Re-Timing Congested Corridors… Cutting Out The Chaos
Signal Timing Updates

How often do you update your signal timing?
Signal Timing Updates

How often do you update your signal timing?
• Every 3 years or less?
Signal Timing Updates

How often do you update your signal timing?
• Every 3 years or less?
• Every 3 to 5 years?
Signal Timing Updates

How often do you update your signal timing?

• Every 3 years or less?
• Every 3 to 5 years?
• Every 5 to 10 years?
Signal Timing Updates

How often do you update your signal timing?

• Every 3 years or less?
• Every 3 to 5 years?
• Every 5 to 10 years?
• More than 10 years?
### Signal Timing Updates

<table>
<thead>
<tr>
<th>Average Retiming Interval</th>
<th>Percent of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Frequently than Every 3 Years</td>
<td>42</td>
</tr>
<tr>
<td>Around 5 Years</td>
<td>18</td>
</tr>
<tr>
<td>Around 10 Years</td>
<td>5</td>
</tr>
<tr>
<td>More than 10 Years</td>
<td>35</td>
</tr>
</tbody>
</table>

*Source: Tarnoff and Ordonez (2004)*
Benefits of Signal Retiming

The Institute of Transportation Engineers has determined that Signal Retiming reduces:
Benefits of Signal Retiming

The Institute of Transportation Engineers has determined that Signal Retiming reduces:

- Motorist delay by 15% to 37% and
- Overall travel time by 7 to 13%
Benefits of Signal Retiming

The Institute of Transportation Engineers has determined that Signal Retiming reduces:

- Fuel consumption by 6 to 9% and
- Vehicle emissions
The Institute of Transportation Engineers has determined that Signal Retiming reduces:

- The number of collisions and driver aggression, and
- Results in a 40:1 Return on Investment
Signal Timing Update Examples

- Big Problems Come In Small Packages
- Right-Sizing a Signal System
- VooDoo Engineering
Big Problems / Small Packages
Big Problems / Small Packages

Recently Upgraded

Existing; Not Upgraded

Recently Upgraded

Recently Upgraded

Recently Upgraded
Big Problems / Small Packages

- The TOD Screen showed no Events
Big Problems / Small Packages

- The TOD Screen showed no Events
- The Coordination Screen showed no coordination Plans
Big Problems / Small Packages

• The TOD Screen showed no Events
• The Coordination Screen showed no coordination Plans
• The Controller Clock did not reflect the accurate time
Big Problems / Small Packages

Plus the controller was of a different make than the other 3 units
Big Problems / Small Packages

How could this have been prevented?
Big Problems / Small Packages

How could this have been prevented?

• Appropriate Project Scope
Big Problems / Small Packages

How could this have been prevented?

• Appropriate Project Scope

• Detail in Design
Big Problems / Small Packages

How could this have been prevented?

- Appropriate Project Scope
- Detail in Design
- Thorough Plan Reviews
Big Problems / Small Packages

How could this have been prevented?

• Appropriate Project Scope
• Detail in Design
• Thorough Plan Reviews
• On-Site Construction Knowledge
How could this have been prevented?

- Appropriate Project Scope
- Detail in Design
- Thorough Plan Reviews
- On-Site Construction Knowledge
- Complaint Investigation
“Right-Sizing” A System
“Right-Sizing” A System

The information presented is not intended to advocate or discourage the purchase of any system or components, nor to endorse or denounce any vendor or product.
“Right-Sizing” A System
“Right-Sizing” A System

Existing Timing Plans

• Level 1 – Free
• Level 2 – Low Volume
• Level 3 – Moderate Volume
  • Direction 1 – Favors southbound movements
  • Direction 2 – Favors northbound movements
  • Average – Balanced flow
• Level 4 – High Volume
  • High Volume Plan is identical to Level 3 Direction 1
“Right-Sizing” A System

Review of System Logs

- Monday through Thursday
  - Generally runs Free or Moderate Volume Balanced Plan
  - PM Peak/High Volume Plan runs 5 periods scattered throughout the day, ranging from 7 minutes to 17 minutes each
  - During the PM Peak period, the PM Peak/High Volume Plan runs for an average total of 28 minutes
  - AM Peak Plan runs for an average of 17 minutes per day during the early afternoon

- Fridays and Weekends
  - Generally Runs PM Peak/High Volume Plan from 7 am to 6 pm
“Right-Sizing” A System

System Problems and Parameters

• Saturated Volumes/Occupancies > Scale Factor
• Inappropriate Service of Directional Imbalances > Detector Groupings
• Bouncing Plan to Plan > Threshold Values
“Right-Sizing” A System

System Considerations

• What functionality do you “Need”?  
• What functionality do you “Want”?  
• What are the respective Capital Costs?  
• Do you have budget and personnel adequate to maintain the system equipment and retain its operational integrity?  
• Do you have budget and personnel adequate to perform routine system updates and re-timing?
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- Start with problem or set of problems
- May collect data and crunch some numbers
- Utilize logic and experience to improve conditions and resolve problem
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NCHRP REPORT 731

Guidelines for Timing Yellow and All-Red Intervals at Signalized Intersections

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OF THE NATIONAL ACADEMIES
Voodoo Engineering

- Travel Speed Approaches Posted Speed
- Far Less Travel Time
- Far Fewer Stops
Estimated Signal Retiming Benefits

Emissions Savings
2.3 kg
$4,544

Fuel Savings
15,782 Gallons
$29,985
Estimated Signal Retiming Benefits

- **Emissions Savings**: 2.3 kg, $4,544
- **Crash Reductions**: 11 Crashes, $185,279
- **Fuel Savings**: 15,782 Gallons, $29,985
Voodoo Engineering

Estimated Signal Retiming Benefits

- **Delay Savings**: 147,607 Hours, $2,886,105
- **Emissions Savings**: 2.3 kg, $4,544
- **Crash Reductions**: 11 Crashes, $185,279
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Voodoo Engineering

Estimated Signal Retiming Benefits

- **Delay Savings**
  - 147,607 Hours
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- **Emissions Savings**
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- **Crash Reductions**
  - 11 Crashes
  - $185,279

- **Fuel Savings**
  - 15,782 Gallons
  - $29,985

- **Benefit Cost Ratio**
  - 71:1
Results
Results

Big Problems Come In Small Packages

• Small Corridors can have problems that are an annoyance, lead to delay and create accident potential

• Often, the solution to such problems is very basic

• Problem solved by input of proper data and installation of GPS clock
Results

Right-Sizing a Signal System

• Make sure you have the personnel and financial abilities to address the maintenance aspects of both hardware and software

• GIGO

• Know what variables affect system decisions
Results

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• Important to review all aspects of corridor operation, including basic timing parameters
• Don’t underestimate the improvement potential
• Review your work
• Tweak as necessary
• Signal Timing Improvements benefit many aspects
Questions

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Upcoming DGL Presentations

Communicating Major Highway Improvements - Lessons Learned
Steve Way (DGL) with Todd Audet (ODOT)
Tuesday, October 25, 2016  4:30 - 5:00pm

Proposed Diverging Diamond Interchange
Rick McGuckin (DGL) with Mike Gramza (ODOT)
Wednesday, October 26  11-11:30 am