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

Purdue University

&

Indiana Department of Transportation
Overview Map

24 Intersections Observed
US-30 Corridor
22 Intersections in Signal System

74,000 Parameters/int

Isolated (Free) Operation

Coordinated Operation

Map Area

Indianapolis, IN

1,000 M

4,000 FT

74,000 Parameters/int

US-30 Corridor

22 Intersections in Signal System

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~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?

About 2,000 Used
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

Signal Timing Process with Feedback Loops
Approach for Assessing Corridor with GPS/Floating Car Data

Traffic “feels” slow

Data Collection → GPS/Floating Car Data → Assess and Redesign Timing Plans → Retime Signal

Re-Evaluation Process
Travel Time – Eastbound (2/03/2012)  TT= 18.6 mins
Travel Time – Westbound (2/03/2012) TT= 18.8 mins
Approach for Assessing Corridor with Bluetooth Probe Data

1. Traffic “feels” slow
2. Data Collection
3. Bluetooth Probe Data
4. GPS/Floating Car Data
5. Assess and Redesign Timing Plans
6. Retime Signal
7. Re-Evaluation Process
Eastbound
Travel Time – EastBound (02/03/2012) TT= 18.6 mins

- Fastest driver in ~11 minutes (Free Flow Travel Time)
- Control Delay = 7 Minutes
- Travel Time = 18.6 Minutes
Fastest driver in ~11 minutes (Free Flow Travel Time)

TRAVEL TIME = ~18 Minutes

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 → Assess and Redesign Timing Plans → Retime Signal

GPS/ Floating Car Data

High Res. Controller Data

Re-Evaluation Process
High Resolution Controller Data Recording, Transferring, and Storing

Cellular Modem → Cellular Network → Server/Database → Webpage/Graphs
Purdue Coordination Diagram (PCD)

Elements and Construction of a Single Cycle
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

Additional Control Delay
Austin Ave. EB PCD
Segmentation Due to Adjacent System
Time Space Diagram
Offset Adjustment

System 1

System 2

Distance

Cycle

Split

Offset

Arrival On
Red

Time
Time Space Diagram
Offset Adjustment

Shift Entire System

Distance

System 1

System 2

Time
Time Space Diagram
Offset Adjustment

System 1

System 2

Distance

Time
System 1

Distance

Good Vehicle Trajectory Across Systems

Good Vehicle Trajectory Across Systems

System 2

Time

Time Space Diagram
Offset Adjustment - Improved
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.
Pattern 1
Austin Ave.
5 Patterns
Austin – Step 01
Program 1 / Pattern 0
PROGRAM
Identifies start time a patterns.

Austin – Step 01
Program 1 / Pattern 0
Austin Ave.

3 Programs with 13 Steps

PROGRAM 1 (Weekday)

PROGRAM 2 (Saturday)

PROGRAM 3 (Sunday)
Weekly Program

TOD Weekly/Yearly

<table>
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<th>Weekly Program</th>
<th>1</th>
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<th>4</th>
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<th>7</th>
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</tbody>
</table>
Only 1 weekly program
Austin – Program 1 (Weekday)

February 1
Robin Hood – Program 1 (Weekday)
February 1
Comparison of Weekday Programs

Robin Hood

Austin
Austin EB PCD (coming from Adjacent System)
Austin EB PCD (coming from Adjacent System)

Austin Programs

![Graph showing cycle time (seconds) vs. time (hour of day) for East.]
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) – 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

Monday, February 6, 2012 – 71.7 % 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 [South Lake Mall]
- 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 Entrance 'B'
- US 30(81st Ave.) @ South Lake Mall Entrance 'C'
- US 30(81st Ave.) @ Entrance #5
- US 30(81st Ave.) @ Colorado St
- US 30 at Clay Street

System: 24
US 30 / SR 53 [Merrillville]
- US 30(81st Ave.) @ Taney Pl
- US 30(81st Ave.) @ SR 55 (Taf St)
- US 30(81st Ave.) @ Polo Club Dr/Saturn Dr

Current Location: US 30 at Clay Street (NER=01-045-391)

Files:
- plot4.scd
- plot4.dat
- plot3.scd
- plot3.dat
- plot2.scd
- plot2.dat
- plot1.scd
- plot1.dat
- plot.p

Graph: PCD Both Directions
Type:

01-045-391 2012-02-27
### System 21
- US 30 (South Lake Mall)
  - 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 (Entrance 'B')
  - US 30 (81st Ave.) @ South Lake Mall (Entrance 'C')
  - US 30 (81st Ave.) @ South Lake Mall (Entrance 'D')
  - US 30 (81st Ave.) @ Entrance #5
  - US 30 (81st Ave.) @ Colorado St
  - US 30 at Clay Street

### System 24
- US 30 / SR 53 (Merrillville)
  - US 30 (81st Ave.) @ Tennessee Pl
  - US 30 (81st Ave.) @ SR 53 (Tall St.)
  - US 30 (81st Ave.) @ Polo Club Dr/Saturn Dr

**Graph Type:** PCD Both Directions

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

**Date:** 01-045-269 2012-02-27

**Maps and Graphs:**
- West
  - Cycle time (Seconds) vs. Time (Hour of day)
- East
  - Cycle time (Seconds) vs. Time (Hour of day)
Weekend Sales Events (Saturday 11/26/11)
US 30 & SR 53

01-045-098 2011-11-26

West

Cycle time (seconds)

Time (Hour of day)

East

Cycle time (seconds)

Time (Hour of day)

01-045-098 2012-02-4

West

Cycle time (seconds)

Time (Hour of day)

East

Cycle time (seconds)

Time (Hour of day)
Thanksgiving Holiday (Thursday 11/24/11)
US 30 & I-65 NB Ramp

01-045-364 2011-11-24

01-045-364 2012-02-2
“Black Friday Sales Events” (Friday 11/25/11)
US 30 & I-65 NB Ramp

01-045-364 2011-11-25

West

East

Cycle time (seconds)

Time (Hour of day)

01-045-364 2012-02-3

West

East

Cycle time (seconds)

Time (Hour of day)
Weekend Sales Events (Saturday 11/26/11)
US 30 & I-65 NB Ramp

01-045-364 2011-11-26

West

01-045-364 2012-02-4

East

West

East