SPM Basics & Applications Overview

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SPM Basic Concept

Automated Data Collection
- Signal controller
- Probe source

Useful Information about Performance
- Signal
- Corridor
- System
System Requirements for SPM’s

1) High-resolution Controller

- Econolite Cobalt: Any Version
- Econolite ASC3 NEMA: V. 2.50+ & OS 1.14.03+
- Econolite 2070 with 1C CPU Module: V. 32.50+
- Intelight Maxtime: V. 1.7.0+
- Peek ATC Greenwave 03.05.0528+
- Trafficware 980ATC V. 76.10+
- Siemens M50 Linux & M60 ATC
  - ECOM V. 3.52+
  - NTCIP V. 4.53+
- McCain ATC Omni eX 1.6+

2) Communications

- Econolite Cobalt: Any Version
- Econolite ASC3 NEMA: V. 2.50+ & OS 1.14.03+
- Econolite 2070 with 1C CPU Module: V. 32.50+
- Intelight Maxtime: V. 1.7.0+
- Peek ATC Greenwave 03.05.0528+
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  - NTCIP V. 4.53+
- McCain ATC Omni eX 1.6+

3) Server

- Econolite Cobalt: Any Version
- Econolite ASC3 NEMA: V. 2.50+ & OS 1.14.03+
- Econolite 2070 with 1C CPU Module: V. 32.50+
- Intelight Maxtime: V. 1.7.0+
- Peek ATC Greenwave 03.05.0528+
- Trafficware 980ATC V. 76.10+
- Siemens M50 Linux & M60 ATC
  - ECOM V. 3.52+
  - NTCIP V. 4.53+
- McCain ATC Omni eX 1.6+

4) Website

- Econolite Cobalt: Any Version
- Econolite ASC3 NEMA: V. 2.50+ & OS 1.14.03+
- Econolite 2070 with 1C CPU Module: V. 32.50+
- Intelight Maxtime: V. 1.7.0+
- Peek ATC Greenwave 03.05.0528+
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  - NTCIP V. 4.53+
- McCain ATC Omni eX 1.6+

5) Detection (optional)

Can be done independent of a central system!
### Controller Enumerations

<table>
<thead>
<tr>
<th>Event Code</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Phase On</td>
</tr>
<tr>
<td>1</td>
<td>Phase Begin Green</td>
</tr>
<tr>
<td>2</td>
<td>Phase Check</td>
</tr>
<tr>
<td>3</td>
<td>Phase Min Complete</td>
</tr>
<tr>
<td>4</td>
<td>Phase Gap Out</td>
</tr>
<tr>
<td>5</td>
<td>Phase Max Out</td>
</tr>
<tr>
<td>6</td>
<td>Phase Force Off</td>
</tr>
<tr>
<td>7</td>
<td>Phase Green Termination</td>
</tr>
<tr>
<td>8</td>
<td>Phase Begin Yellow Clearance</td>
</tr>
<tr>
<td>9</td>
<td>Phase End Yellow Clearance</td>
</tr>
<tr>
<td>10</td>
<td>Phase Begin Red Clearance</td>
</tr>
<tr>
<td>11</td>
<td>Phase End Red Clearance</td>
</tr>
<tr>
<td>81</td>
<td>Detector Off</td>
</tr>
<tr>
<td>82</td>
<td>Detector On</td>
</tr>
<tr>
<td>83</td>
<td>Detector Restored</td>
</tr>
<tr>
<td>84</td>
<td>Detector Fault- Other</td>
</tr>
<tr>
<td>85</td>
<td>Detector Fault- Watchdog Fault</td>
</tr>
<tr>
<td>86</td>
<td>Detector Fault- Open Loop Fault</td>
</tr>
<tr>
<td>101</td>
<td>Preempt Advance Warning Input</td>
</tr>
<tr>
<td>102</td>
<td>Preempt (Call) Input On</td>
</tr>
<tr>
<td>103</td>
<td>Preempt Gate Down Input Received</td>
</tr>
<tr>
<td>104</td>
<td>Preempt (Call) Input Off</td>
</tr>
<tr>
<td>105</td>
<td>Preempt Entry Started</td>
</tr>
</tbody>
</table>

**Active Phase Events:**

**Detector Events:**

**Preemption Events:**
High-resolution Data

Timestamp, Enumeration Code, Parameter

Detector 5 OFF

Phase 8 GREEN

Detector 5 ON
Signal Performance Metrics

http://udottraffic.utah.gov/signalperformancemetrics
Coordination Optimization Example: Progression Quality

One approach shown

<table>
<thead>
<tr>
<th>Detector Activation</th>
<th>Change to Green</th>
<th>Change to Yellow</th>
<th>Change to Red</th>
<th>Volume Per Hour</th>
<th>AoG - Arrival On Green</th>
<th>GT - Green Time</th>
<th>PR - Platoon Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free</td>
<td>79% AoG</td>
<td>75% GT</td>
<td>1.05 PR</td>
<td></td>
<td>78% AoG</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan 1</td>
<td>75% AoG</td>
<td>48% GT</td>
<td>1.56 PR</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan 7</td>
<td>84% AoG</td>
<td>47% GT</td>
<td>1.79 PR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan 13</td>
<td>72% AoG</td>
<td>47% GT</td>
<td>1.53 PR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan 7</td>
<td>83% AoG</td>
<td>48% GT</td>
<td>1.73 PR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free</td>
<td>68% AoG</td>
<td>54% GT</td>
<td>1.26 PR</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vehicles arrive on green
Vehicles arrive on yellow
Vehicles arrive on red

Metric: Purdue Coordination Diagram
Detection Requirements: Advance Counters
Approach Speeds

Bluff & 100 S, St. George, NB

Use 85th percentile to set yellow & red clearance intervals

Metric: Approach Speeds
Detection Requirements: Wavetronix Advance Radar
Operations & Traffic Study Example:
Vehicle Speeds at Intersections

Metric: Approach Speeds
Detection Requirements: Wavetronix Advance Radar
Approach Volumes

- When to take a lane for maintenance
- Directional splits for offset optimization
- Network models
Lane-by-Lane Volume Counts

Use for traffic studies, models, adjust splits, coordination balance

**US-89 Main Street (American Fork) SIG#5023**

**Westbound Thru**

TV: 7666 PH: 6:15 PM - 6:15 PM PHV: 721 VPH
PHF: 0.9 TLU: 0.96

**Eastbound Thru**

TV: 8076 PH: 6:00 PM - 6:00 PM PHV: 757 VPH
PHF: 0.95 TLU: 0.74

**Southbound Left**

TV: 5590 PH: 1:00 PM - 2:00 PM PHV: 633 VPH
PHF: 0.89 TLU: 0.87

**Metric: Turning Movement Counts**

Detection Requirements: Stop Bar Counters
Red Light Monitoring

Use for identifying safety trends and engineering countermeasures

Metric: Red Light Monitoring
Detection Requirements: Stop Bar Counters with speed filter or detectors in intersection
Red Light Monitoring

Analysis: 7:00 AM to 8:15 AM - May 18, 2015

- Is green time too short? – Would increasing the split fix the problem?
- Is coordination poor? – More vehicles arriving on green could fix this?
- Is sight distance poor? – Are their trucks or other obstructions blocking signal?
- Is law enforcement needed? – Time can be pinned down for law enforcement.
Metric 1: Purdue Coordination Diagram
Detection Requirements: Advance

Metric 2: Purdue Travel Time Diagram
Requirements: Probe data set

SB Travel Time Savings: 1.1 Minutes
NB Travel Time Reliability: 52% Increase

Corridor PM Peak Arrival on Green
23% 57% 19%

Initial Percent Arrival on Green
Increase in Percent Arrival on Green
Decrease in Percent Arrival on Green
2013

Purdue Coordination Diagrams

Initial Percent Arrival on Green
Increase in Percent Arrival on Green
Decrease in Percent Arrival on Green
2015 Purdue Link Pivot

Initial Percent Arrival on Green
Increase in Percent Arrival on Green
Decrease in Percent Arrival on Green