ITS-NJ
Stretching the Limits of Traffic Signal Optimization
Making Connections

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Signal Optimization

- Performance Testing
- Data Collection
- Installing
- Modeling
- Recommending

Traditional Signal Optimization Process
Signal Optimization

TSM&O

- Active Traffic Management
- Incident Management
- Transit Management
- Connected & Autonomous Vehicles
- Multimodal Regional Integration

Arterial Management Process

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- Active Traffic Management
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Signal Optimization

ARterial Management Tier System

- T1: Adaptive Traffic Signal System
- T2: Responsive Traffic Signal System
- T3: Communications with TOD
- T4: Hardware Upgrade with TOD
- T5: Coordinated Time of Day (TOD)
- T6: Isolated Intersections

Systems Engineering
Signal Optimization Program Background

Goals

• Operational
  • Improve travel times
  • Reduce number of stops, delay, and congestion
  • Reduce fuel consumption

• Safety
  • Improve safety of non-motorized and motorized users at signals

• Planning for Special Needs
  • Peak and Off-Peak timings
  • Incident Management
  • Pedestrian and bicyclist considerations
Optimization Process

• Data Collection Plan
• Pre-Implementation Study
  • Traffic Data Collection
    • Manual Turning Movement Counts
    • Pedestrian Counts
    • ATRs
  • Travel Time Runs
  • Field Observations
  • Field check signal plans and timing plans
• Data Collection Report

Volume Profiles
Optimization Process (cont.)

- Optimization Analysis
  - Existing Conditions
  - Clearance Interval Calculations
  - Signal Groupings (Zones) recommendations
  - Network cycle length recommendations
  - Split/Offset optimization

- Timing Directive Development
Optimization Process (cont.)

- Post Implementation Study
  - Confirm timing implementation
  - Travel time runs
  - ATR counts
  - Traffic observations
  - Fine tuning of timings

- Final Report
  - Process and findings
  - Project benefits
  - Long-term recommendations

Speed Distance Profile
Standardization of Process

- Data Collection Guidelines
- Data Collection Report Appendix template
- Synchro Quality Checklist
- Timing Directive Review – Quality Assurance Form
- Final Report Template
Lessons Learned - Data Collection

- **Local Knowledge**
  - Cut-Thru’s, Bottlenecks, problem areas

- **Collect Video**
  - Useful in every aspect of the project

- **Field Observations**
  - Signal timings vs directives
  - Driving behavior/Lane utilization

- **Travel Times**
  - Start travel time runs outside network
Lessons Learned - Existing Conditions Analysis

• Demand vs. Processed
  • Need to account for unserved demand

• Simulation
  • Useful in understanding underlying issues and potential benefits
  • Can help address demand vs. processed

Route 72
8 mile queue
Lessons Learned - Optimization

• Zones
  • Bring in extra intersection(s)...at least initially
  • Platoons may break up, but at least we have control
Lessons Learned - Optimization

- Zones

<table>
<thead>
<tr>
<th>Existing Zone</th>
<th>Int ID</th>
<th>Intersection</th>
<th>Distance to Downstream Intersection (mi)</th>
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<tr>
<td>Landis</td>
<td>1</td>
<td>Garden Road (CR 674)</td>
<td>0.70</td>
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<tr>
<td></td>
<td>2</td>
<td>Wheat Road</td>
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<td>3</td>
<td>Oak Road</td>
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<td>4</td>
<td>Park Avenue</td>
<td>0.38</td>
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<td></td>
<td>5</td>
<td>Landis Avenue (RT 56)</td>
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<td></td>
<td>6</td>
<td>Chestnut Avenue</td>
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<td></td>
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<tr>
<td></td>
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<td>Elmer Road</td>
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**Lessons Learned - Optimization**

- **Cycle Length**
  - Higher volumes = Higher cycle length (Not Always!!)
  - Initial/residual queue and *signal spacing* have impact

- **Splits**
  - When cycle length changes, get your g/C back to existing and then adjust
  - Watch v/c ratios

- **Offsets**
  - Use more than one tool (Synchro, Tru-Traffic, etc.)
  - Manually adjust offsets to fit your needs (quality of band)
  - Optimize offsets downstream of bottlenecks
Case Study 1 – Route US-202

- 4.22 Miles, 14 Signals
- Multi-jurisdictional
- Two existing timings unable to be modified
- Number of zones stayed constant, but shift in zonal limits
- Delay improvements for all peak periods

Eliminated most peak period variable cycles
Case Study 2 – Route NJ-72

- 8.5 Miles, 14 Signals
- Access to/from GSP and RT 9 and only access to Long Beach Island
- Heavier Inbound traffic
- Extensive queuing
- Major weekend congestion

Hold 72 Outbound and leave Barnegat NB green

Before 45 min.
After 15 min.
Case Study 3 – Route US-1&9

- 2011 - 2.79 Miles, 17 Signals
- 2012 - NJ Tpk Toll increase prompted reoptimization of 8 northern intersections (1.14 Miles)
- Extensive queueing
- Super saturated conditions
- Minimum existing bandwidth

Optimized for stop reduction resulting in improved bandwidth and reduced queues
Recipe for Success

- **Funding**
  - 3 Years
  - $6.2 M

- **Teamwork**
  - NJDOT MSE
  - Consultants

- **Dedication**
  - Standardization
  - Quality
Quantifiable Benefits Matter

231 Miles

42 Corridors

562 Signals

B/C

12.41 ~ $77 M
Questions?

THANK YOU!