US 30 Before/After: Measuring & Quantifying Traffic Signal Success Stories

Purdue University

&

Indiana Department of Transportation
Overview Map

24 Intersections Observed
~74,000 Configurable Parameters at Each Intersection

192M Statewide!

~1.6M Parameters

Default Database

Default Database Query of Each Intersection

Longitudinal Query of Intersection Controller Databases
How Many Parameters Are Used?

- **Isolated (Free) Operation**
- **Coordinated Operation**

<table>
<thead>
<tr>
<th>INTERSECTION ID</th>
<th>COUNT OF ALTERED PARAMETERS</th>
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About 2,000 Used
Signal Timing Process with Feedback Loops

I. Define Objectives, Assess and Prioritize activities by Time of Day and location

II. Assemble relevant data to support timing and documentation objectives

III. Software Modeling

IV. Timing Design and Documentation

V. Deployment

VI. Assess

Project Focus
Approach for Assessing Corridor with GPS/Floating Car Data

1. **Traffic “feels” slow**
   - **Data Collection**
   - GPS/Floating Car Data
   - Assess and Redesign Timing Plans
   - Retime Signal

2. **Re-Evaluation Process**
Travel Time – Eastbound (2/03/2012)  TT= 18.6 mins
Travel Time - Westbound (2/03/2012) TT = 18.8 mins

Distance traveled (miles)

Time of Day

Free Flow Speed

Control Delay

Start Node

End Node

~90 Sec

~60 Sec

~60 Sec

~60 Sec

~30 Sec

WESTBOUND

Travel Time – Westbound (2/03/2012) TT= 18.8 mins

Distance traveled (miles)
Approach for Assessing Corridor with Bluetooth Probe Data

Traffic “feels” slow

Data Collection

Bluetooth Probe Data

GPS/ Floating Car Data

Assess and Redesign Timing Plans

Retime Signal

Re-Evaluation Process
**Travel Time – EastBound (02/03/2012)**

**TT = 18.6 minutes**

**Fastest driver in ~11 minutes**

(Free Flow Travel Time)

- **Travel Time (TT):** 18.6 minutes
- **Control Delay:** 7 minutes
- **Free Flow Speed:** ~90 Sec
- **Delay:** ~60 Sec
- **Distance Traveled:** Miles
- **Time of Day:** PM
- **Start Node:** 2:05 PM
- **End Node:** 2:10 PM
- **EASTBOUND:**

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**SYSTEM BLUETOOTH TRAVEL TIME (MINUTES)**

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**FINISH**

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**TRAVEL TIME = 18.6 Minutes**

**CONTROL DELAY = 7 Minutes**
Eastbound

TRAVEL TIME = ~18 Minutes

Fastest driver in ~11 minutes (Free Flow Travel Time)

This line corresponds to control delay of 7 minutes
Thursday, February 9, 2012 (Eastbound)

These vehicles don’t make the green and have to wait for next cycle.

Progressing through the system as desired.
Thursday, February 9, 2012 (Westbound)

These vehicles don’t make the green and have to wait for next cycle.

Vehicles not making 2 greens and waiting?

Progressing through the system as desired.
Approach for Assessing Corridor with High Resolution Controller Data

Traffic “feels” slow

Data Collection

Bluetooth Probe Data

GPS/ Floating Car Data

Assess and Redesign Timing Plans

Retime Signal

High Res. Controller Data

Re-Evaluation Process
High Resolution Controller Data
Recording, Transferring, and Storing
Purdue Coordination Diagram (PCD)

Elements and Construction of a Single Cycle

- Loop Detection
- Coordination

- Cycle begins
- Green phase begins
- Green phase ends
- Cycle ends

- Time of day
- Time in cycle
- Green window
- Red
- Green

- 0 sec 12:00:00
- 50 sec
- 70 sec 12:01:10
- 90 sec
- 120 sec 12:02:00
Purdue Coordination Diagram (PCD)
Elements and Construction of Multiple Cycles
Thursday, February 9, 2012 (Eastbound)

Additional control delay of Cycle Length (140s)

Progressing through the system as desired
Austin Ave. EB PCD
Segmentation Due to Adjacent System

01-045-225 2012-02-1

West

Cycle time (seconds)

Time (Hour of day)

East

Cycle time (seconds)

Time (Hour of day)
Austin Ave. EB PCD
Segmentation Due to Adjacent System

Segmented?
Time Space Diagram
Offset Adjustment

Shift Entire System
Time Space Diagram
Offset Adjustment
Time Space Diagram
Offset Adjustment

System 1

System 2

Distance

Time
Time Space Diagram
Offset Adjustment - Improved

System 1

System 2

Distance

Good Vehicle Trajectory Across Systems

Good Vehicle Trajectory Across Systems

Time
Austin Ave.
Pattern 1
The cycle was 140s for all patterns and intersections.
Austin Ave.
Pattern 1

SPLITS
Varied by intersection and time of day. Presumed optimized.
Offsets
Varied by intersection and time of day...feasible to adjust.
Austin Ave.

5 Patterns
Austin – Step 01
Program 1 / Pattern 0

Select Program Step
- Step 1
  - Program: 1
  - Step Begins: 0000
  - Pattern: 0
  - Override: No
PROGRAM Identifies start time a patterns.
Austin Ave.

3 Programs with 13 Steps

PROGRAM 1
(Weekday)

PROGRAM 2
(Saturday)

PROGRAM 3
(Sunday)
Weekly Program

Aries Data Entry - US 30 @ Austin (01-045-225)

Weekly Program

Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday

Data Entry Limits: Minimum: 3.0  Maximum: 25.5  Phase 1 Yellow Clearance
Only 1 weekly program
Austin Ave.
Comprehensive Schedule

Weekly Program

Program 1 (Weekday) Steps 1-6

Program 2 (Saturday) Steps 7-10

Program 3 (Sunday) Steps 11-13

Pattern 0

Pattern 1

Pattern 2

Pattern 3

Pattern 4
Austin – Program 1 (Weekday)
February 1
Robin Hood – Program 1 (Weekday)
February 1
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

[Graph showing time vs. cycle time with marked hours.]
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
Austin EB PCD (coming from Adjacent System) BEFORE

Monday, February 6, 2012 – 71.7% on Green
Austin EB PCD (coming from Adjacent System) AFTER Monday, February 13, 2012 – 77.1 % on Green
Austin EB PCD (coming from Adjacent System) – Before/After
February 6, 2012 (71.7 P.O.G) vs. February 13, 2012 (77.1 P.O.G)
5.4 % more Vehicles arriving on green (1,706 more detections)
## INDOT Intersection Data Viewer

### System 21
- **US 30 / SR 67 & Carroll Rd**
- **US 30 (81st Ave.) @ Rhode Island Ave.**
- **I-65 SB Ramp @ US 30**
- **I-65 NE Ramp @ US 30**
- **US 30 (81st Ave.) @ Mississippi St (So Lake 'A')**
- **US 30 (81st Ave.) @ South Lake Mall 'B'**
- **US 30 (81st Ave.) @ South Lake Mall 'C'**
- **US 30 (81st Ave.) @ South Lake Mall 'D'**
- **US 30 (81st Ave.) @ Entrance #5**
- **US 30 (81st Ave.) @ Colorado St**
- **US 30 at Clay Street**

### System 24
- **US 30 (81st Ave.) @ Tannier Pl**
- **US 30 (81st Ave.) @ SR 55 (Teff St)**
- **US 30 (81st Ave.) @ Polo Club Dr/Saturn Dr**

### Current Location
- **US 30 (81st Ave.) @ Colorado St**
- **NBR=01-045-269**

### Map and Graphs
- **Map**
- **Satellite**
- **Graph Type:** PCD Both Directions
- **Date:** 01-045-269 2012-02-27

### Cyclist Time (Seconds)

#### West
- Time (Hour of Day)
- Cycle Time (Seconds)

#### East
- Time (Hour of Day)
- Cycle Time (Seconds)
### System 21
- US 36 SR 67 & Carroll Rd
- US 30 (81st Ave) @ Rhode Island Ave
- I-65 SB Ramp @ US 30
- I-65 NB Ramp @ US 30
- US 30 (81st Ave) @ Mississippi St (So Lake A)
- US 30 (81st Ave) @ South Lake Mall Entry 'B'
- US 30 (81st Ave) @ South Lake Mall Entry 'C'
- US 30 (81st Ave) @ South Lake Mall Entry 'D'
- US 30 (81st Ave) @ Entrance #5
- US 30 (81st Ave) @ Colorado St
- US 30 at Clay Street

### System 24
- US 30 (81st Ave) @ Taryn Pl
- US 30 (81st Ave) @ SR 55 (Tatl St)
- US 30 (81st Ave) @ Polo Club Dr/Saturn Dr

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**Current Location:** US 30 (81st Ave) @ Entrance #5  
(NBR=01-045-322)

**Date:** 02/27/2012

**Graph Type:** PCD Both Directions

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**West**

<table>
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<th>Cycle time (seconds)</th>
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<tbody>
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<td>0</td>
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<tr>
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**Time (Hour of day):**

0 5 10 15 20 25

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**East**

<table>
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<tr>
<th>Cycle time (seconds)</th>
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<tr>
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<tr>
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**Time (Hour of day):**

0 5 10 15 20 25
INDOT Intersection Data Viewer

System 24
US 30 / SR 53
[Merrillville]
US 30 (81st Ave) @ Taney Pl
US 30 (81st Ave) @ SR 55 (Taft St)
US 30 (81st Ave) @ Polo Club
DeSauve Dr
US 30 (81st Ave) @ Grant St
US 30 (81st Ave) @ Meijer Entr
US 30 (81st Ave) @ Merrillville Rd
US 30 (81st Ave) @ Kmart / Frontage Rd
SR 53 (Broadway) @ 69th Place
SR 53 (Broadway) @ 73rd Ave
SR 53 (Broadway) @ 78th Ave
SR 53 (Broadway) @ 80th Pl
SR 53 (Broadway) @ 84th Ave
SR 53 (Broadway) @ Century Mall
Entr
SR 53 (Broadway) @ 86th Ave
SR 53 (Broadway) @ 87th Ave
US 30 (81st Ave) @ SR 53 (Broadway)
INDOT Intersection Data Viewer

Current Location: US 30 (Lincoln Hwy) @ Clute Ave.
(NBR=01-045-245)

System 26
US 30 [Scherer / Merrillville - East of US 41]

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

Graph:
Type:

01-045-245 2012-02-27

West

East

Cycle time (seconds)

Time (Hour of day)
“Black Friday Sales Events” (Friday 11/25/11)
US 30 & SR 53

01-045-098 2011-11-25

01-045-098 2012-02-3
Weekend Sales Events (Saturday 11/26/11)  
US 30 & SR 53  
01-045-098 2011-11-26
Weekend Sales Events (Sunday 11/27/11)
US 30 & SR 53
01-045-098 2011-11-27

C1-045-098 2012-02-5

Weekend Sales Events (Sunday 11/27/11)
US 30 & SR 53
01-045-098 2011-11-27

C1-045-098 2012-02-5

Weekend Sales Events (Sunday 11/27/11)
US 30 & SR 53
01-045-098 2011-11-27

C1-045-098 2012-02-5
Thanksgiving Week (Wednesday 11/23/11)
US 30 & I-65 NB Ramp

01-045-364 2011-11-23

01-045-364 2012-02-1
Thanksgiving Holiday (Thursday 11/24/11)  
US 30 & I-65 NB Ramp

01-045-364 2011-11-24

West

Cycle time (seconds)

Time (Hour of day)

East

Cycle time (seconds)

Time (Hour of day)

01-045-364 2012-02-2

West

Cycle time (seconds)

Time (Hour of day)

East

Cycle time (seconds)

Time (Hour of day)
“Black Friday Sales Events” (Friday 11/25/11)
US 30 & I-65 NB Ramp

01-045-364 2011-11-25

01-045-364 2012-02-3

West

East

Cycle time (seconds)

Time (Hour of day)
Weekend Sales Events (Sunday 11/27/11)
US 30 & I-65 NB Ramp

01-045-364 2011-11-27

West

East

01-045-364 2012-02-5

West

East

Cycle time (seconds)

Time (Hour of day)