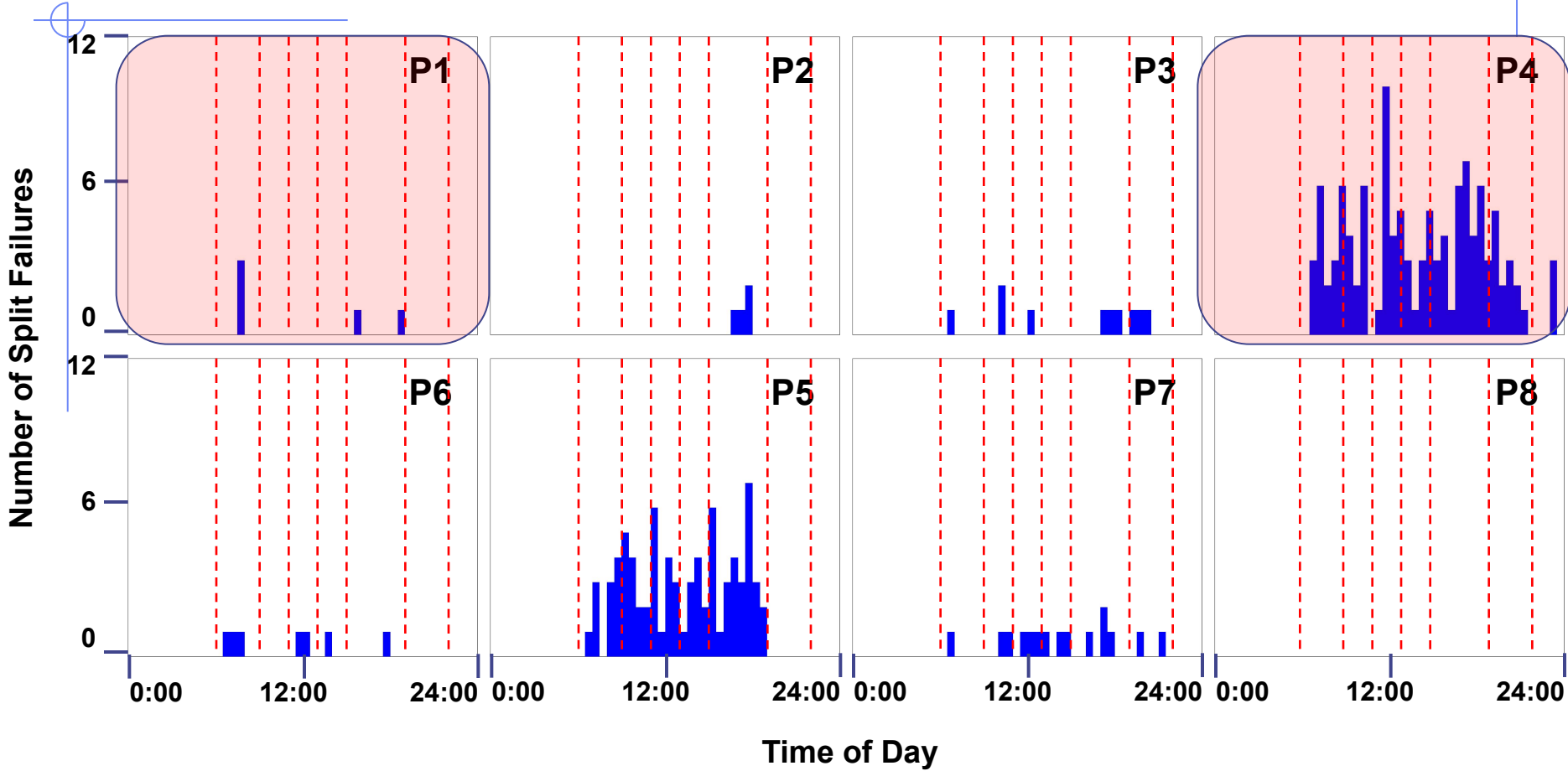


$$\left(\frac{v}{c}\right)_l = \frac{q_g}{\left[s_l * \left(\frac{g_l}{C}\right) \right]} = \frac{(v_l * C)}{(s_l * g_l)}$$

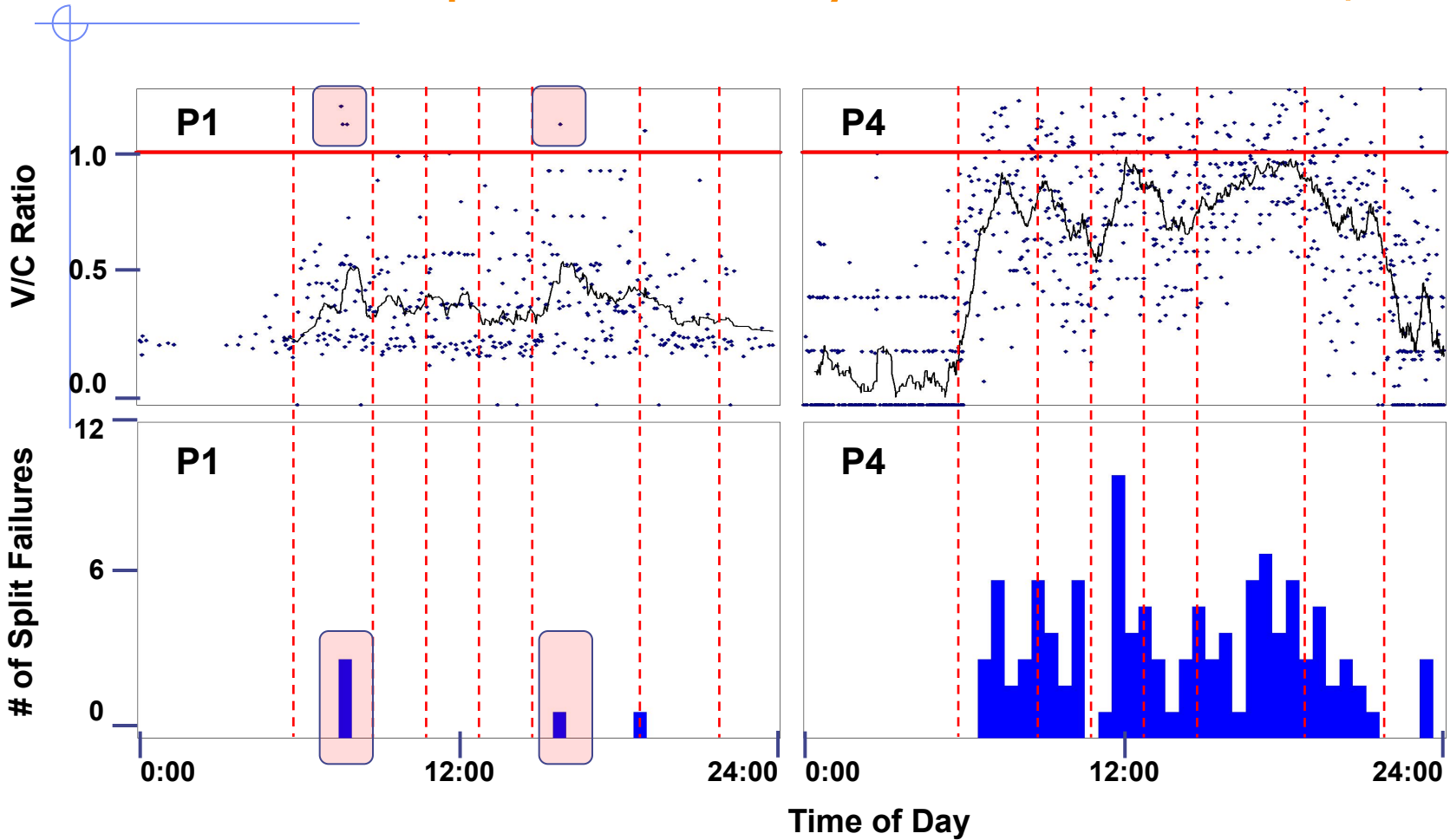
V/C Ratios by Phase, 24 Hours



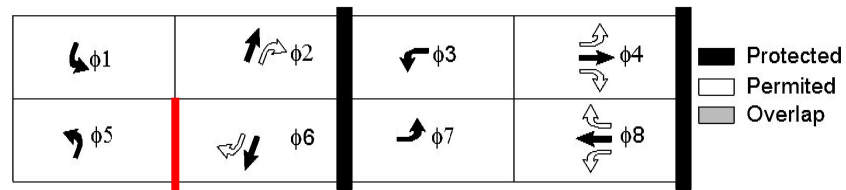
Number of Split Failures, 30-minute Bins



Number of Split Failures by Hour – Phases 1, 4

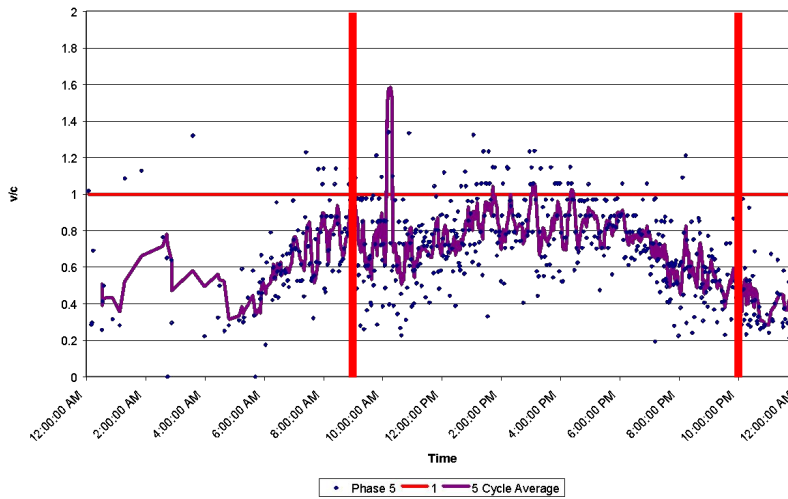


October 18th, 2004



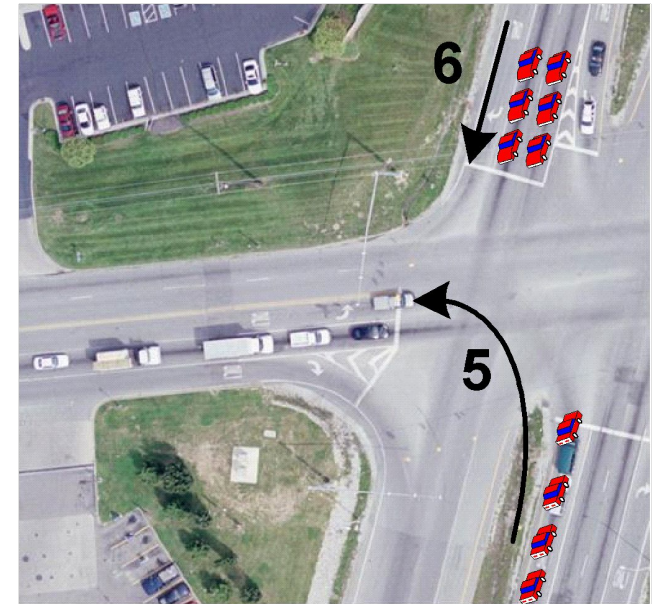
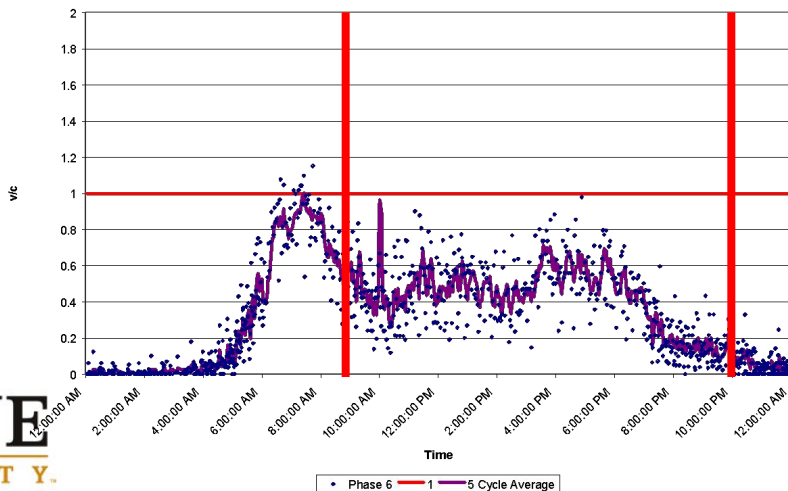
Phase 5

Phase 5 v/c October 18th, 2004 (NL12C)



Phase 6

Phase 6 v/c October 18th, 2004 (SA123C, SB123C)



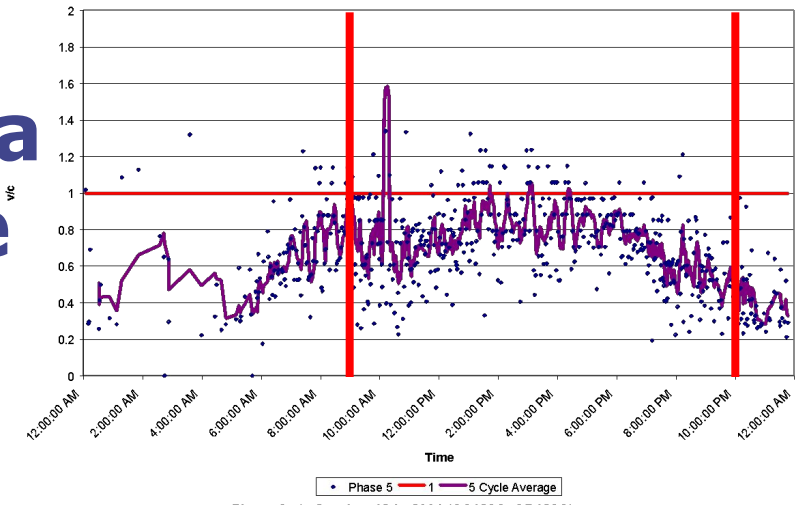
Split reallocation

| | | | |
|---|---|---|---|
| 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 |

October 18th

Phase 5 v/c October 18th, 2004 (NL12C)

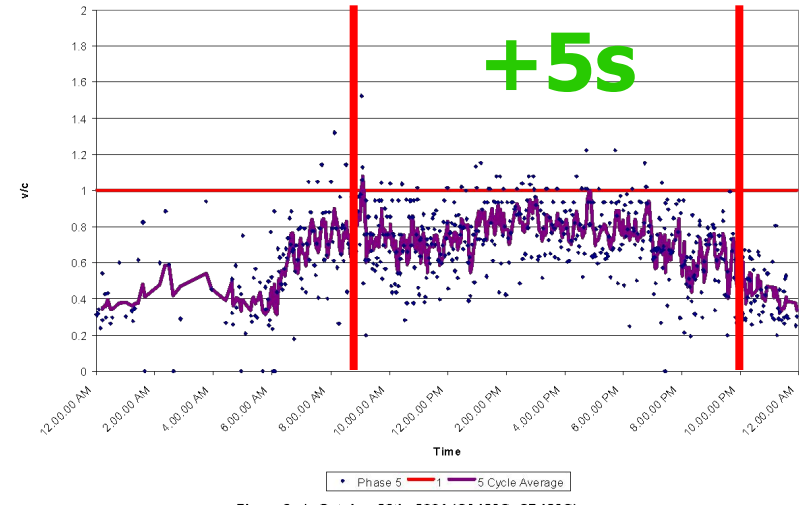
Phase 5



October 26th

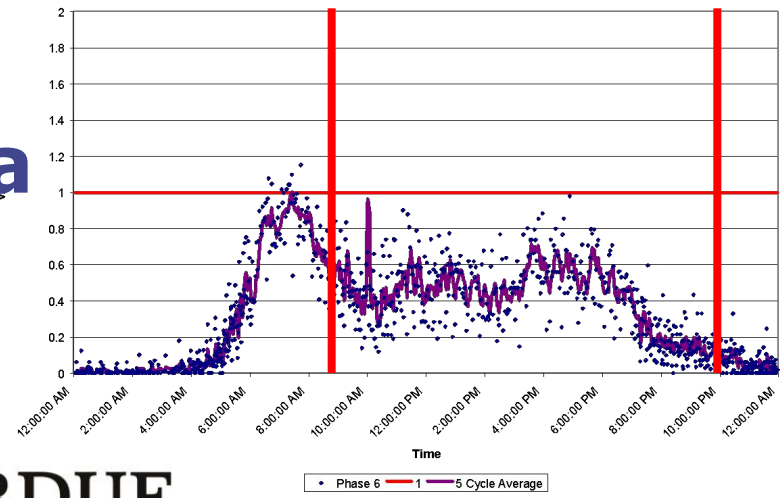
Phase 5 v/c October 26th, 2004 (NL12C)

+5s



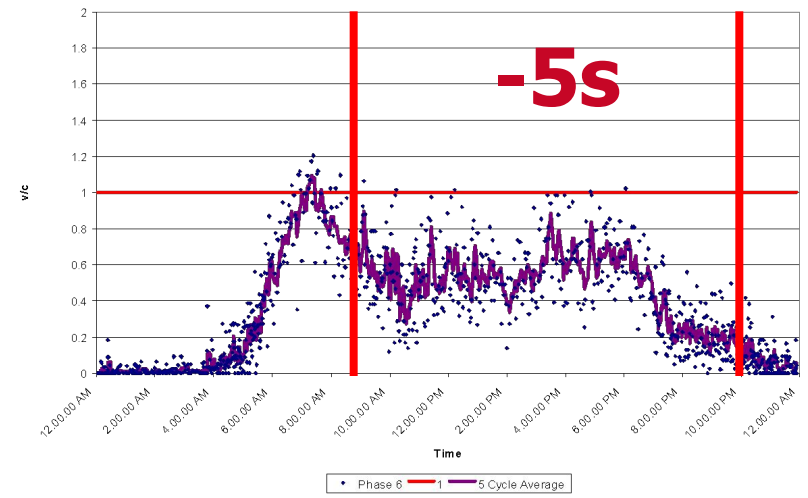
Phase 6

Phase 6 v/c October 18th, 2004 (SA123C, SB123C)



Phase 6 v/c October 26th, 2004 (SA123C, SB123C)

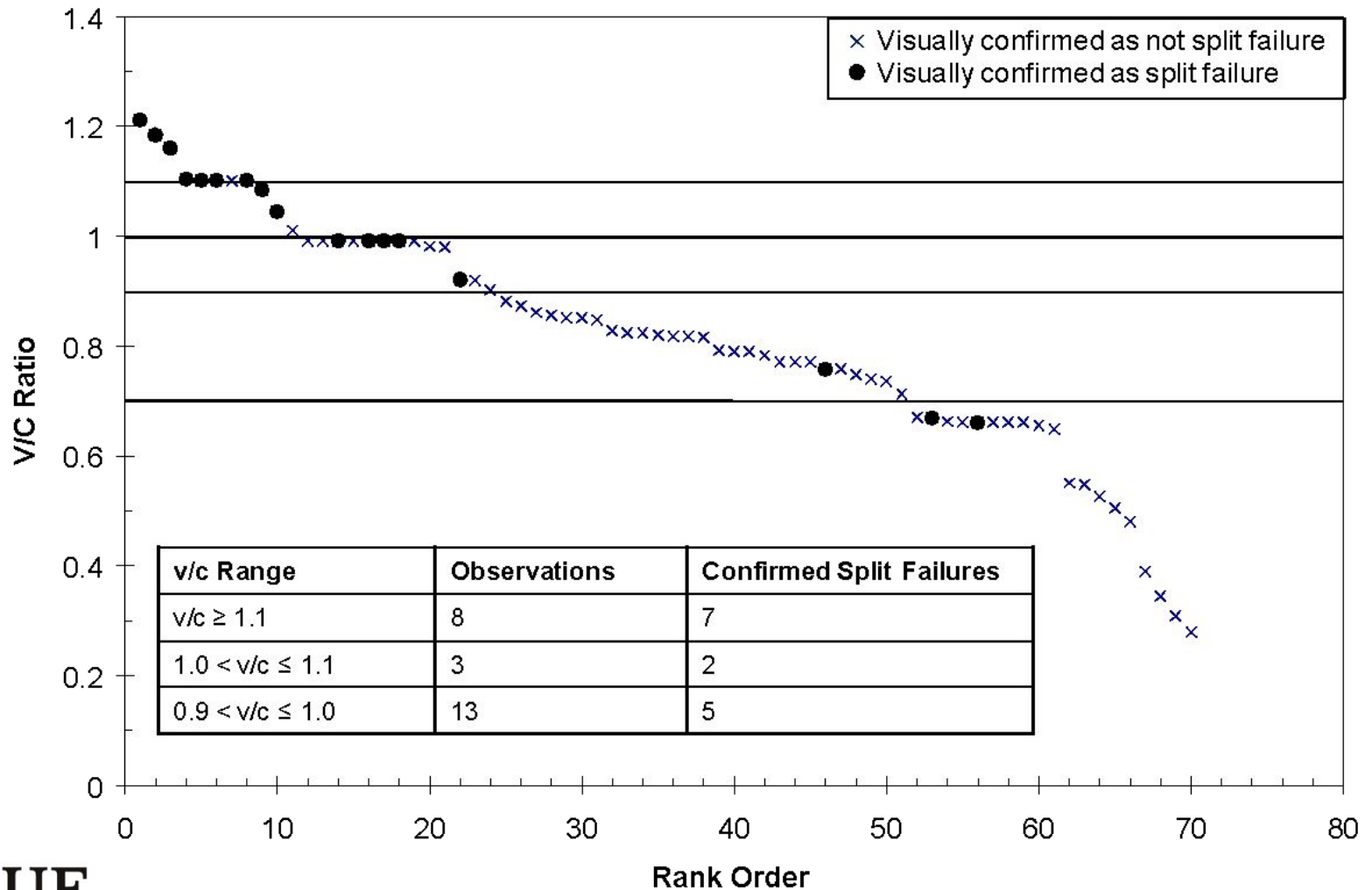
-5s



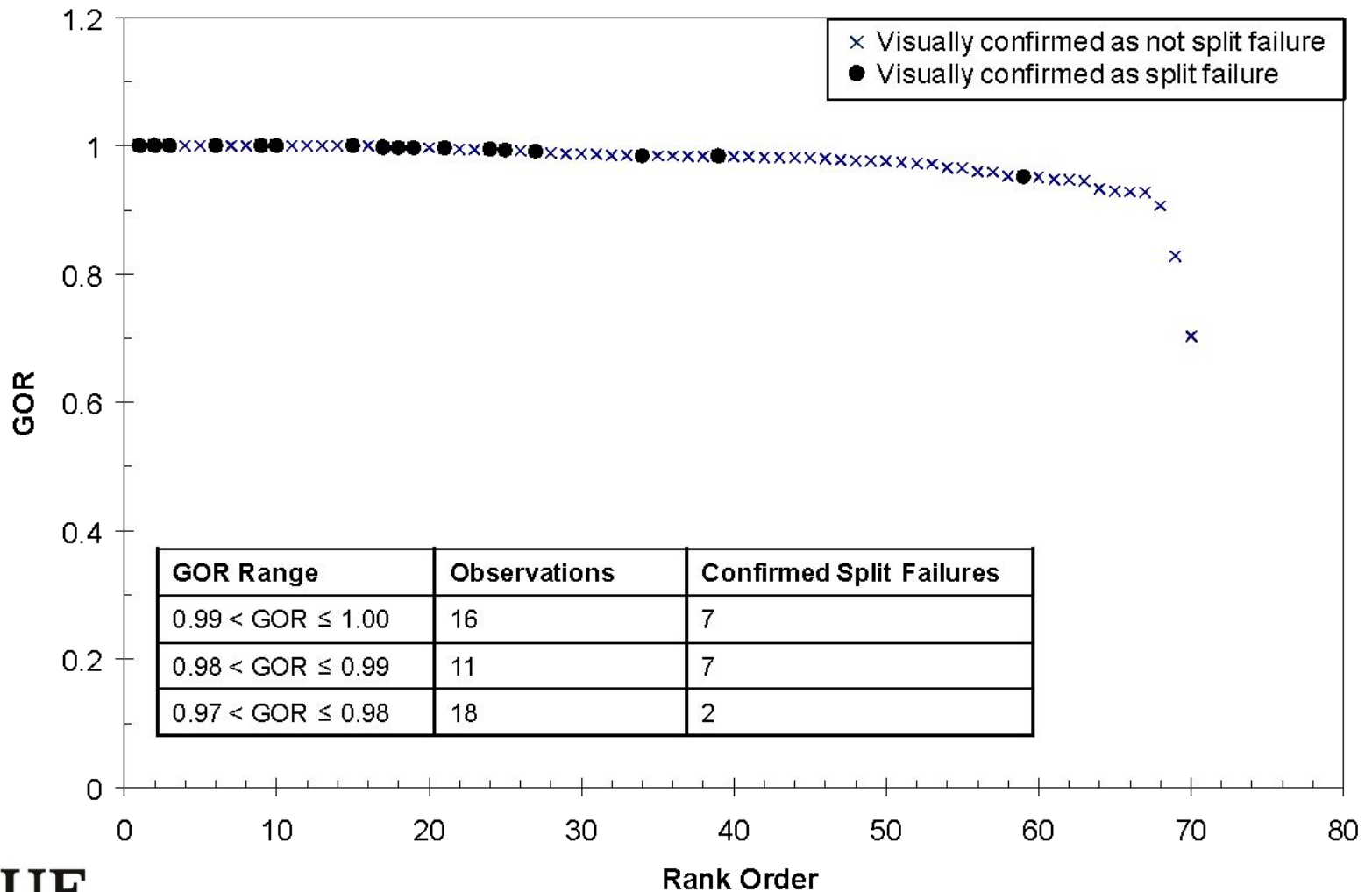
Impact of 5s reallocation on Split Failures

| Timing Plan | Duration of Operation | Split Failures (Before) | Number of Phases (Before) | Split Failures (After) | Number of Phases (After) |
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Split Failures (v/c)



Split Failures (GOR)



Intersection Saturation, X_c

- The degree to which the capacity of the entire intersection is being utilized.

$$X_c = \sum_i (v / s)_{ci} \left(\frac{C}{C - L} \right)$$

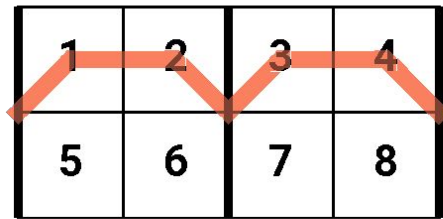
$(v / s)_c \rightarrow$ Critical Ratio of Volume to Saturation

$C \rightarrow$ Cycle Length (s)

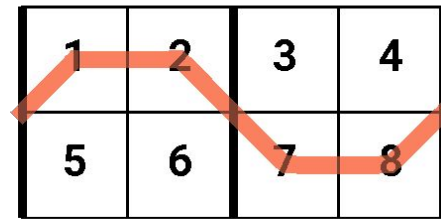
$L \rightarrow$ Lost Time (s)

X_c for Dual-Ring, Eight Phase Case

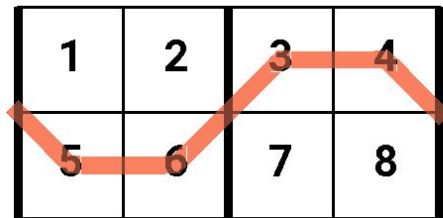
$$X_c = \left[\text{Max} \left(\frac{V_1 + V_2}{S}, \frac{V_5 + V_6}{S} \right) + \text{Max} \left(\frac{V_3 + V_4}{S}, \frac{V_7 + V_8}{S} \right) \right] \left(\frac{C}{C - L} \right)$$



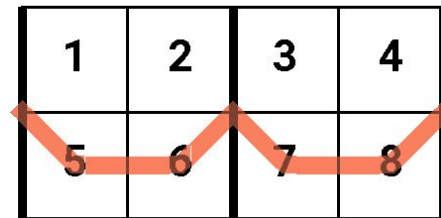
(a) Critical Path 1234



(b) Critical Path 1278



(c) Critical Path 5634



(d) Critical Path 5678

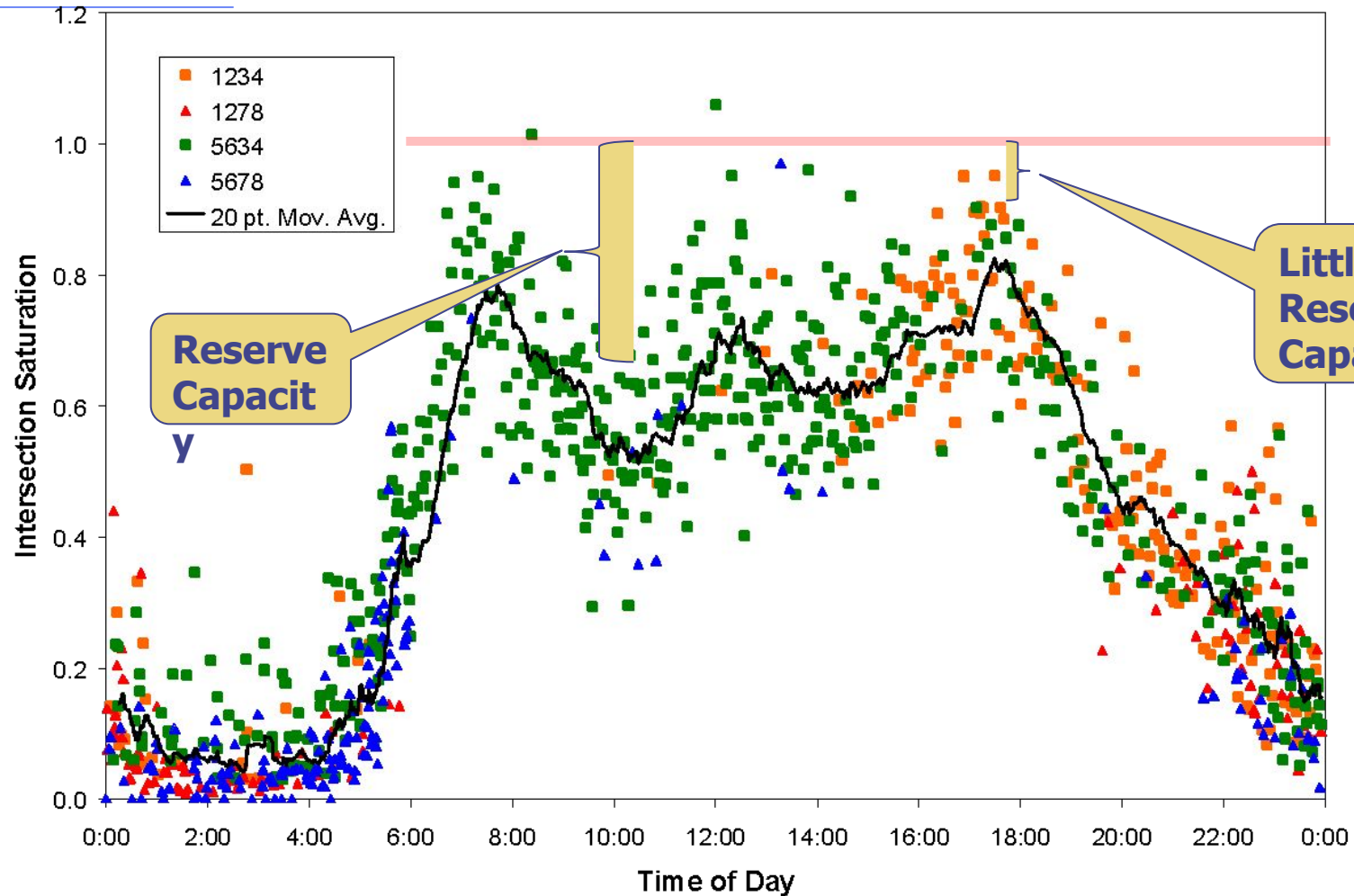
Intersection Saturation

$$X_c = \sum_i (v/s)_{ci} \left(\frac{C}{C-L} \right)$$

$(v/s)_c \rightarrow$ Critical Ratio of Volume to Saturation

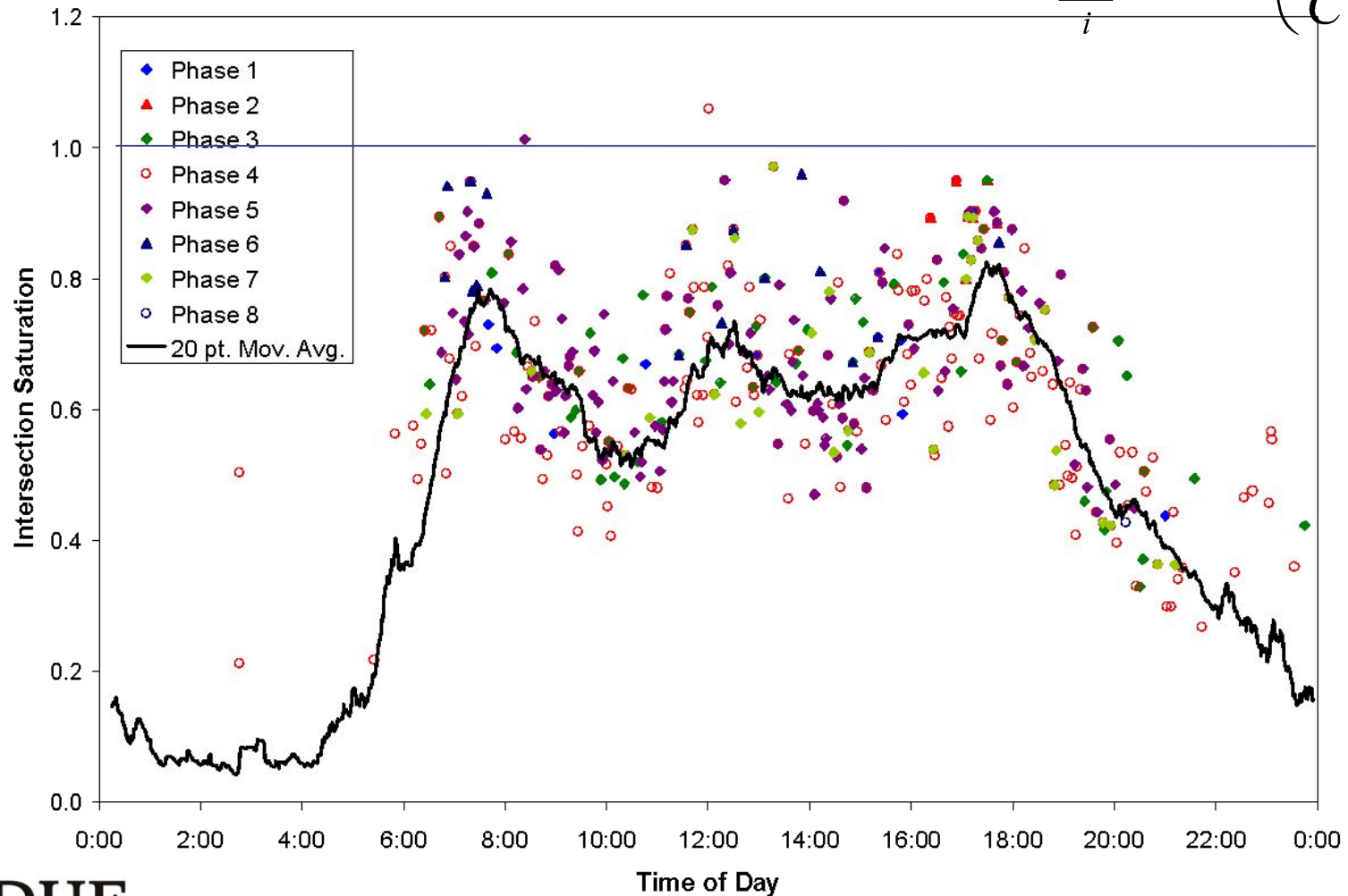
$C \rightarrow$ Cycle Length (s)

$L \rightarrow$ Lost Time (s)



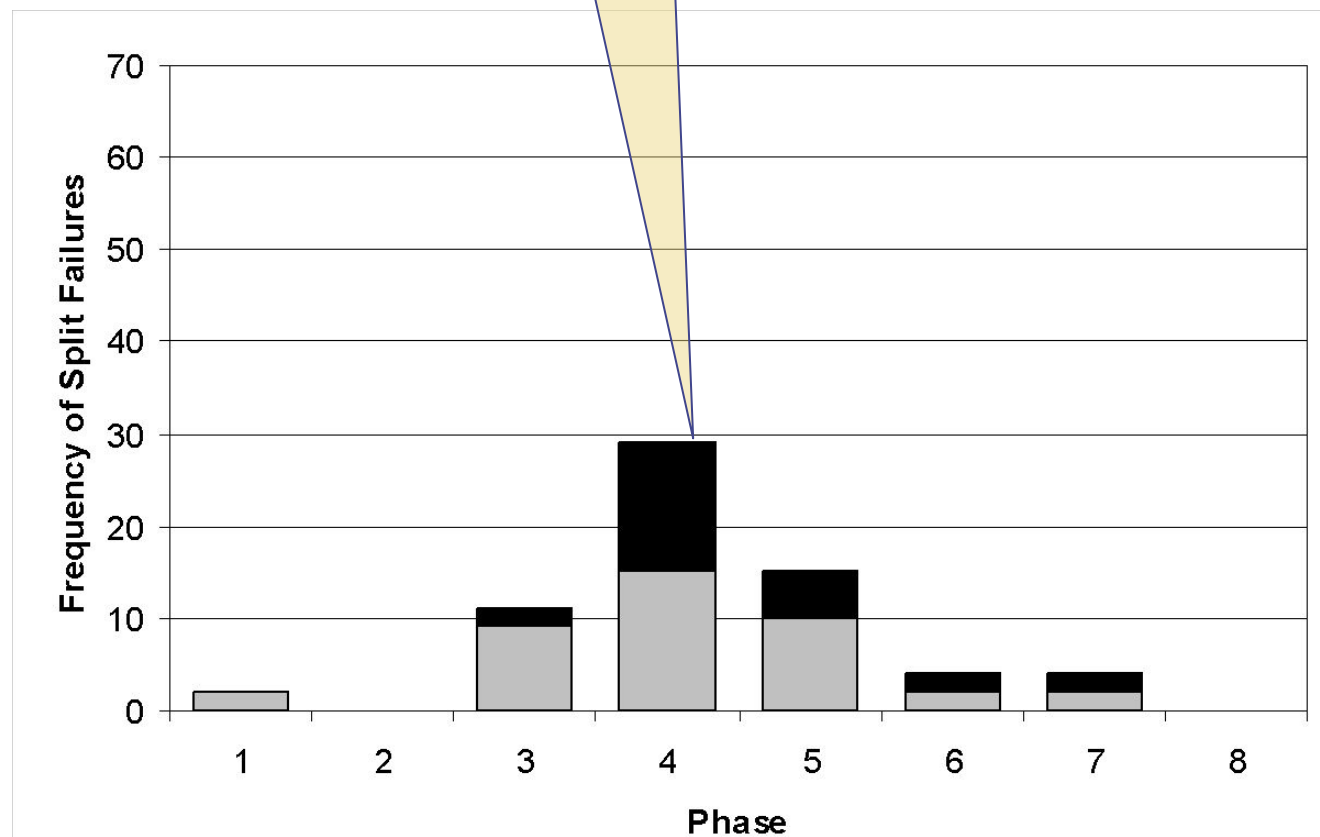
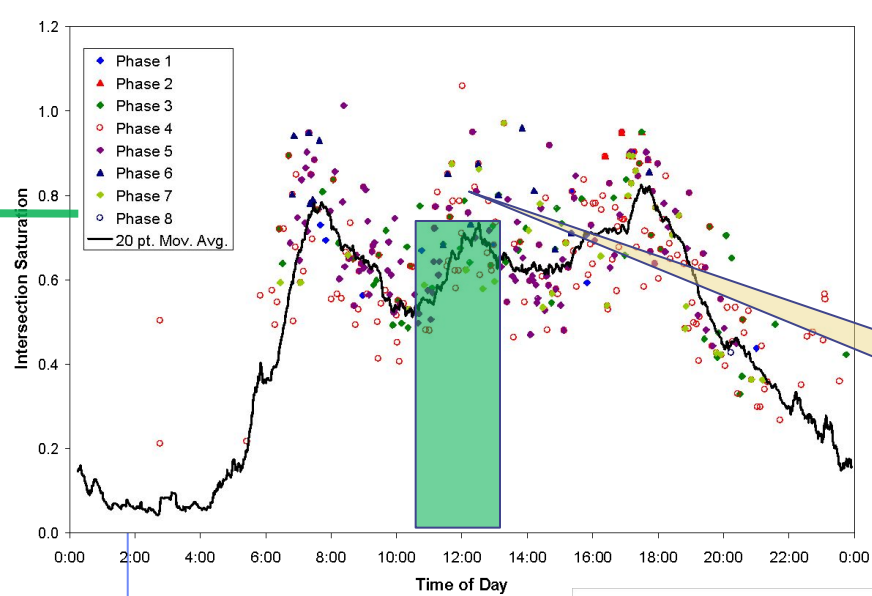
24-Hour Plot of Intersection Saturation With Split Failures Indicated

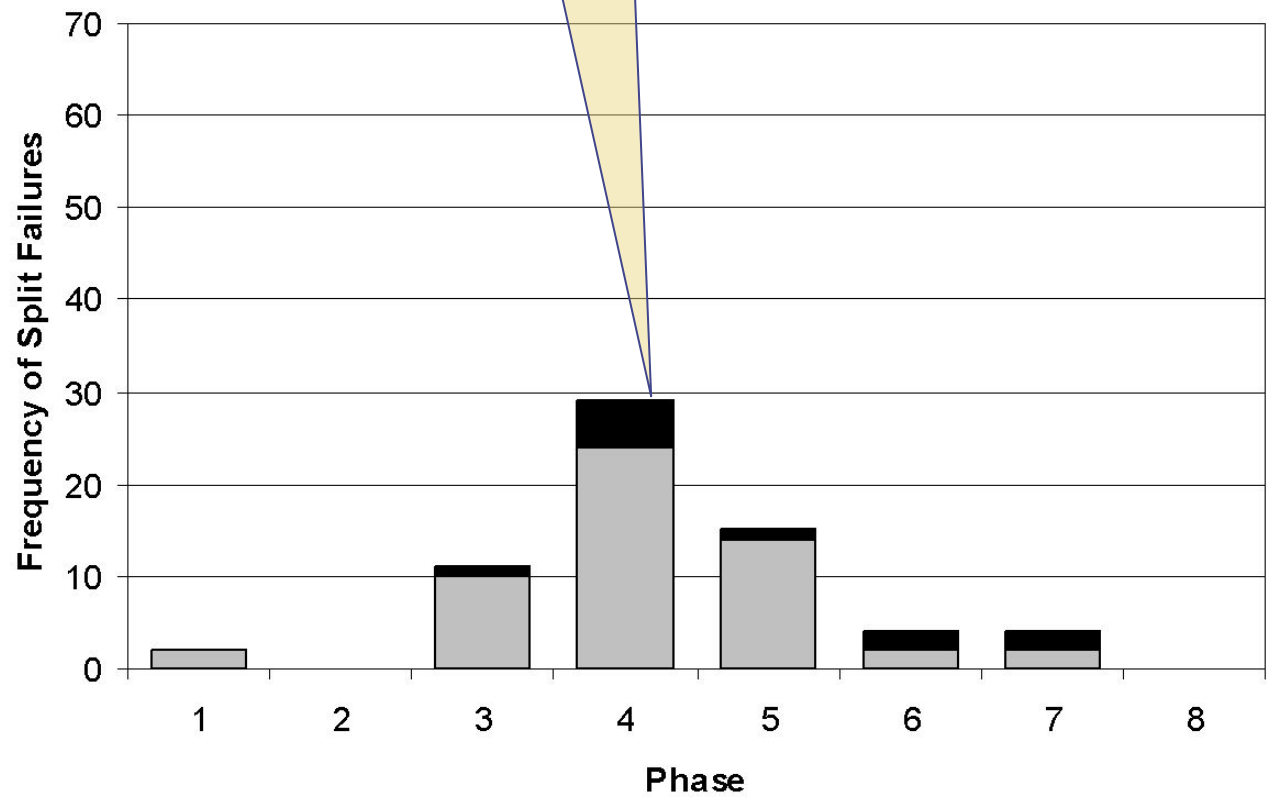
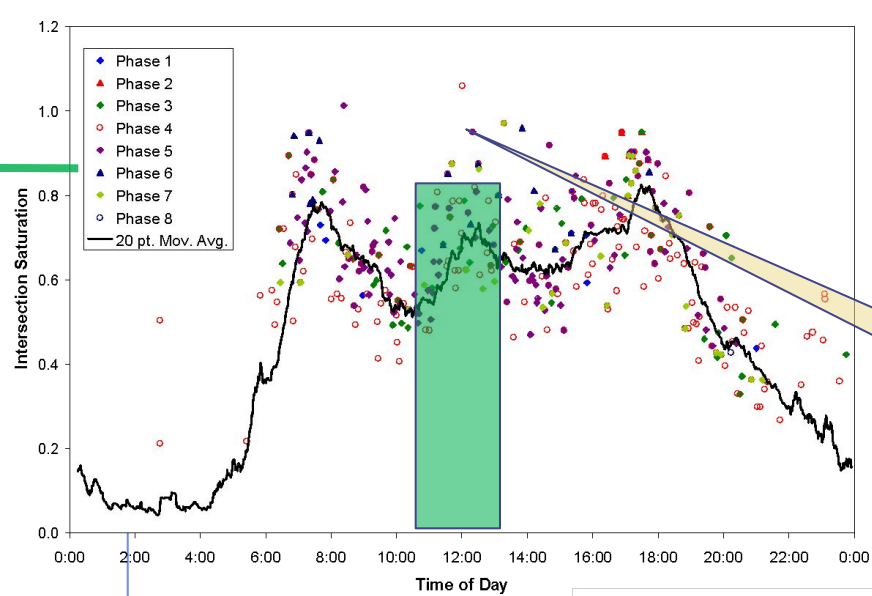
$$X_c = \sum_i (v/s)_{ci} \left(\frac{C}{C-L} \right)$$



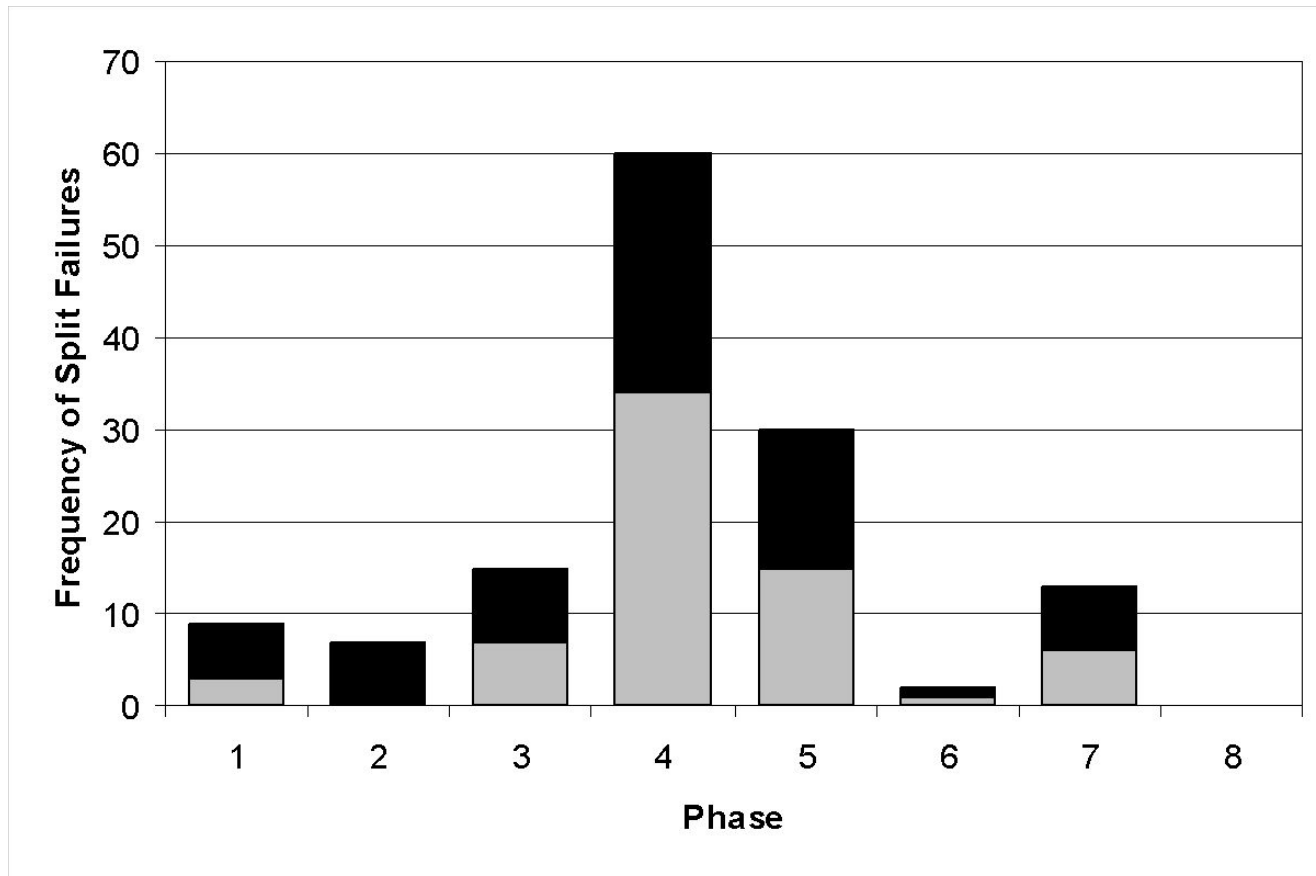
Addressing Split Failures

- $X_C < 1.0$ suggests that there is spare capacity in the intersection.
- For example, we may consider $X_C = 0.75$ as the cutoff point for cycles to be considered easily “correctable” with adjusted splits.

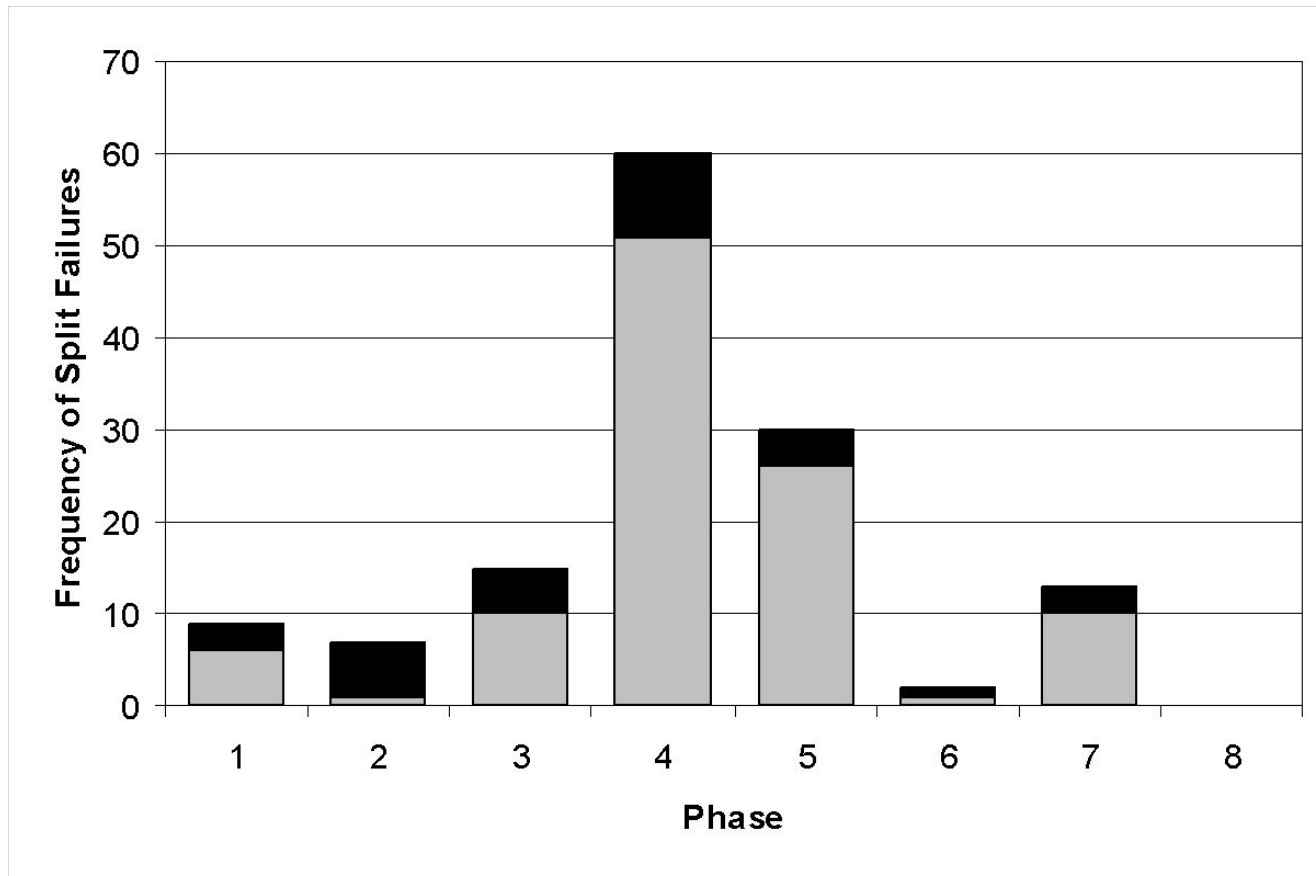




3:00 PM—7:00 PM, ($X_c=0.75$)



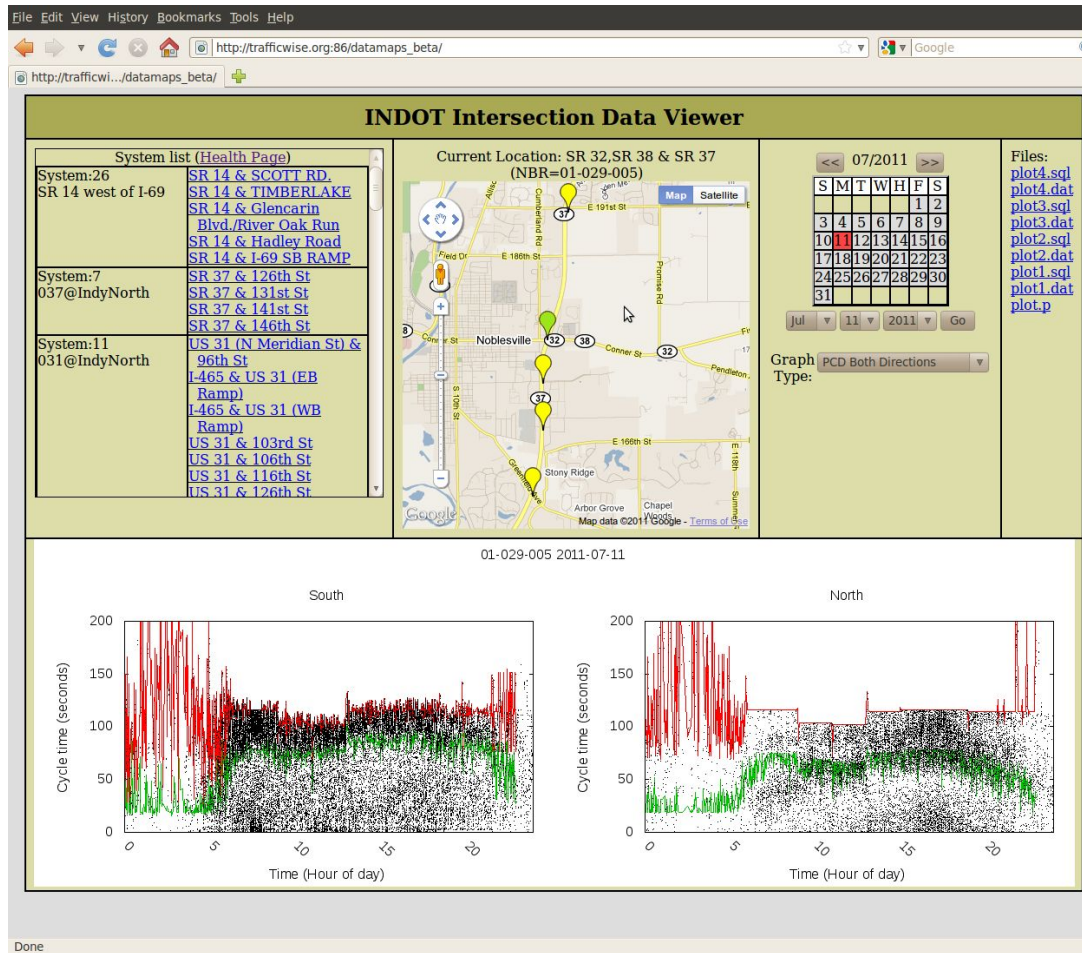
3:00 PM—7:00 PM, ($X_c=0.85$)



Flow Profiles



Original Instrumented Intersection SR37/SR32



Flow Profiles Overview

Applications Places System VirtualBox OSE Manager 1-WinXP [Running] - Vir... jsturdevant@dell-e150... Mozilla Firefox Mon Apr 25, 4:19 PM

Mozilla Firefox
File Edit View History Bookmarks Tools Help

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

Most Visited Getting Started Latest Headlines

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 |
| System:1R | SR 37 @ SR 144 |

Current Location: SR 37 & 141st St
(NBR=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 14 2011 Go

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](#)

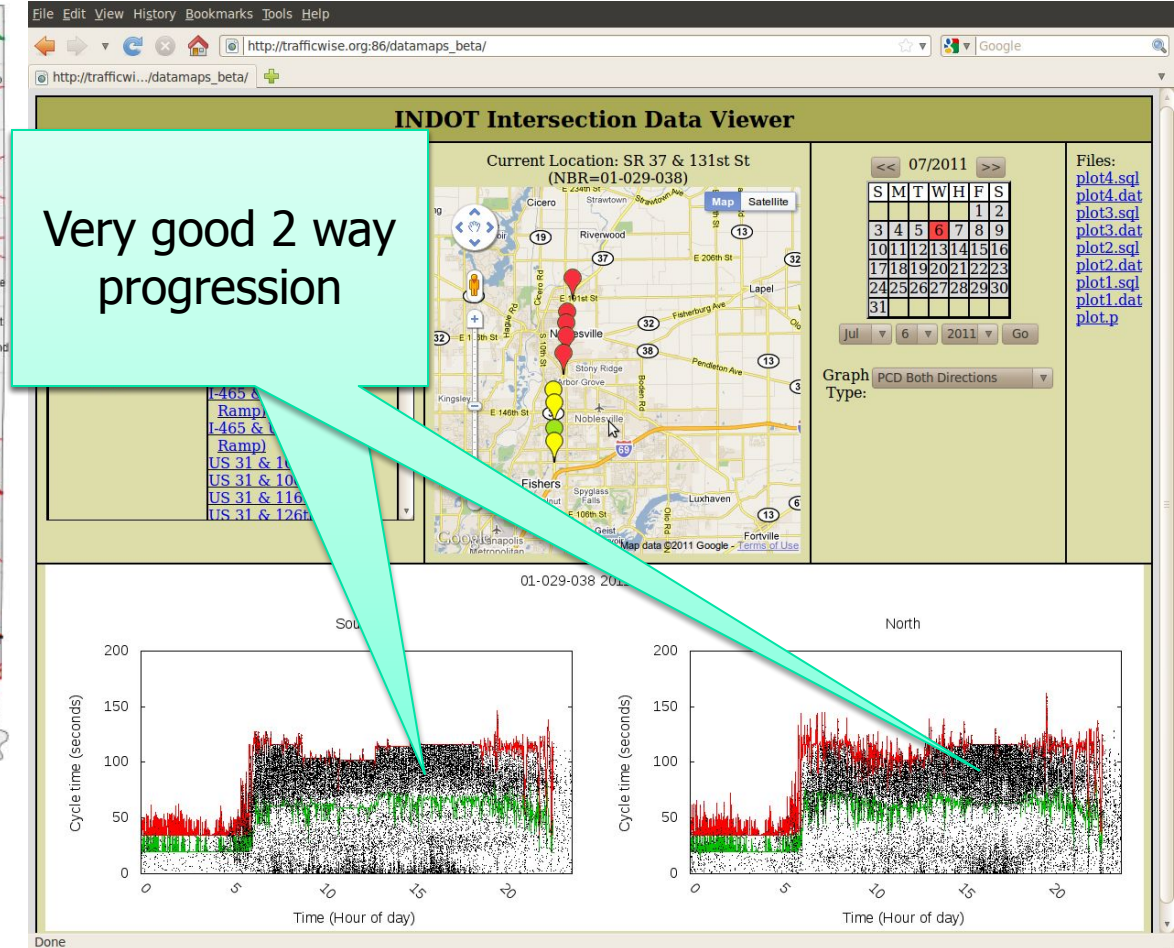
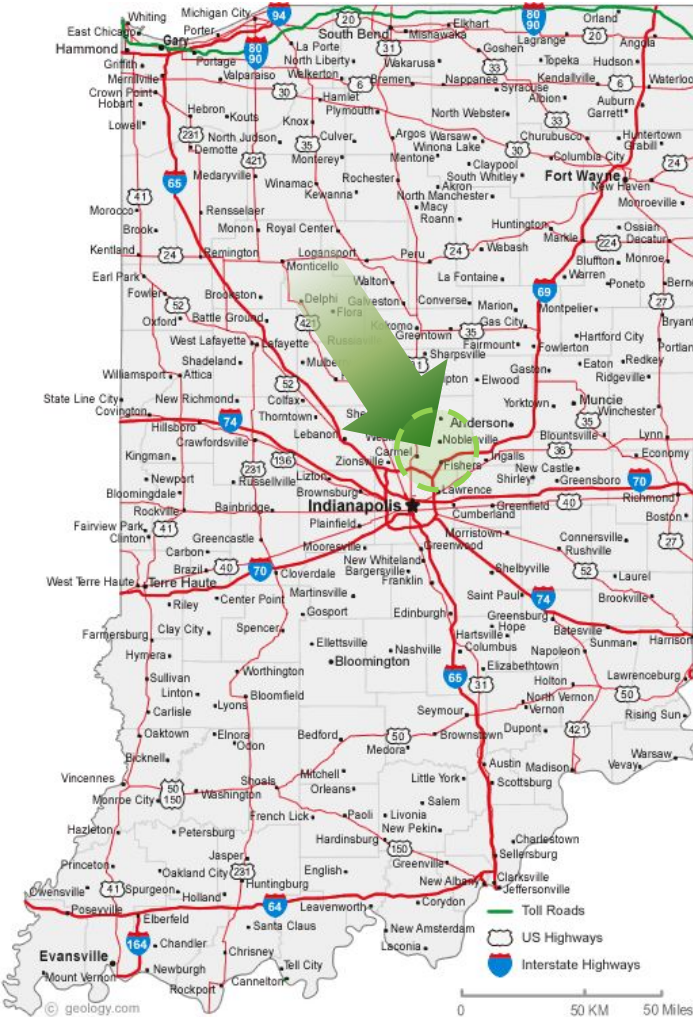
01-029-059 2011-04-14 (06:00:00.3-09:00:00.2)

South

North

Done

SR37 Fishers/Noblesville- (9)



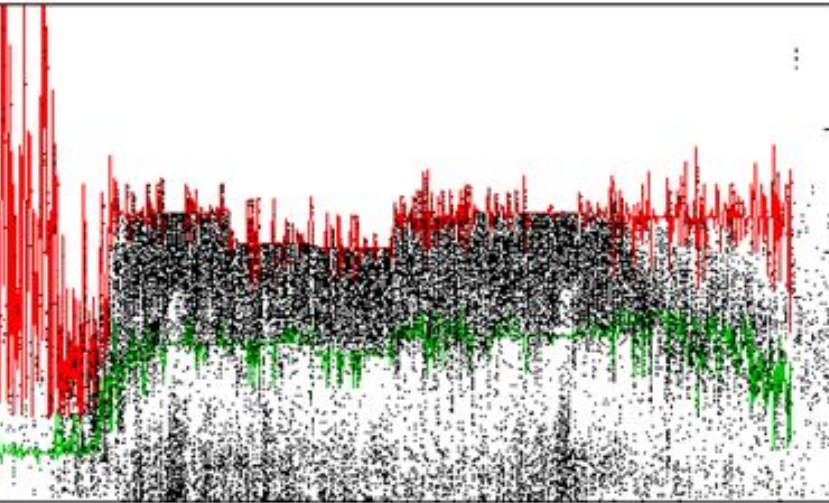
Very good 2 way progression



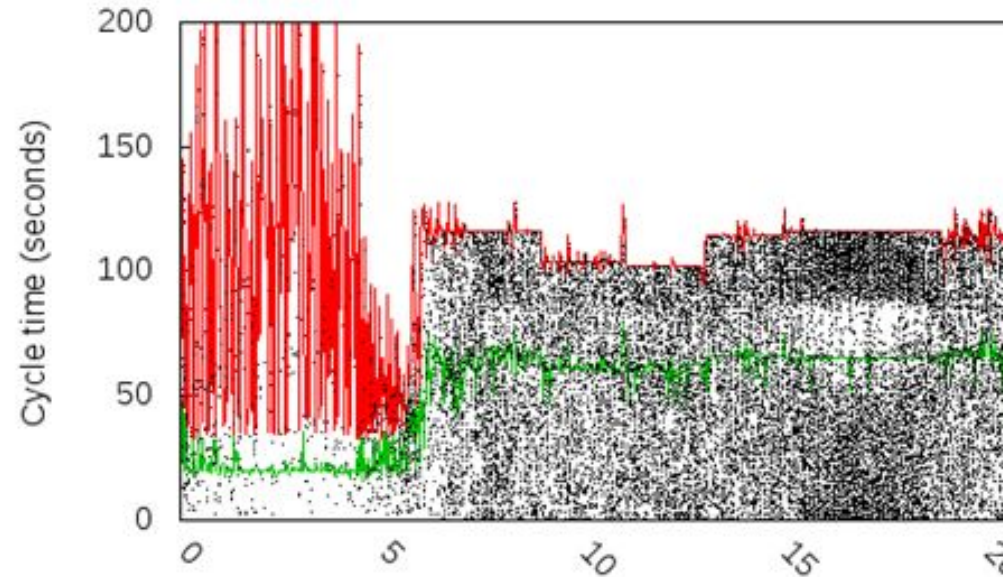
SR-37 & 126th adjacent to I-69

01-029-042 2011-07-6

South

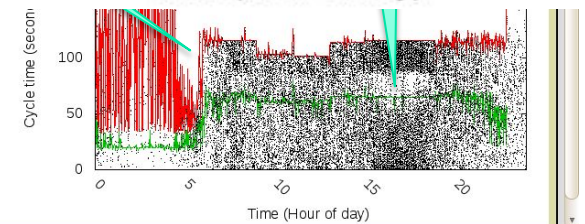
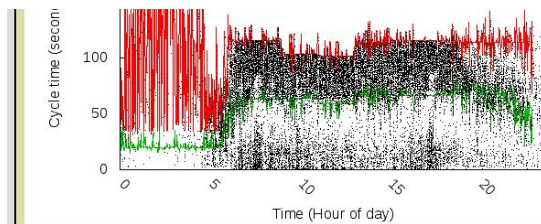


North

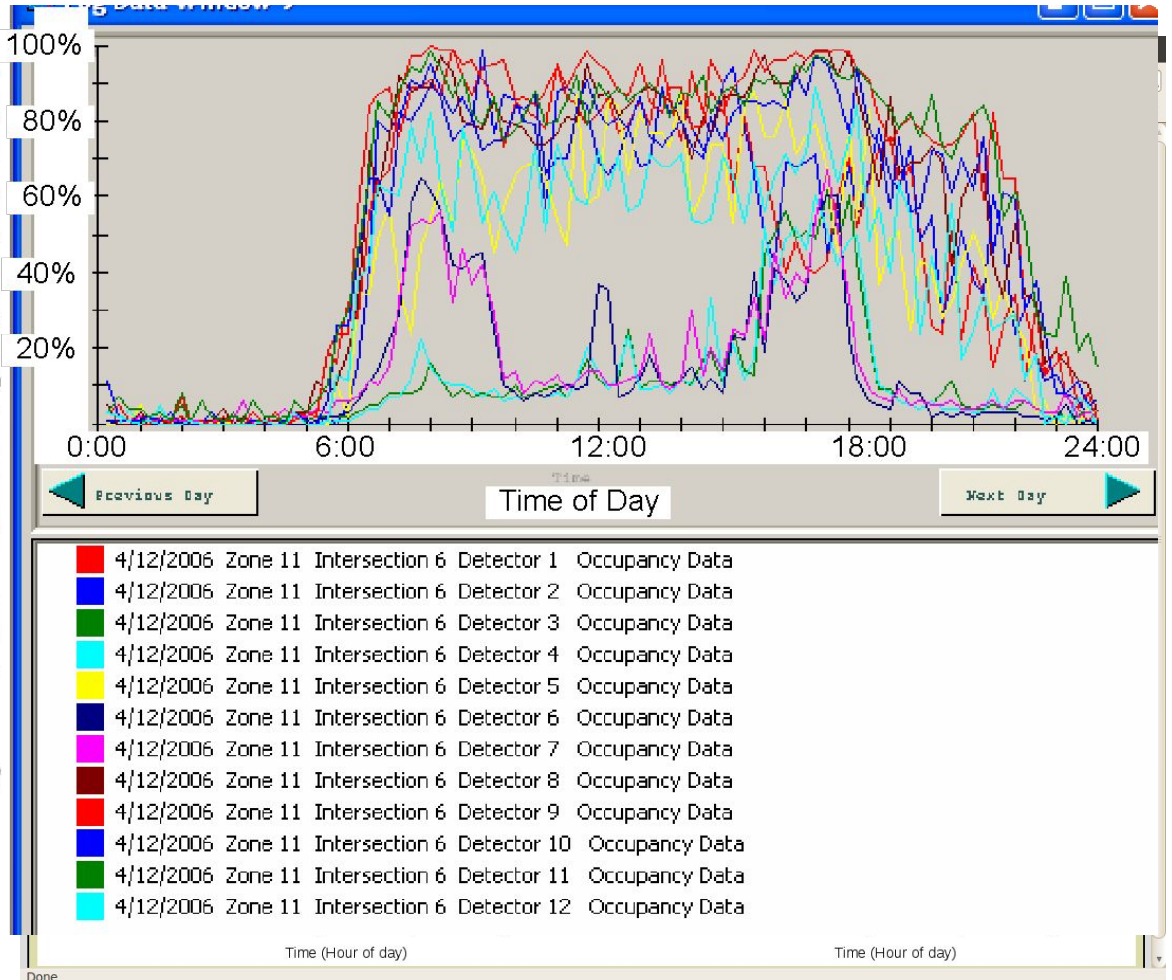
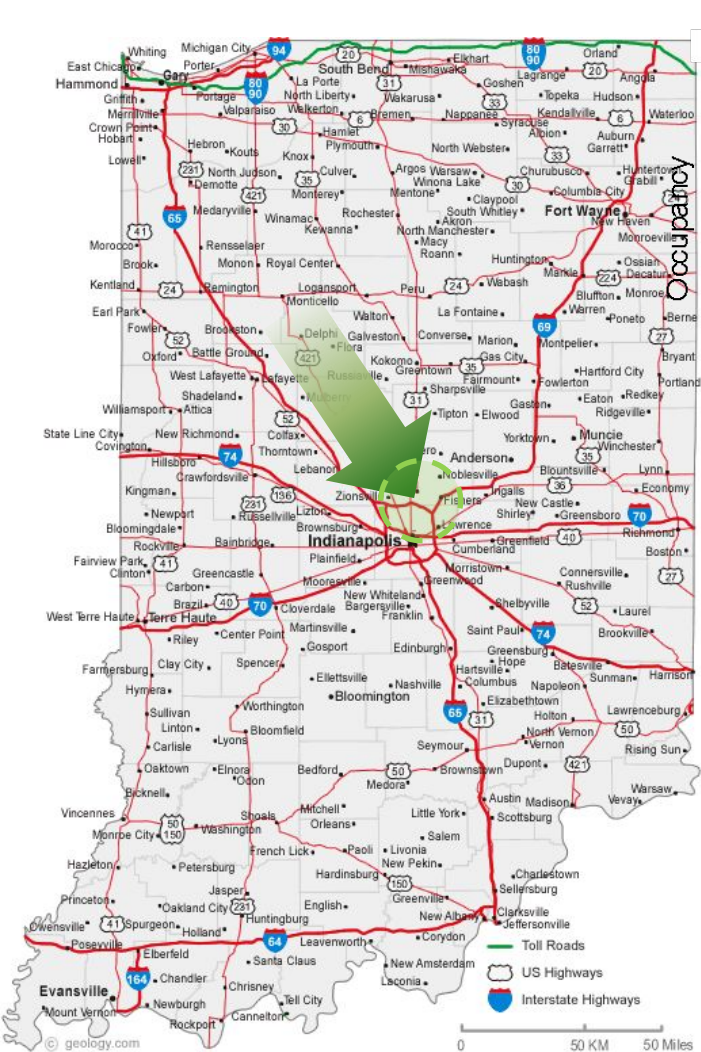


Time (Hour of day)

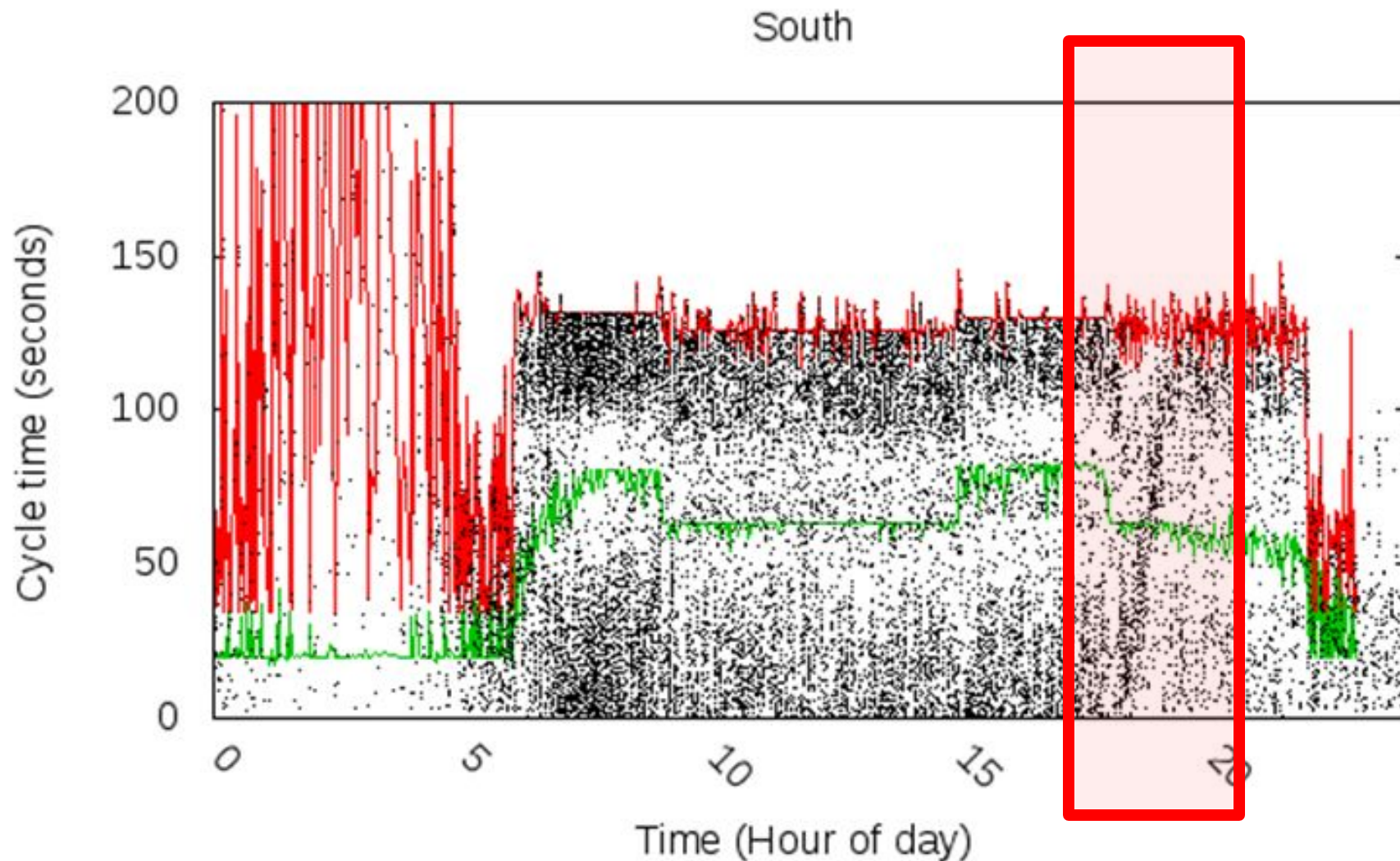
Time (Hour of day)



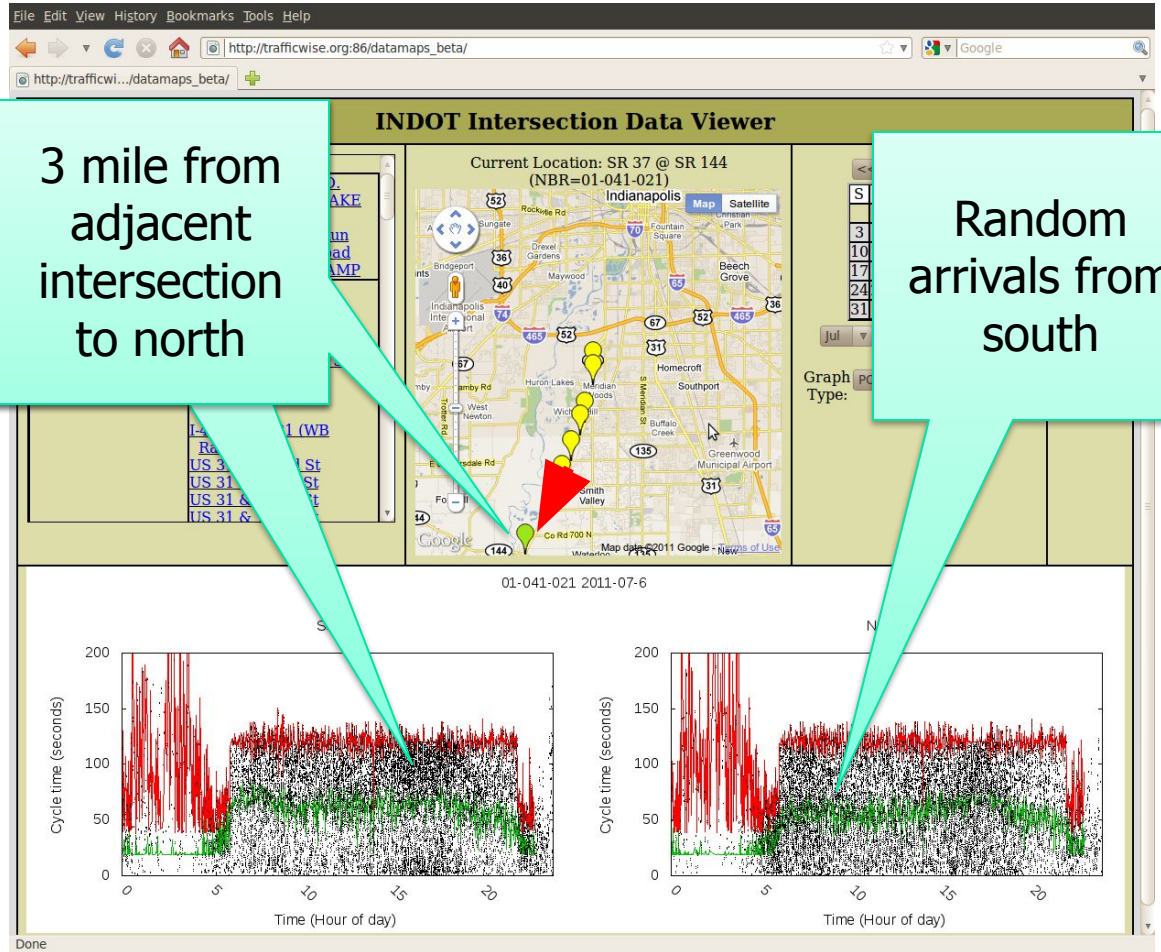
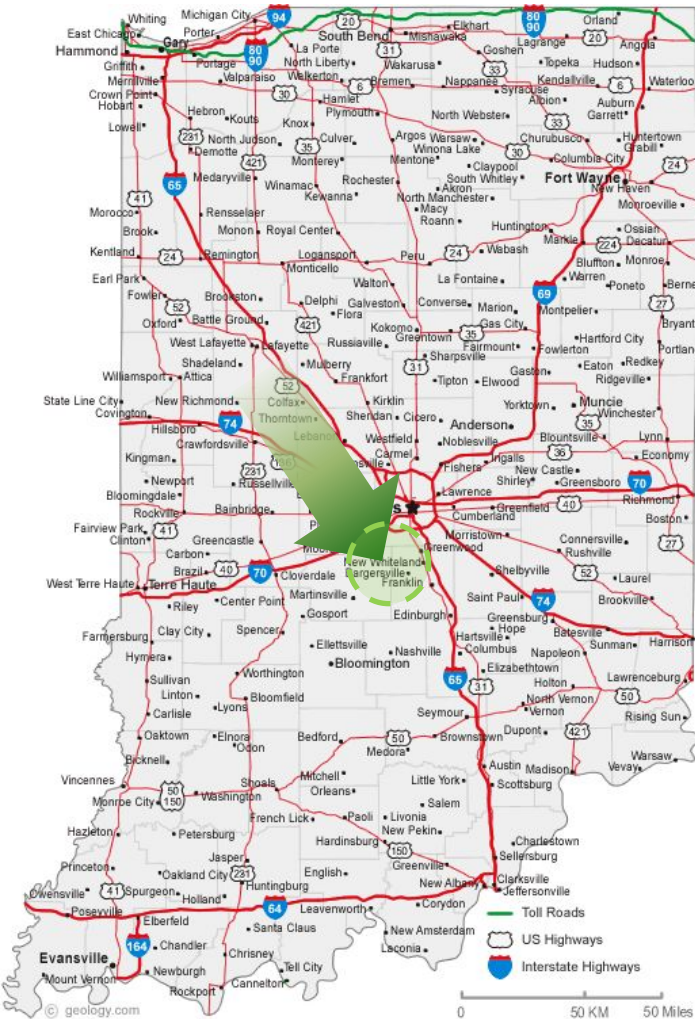
US31 N @ 116th



US 31 @ 126th (8 in system)

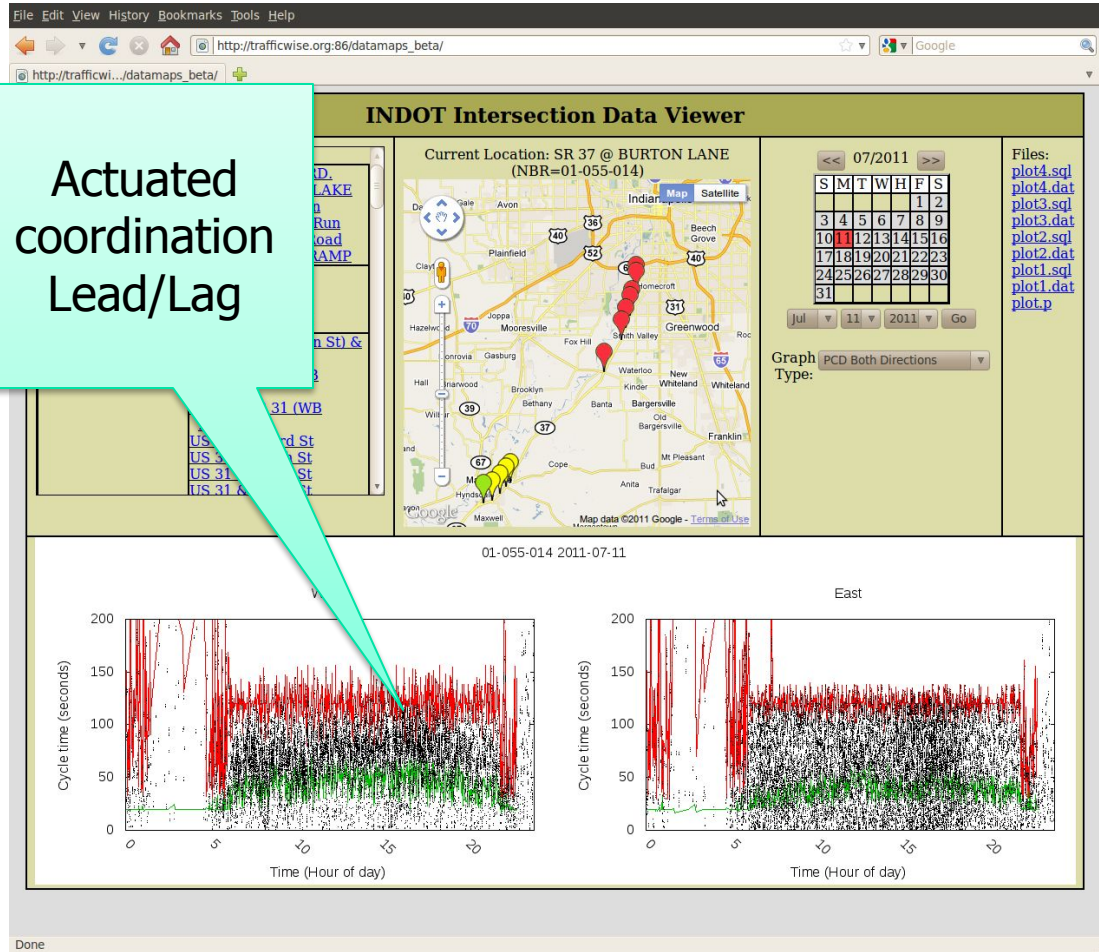
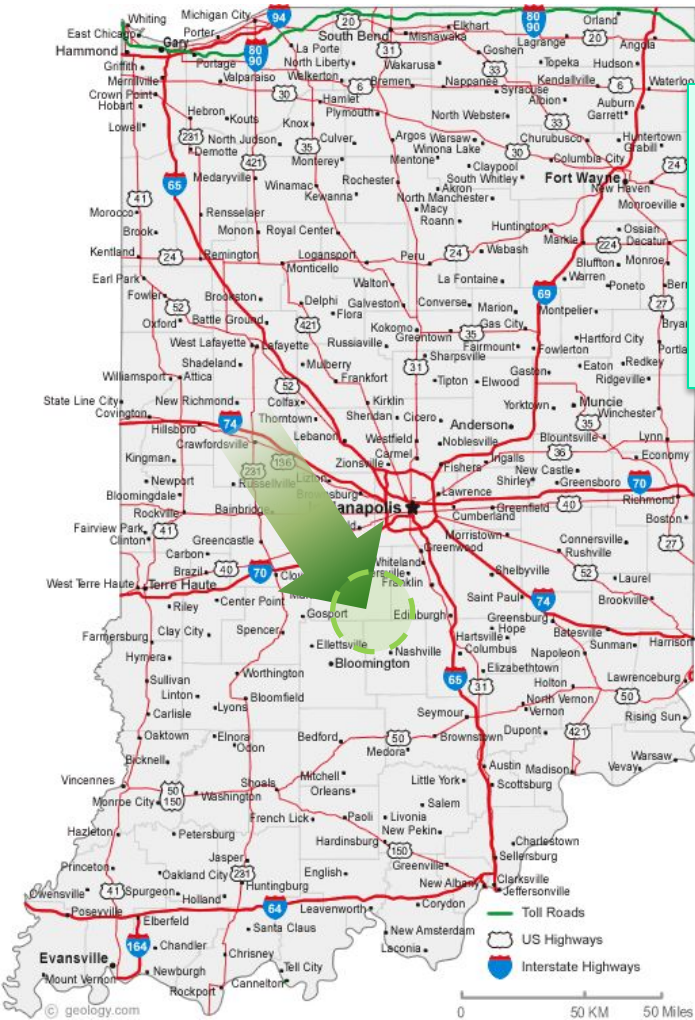


SR 37 South



Indy-Bloomington

SR 37- Martinsville



Actuated
coordination
Lead/Lag



SR 14- Ft Wayne

East

