An Operational Test of Adaptive Signal Control

Campbell Road Corridor
Richardson, Texas

September 2011

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Operational Test Objectives

• Install Rhythm adaptive system on Campbell Road prior to a regional deployment on Greenville Avenue (Integrated Corridor Management Project)

• Measure the benefit on Campbell Road compared with time-of-day plans developed with Synchro

• Measure the effect of the system on the adjacent signal grid running time-base coordination

The following slides describe the existing signal system coordination prior to the operational test
Weekday AM Period

East Richardson Signal System Network
Weekday Noon Period

East Richardson Signal System Network
Weekday PM Period

East Richardson Signal System Network
What is it?

• The Insync adaptive system from Rhythm Engineering integrates with all existing traffic signal systems – see: [http://www.rhythmtraffic.com/](http://www.rhythmtraffic.com/)

• Insync provides two modes of operation:

  1) VIVDS (video detection) - supports coordination and control already programmed in the local controller

  2) Adaptive Control - uses vehicle calls to call and extend phases based on current demand and while maintaining coordination under supervision of a facilitator (master)
Insync Hardware Overview

- The Rhythm “Travis Box” is a Windows XP computer that interfaces the detector rack as a VIVDS system.

- Insync is a Windows app running on each “Travis Box”. One intersection is designated as the Facilitator (master).

The Travis Box at Campbell/Greenville was designated as the Facilitator for adaptive control in the operational test.
“Travis Box” Windows Remote Desktop

- Insync app provides local status and control at each signal
- Insync provides supervisor control at the signal designated as the facilitator master
- Embedded web server provides a web interface to program, monitor and query the VIVDS system at each intersection
Insync Time-of-Day Schedule

Insync selects Detector Mode or Adaptive Mode (Optimized) from a user specified time-of-day schedule programmed from Remote Desktop in each “Travis Box”.

Day-of-Week / Time-of-Day entries select the configuration

Configuration plans are programmed here
Existing vs. Rhythm TOD Schedules

Synchro Weekday Schedule vs. Rhythm Weekday Schedule

- Synchro Fixed Cycles
- Rhythm Fixed Periods

Cycle Length (Period) - sec.

Hour
Insync TOD Configuration Walk-Thru

The AM plan shown here is from the Facilitator at Campbell Road / Greenville.

The TOD schedule selects Optimized (Adaptive) mode for all periods except late-night when the controller runs free in Detect Mode.

The user specifies a NS or EW direction priority for the corridor (Insync cannot optimize a grid network). One intersection is specified as the “Master” (Facilitator).

Each “Tunnel” (Green Band) is specified by the “Offset” to the start of the tunnel and the “Duration”, or width of the tunnel.

All plans developed by Rhythm Engineering for the operational test call for a “Fixed Period” (cycle length) with “Adjustability” turned off at the facilitator.

NEXT: How Rhythm Determines Tunnel Offset and Duration:
CentralSync is Rhythm’s offline program that models time-space relationships for the adaptive plan.

The user enters intersection distance, speed (or travel time) and a Fixed Period (or cycle length) for the corridor.

The user manually adjusts the offset and duration of each tunnel in the model.

The user is responsible for leaving enough time outside of the tunnels to service the demand for the non-coordinated phases. Rhythm has recently implemented a “watchdog feature” to kick the intersection free if phases are skipped for 2+ periods.
Each TOD Plan specifies the phases that are permitted to run together and all allowable phase sequences.
Min/Max times and MaxDetect/Corrected Queue values are set for each movement.

Values > 99 simply directs the adaptive algorithm to determine those values.

The only Max Detect / Queue values varied for the corridor were at Campbell/US 75.
System Status Configuration

Rhythm Engineering is currently working to enhance CentralSync to allow the Optimizer Configuration and E-mail setting to be accessed from central.

At present you need to access and program Insync for each “Travis Box” using Windows Remote Desktop.

E-mail settings specified at each “Travis Box” are used to report all system status.

Status may be turned off by TOD to mask bogus messages – i.e., “NoPeriod” during free.
Central System Monitoring and Control

• All alarms arrive via email direct from each TraVis Box
• No MoE alarms
• No aggregate alarms or commands to multiple intersections
• System needs manuals and documentation for advanced users
Measures of Effectiveness

- Real-time MoE (volume, delay and LOS), for a single measurement period, may be viewed on each approach camera.
- No alarms for “bad” MoE conditions.
- Cumulative, historical MoE may be retrieved and viewed as a graph or table, or exported.
Split Utilization – Adaptive vs. Time-of-Day

Phase utilization at Campbell/Plano for 2 Thursday morning periods 7:15-8:30AM. 9/1/11 (160” Period / Insync adaptive); 9/8/11 (160” Cycle / Synchro TOD plan). Phase times captured from Insync history logs (CSV data) imported to Excel.
Results of Floating Car Runs

1. Stops and delay in the Campbell corridor essentially the same before and after Insync was implemented.

2. Side street and left turn delay was not evaluated, however may have been significant.

3. Negative progression impact on Plano Road due to the inability of the system to operate in a grid.

4. More work needed to resolve accuracy of Motion-X iPhone app used to gather GPS tracks for Tru-Traffic.

Floating Car Comparison Before and After Rhythm Adaptive Implementation

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Stop = Cstoppers (Tru-Traffic), cumulative number of stops in run where speed drops below 15 MPH
Delay = SC (Tru-Traffic), cumulative delay since the beginning of the run (seconds)
Comparison of Floating Car Data – AM Period
Comparison of Floating Car Data – PM Period
Final Deployment – Rhythm Adaptive System
Conclusions From the Operational Test

Insync adaptive system comparable to the well-tuned Synchro plans for Campbell Road in the before case

Campbell/Plano Road switched to detect mode to coordinate with the rest of the time base grid

Master offsets at the facilitator have been adjusted to coordinate with the rest of the time base grid

Rhythm plans to enhance Insync to provide 2 tunnels through the four phase diamond and also improve split adjustments with “Adjustability” turned on. This is needed for true cycle selection since the diamond will always be the critical intersection in this corridor.
Questions ?