

Operational Alternatives for Congested Corridors

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Introduction

- Discussion of Problem
- Review signal timing alternatives
- Examine in service signal timing adjustment



The Problem

- Saturated or Over Saturated Roadway Conditions $V/C \Rightarrow 1.0$
 - High Delays
 - Long Queues
 - Operational Breakdowns “Gridlock”



The Solution

- Increase Traffic Control
 - Increase Timing Splits
 - Protect Turning Movements
 - Increase Cycle Lengths



The Result

- Increased Lost Time
- Increased Delays
- Longer Queues



The Alternative

- Back to the Basics
 - Cycle Lengths

 - Phasing

- “Congestion Management”



Cycle Lengths

Traffic Bowl Answer

The maximum suggested cycle length according to the ITE Traffic Engineering Handbook.



Cycle Lengths

Question

What is 150 seconds?



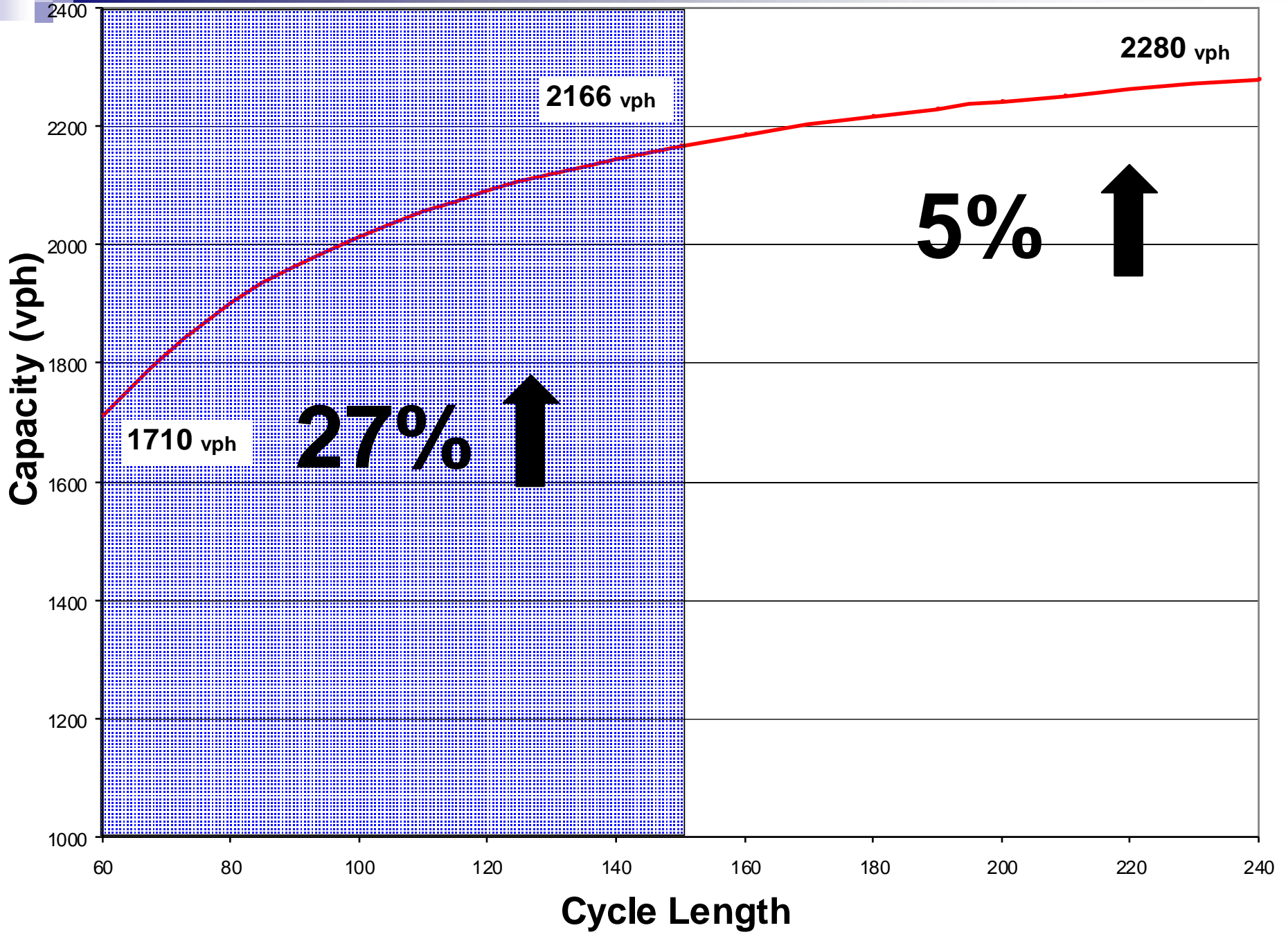
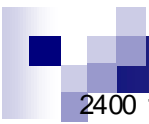
How long is too long?

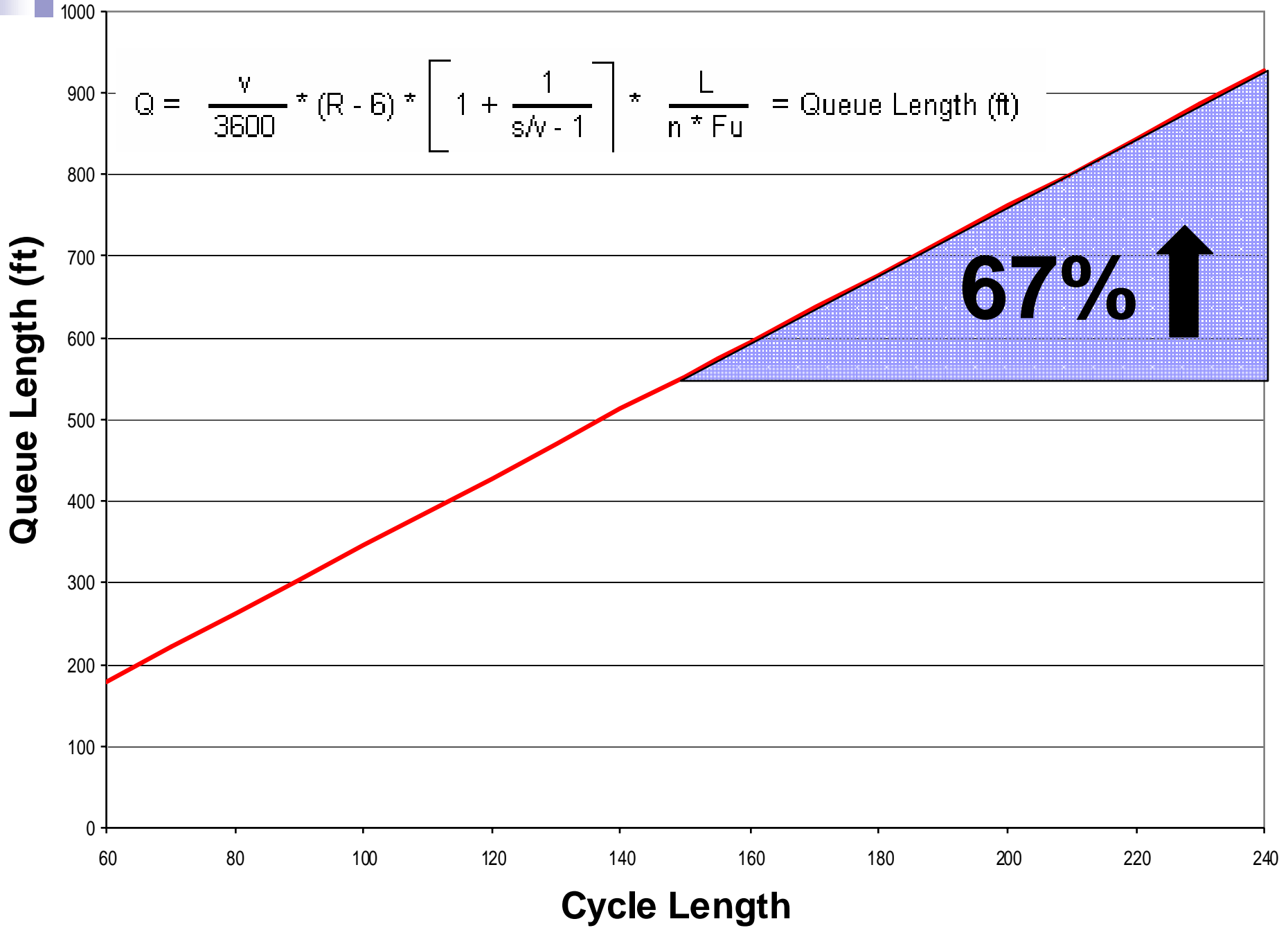
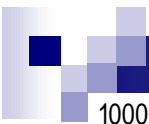
- What benefits are gained by longer cycle lengths?
- What negative impacts are brought about by long cycle lengths?

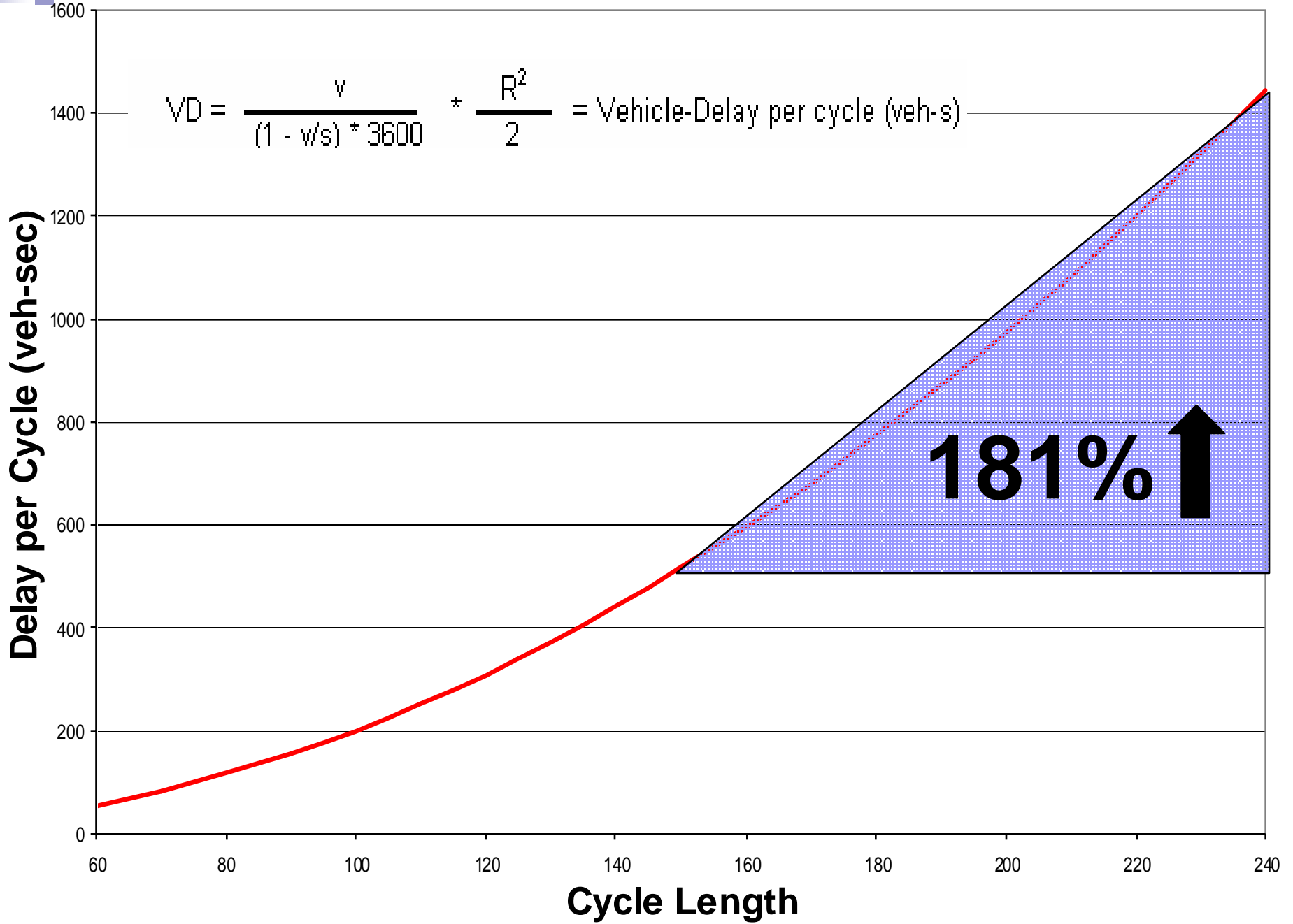


Example

- **3 phase signal**
- **4-Lane facility**
- **Vol = 900 vphpl**
- **Assume 1900 vphpl sat flow**
- **65 % - 35 % Split of Green Time**
- **Assume 4 seconds Lost Time per phase**









Signal Phasing

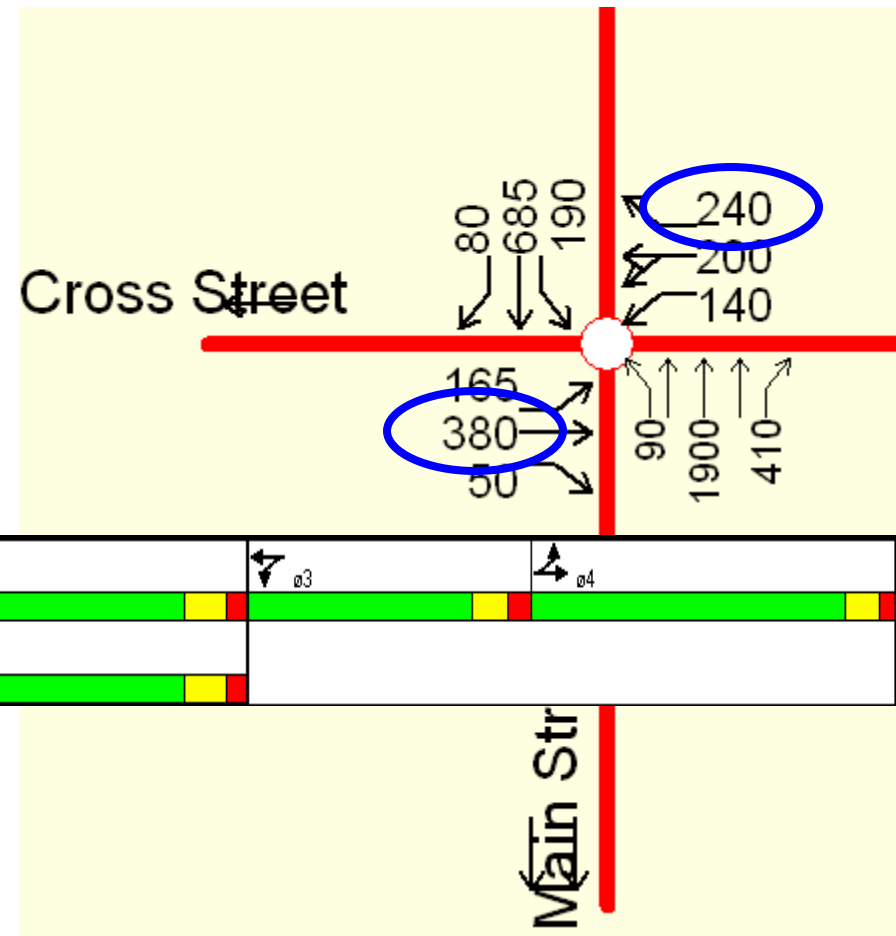
- Assume 4 sec lost time / phase
- 4-phase signal = 16 sec / cycle
- $C = 120 \text{ sec}$; 30 cycle/hr; 480 sec / hr

- 3-phase signal = 12 sec/ cycle ; 360 sec/hr

- Save 2 minutes of lost time per hour
Increase in Capacity = 3.5 %

Intersection of Main St. at Cross St.

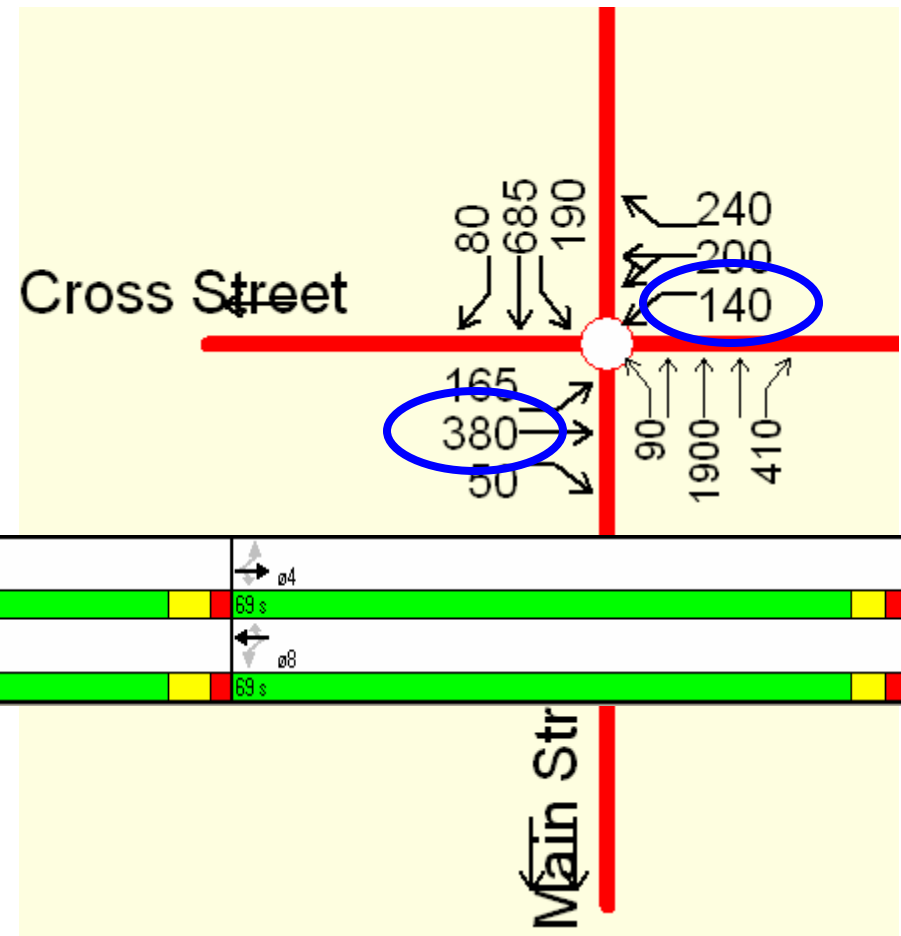
- Entering Volume
3355 / 1175 vph



- Critical Volume
~1400 vphpl
~620 on Cross Street

Intersection of Main St. at Cross St.

- Entering Volume
3355 / 1175 vph



- Critical Volume
~1300 vphpl
~520 on Cross Street

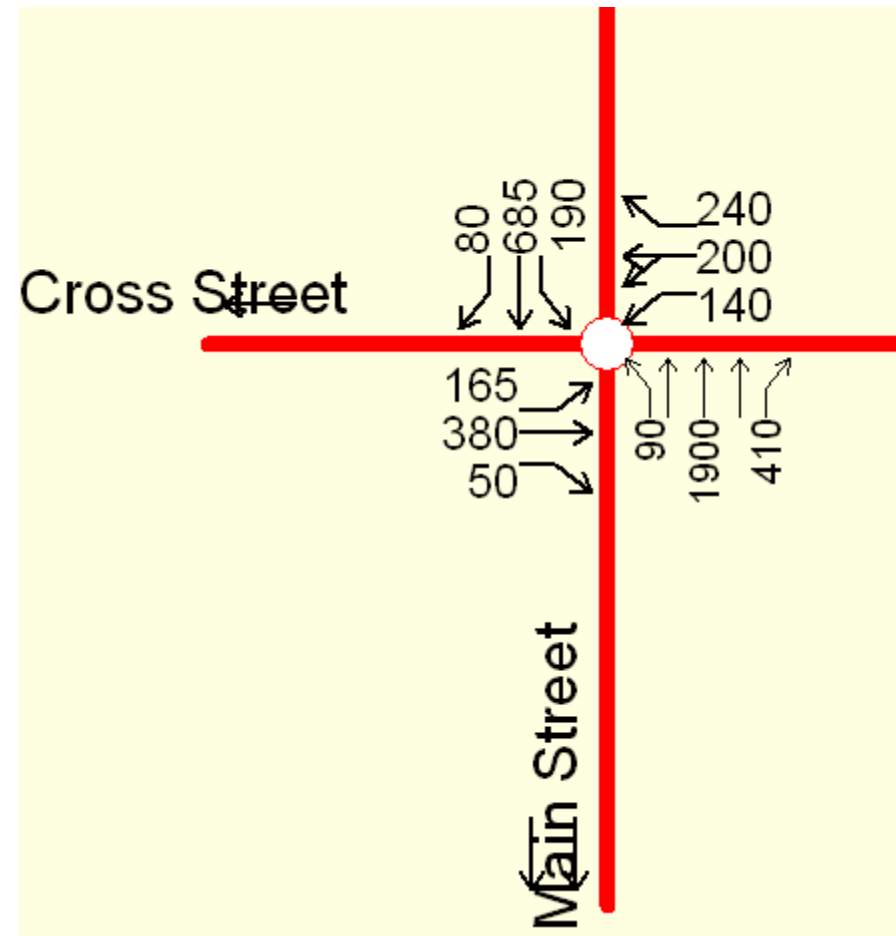
Intersection of Main St. at Cross St.

■ Existing

- 180 sec Cycle
- 4-Phase
- LOS E (60.5 sec/veh)
- Max V/C = 1.24

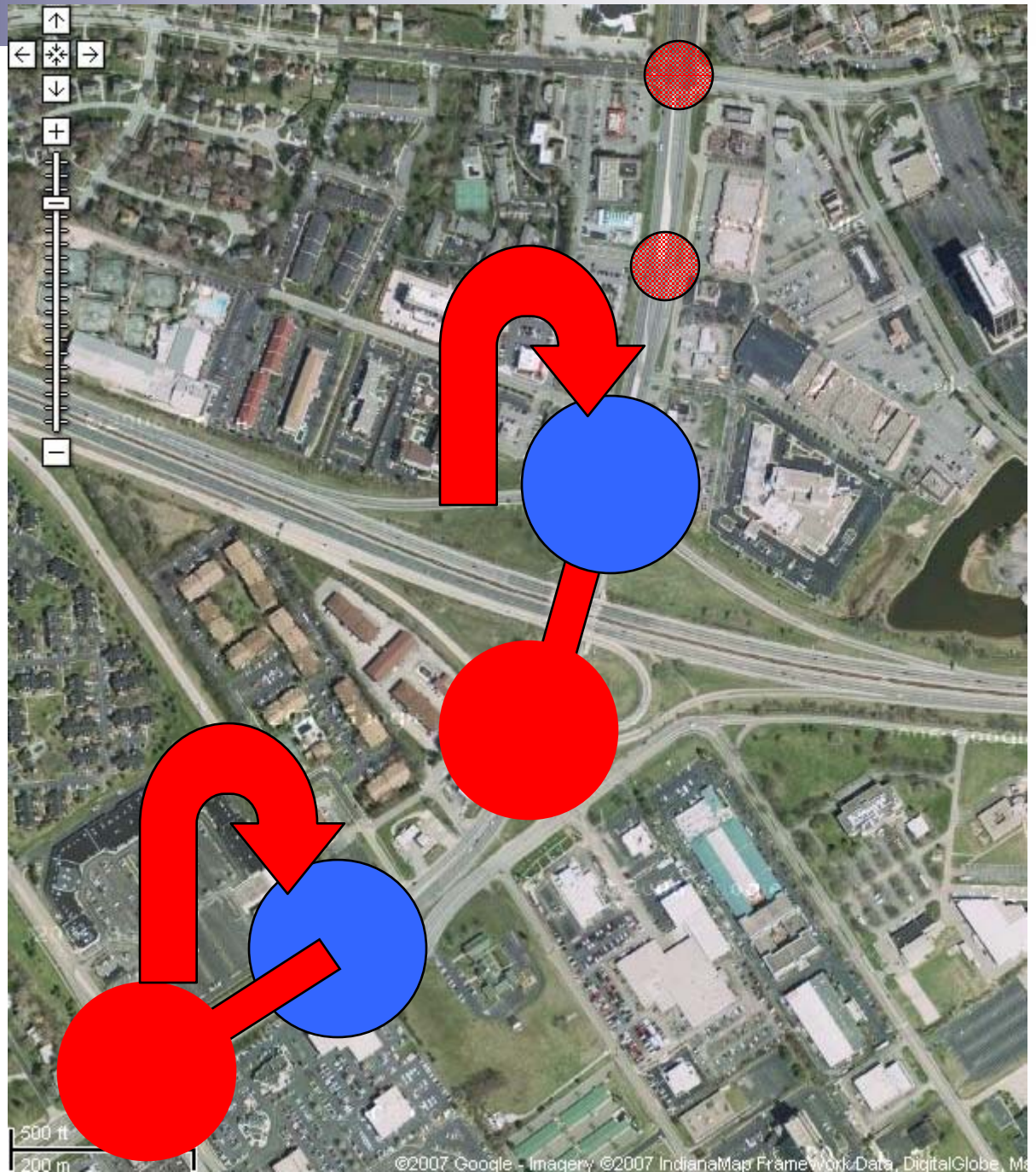
■ Alternative

- 100 sec Cycle
- 3-phase
- LOS D (37.4 sec/veh)
- Max V/C = 0.99



In-Service Cycle Length Reduction

- $\frac{3}{4}$ Miles
- 6 Signals
- 7-Lane Section
- ADT > 75,000 vpd



In-Service Cycle Length Reduction

■ Existing

$C = 180 \text{ s}$

6 am to

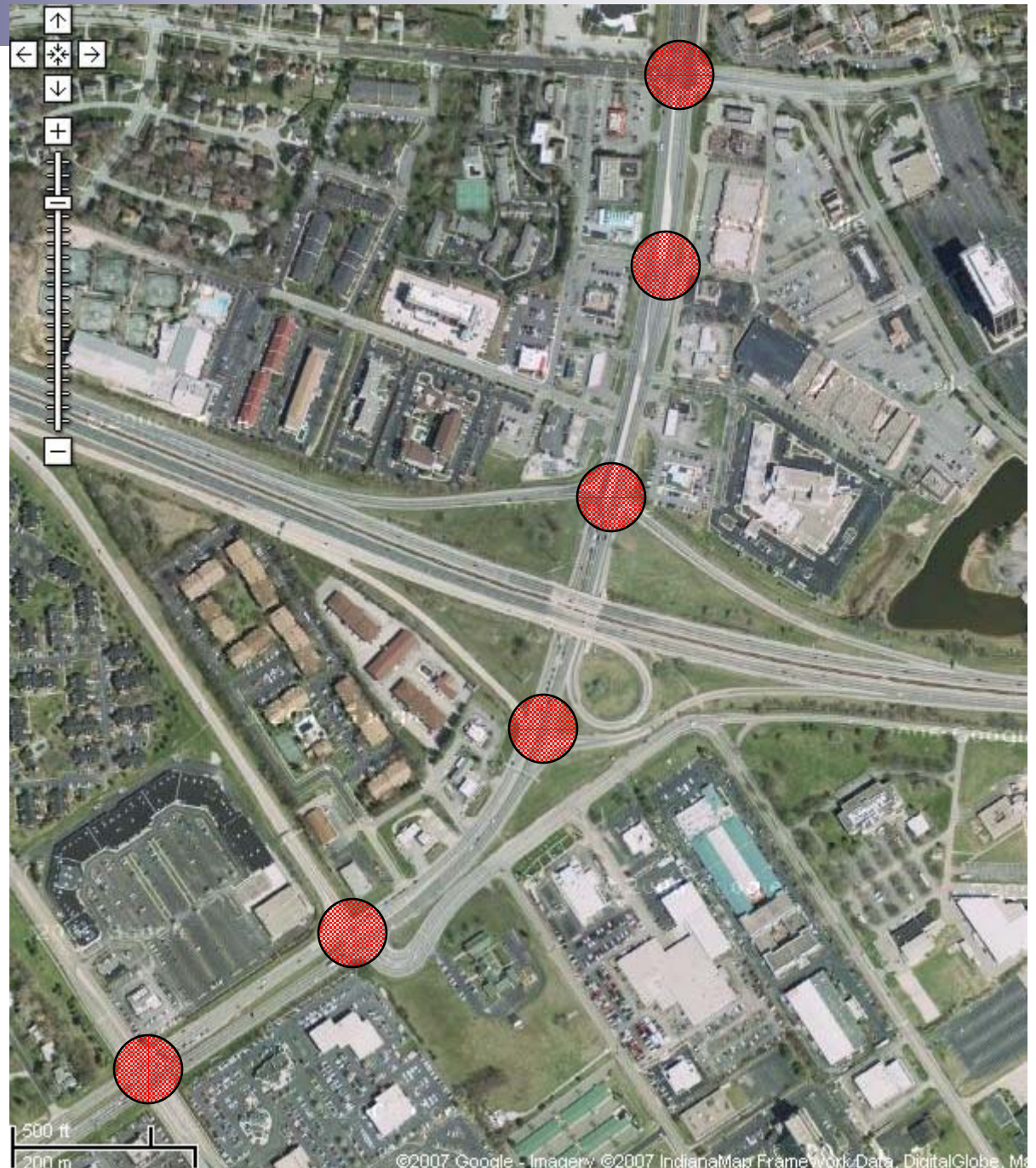
7 pm

■ Alternative

$C = 110 \text{ s}$

6 am to

8 am





Simulation Estimates

Existing Conditions

- Delay
 - 574 hr
- Stops
 - 25,180
- Speed
 - 8 mph

Alternative

- Delay
 - 212 hr
- Stops
 - 15,845
- Speed
 - 14 mph

Greenband

Existing Conditions

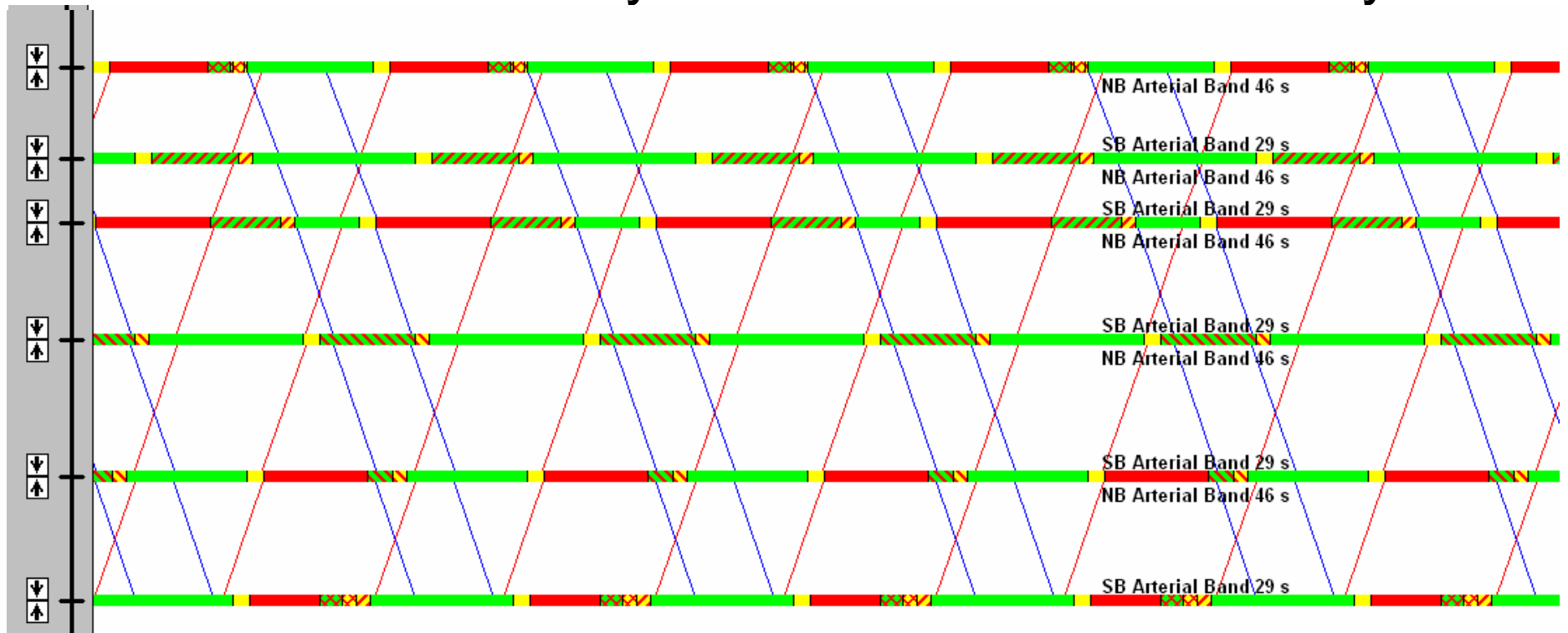
69 sec / 180

38 % Efficiency

Alternative

46 sec / 110

42 % Efficiency





Travel Time Analysis

- Collected with GPS
- 15-20 individual runs per Alternative

Existing Conditions

12.8 mph SB

17.5 mph NB

Alternative

17.6 mph SB

21.1 mph NB

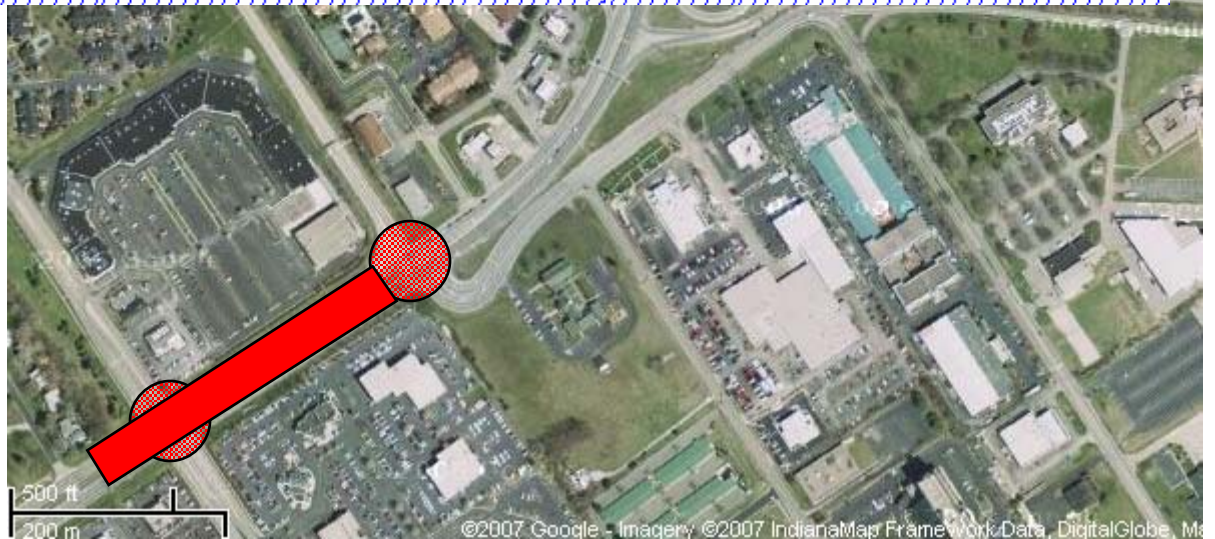
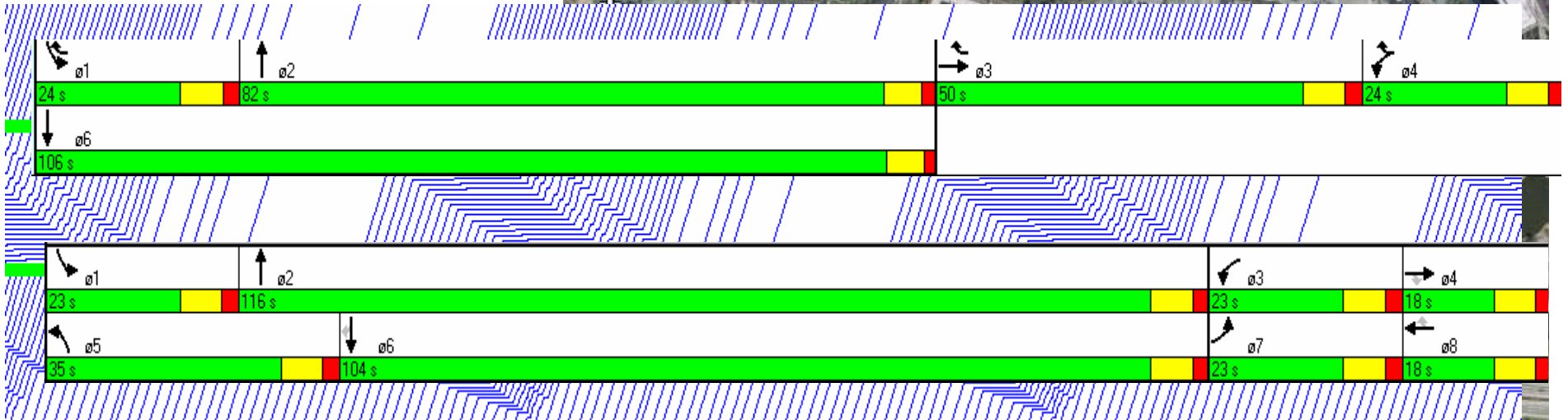


Congestion Management

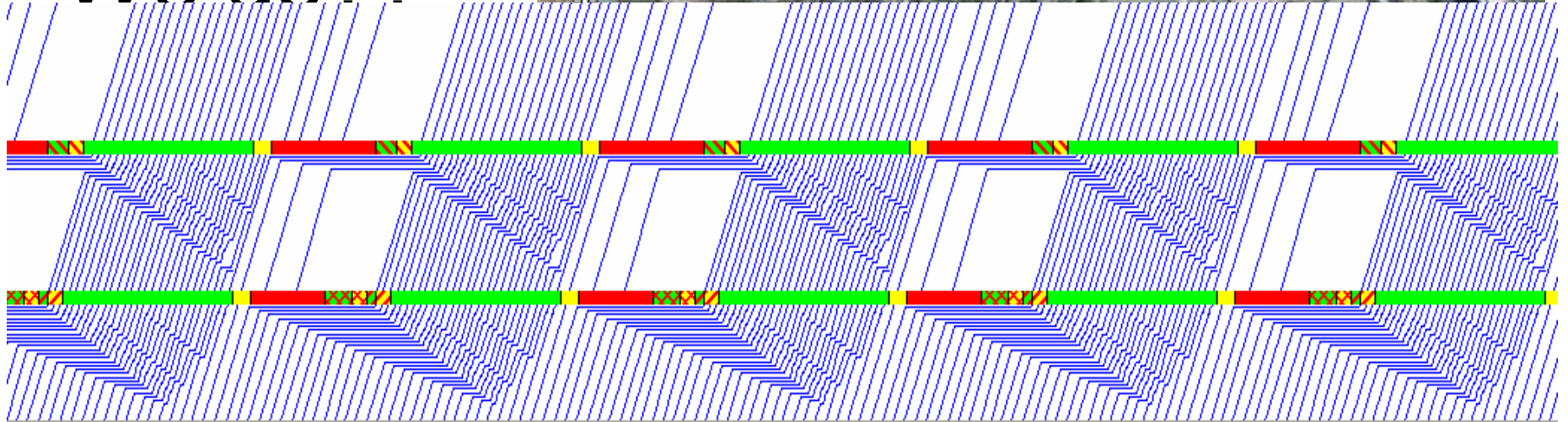
- Traffic in the area can be so bad that Kentucky Farm Bureau staggers work hours for the 500 employees at its headquarters, CEO David S. Beck said.
- “Local resident Marty Dunn is a financial adviser who has figured out a faster way to get to his office by avoiding the interchange. ‘I probably go twice the distance, but it takes less time,’ he said.”

-Courier Journal

Congestion Management



What Can We do??





Summary

- Timing under saturated conditions requires extensive analysis and evaluation of the interaction between elements
- Placing artificial constraints through signal operation can be used to protect critical infrastructure
- Sometimes less is more...