OVERVIEW OF UDOT SPM SYSTEM

SPM Workshop
Tuesday, January 26th

Mark Taylor
Traffic Signal Operations Engineer
Utah Department of Transportation
Agency Factoids (System/Comm.)

- Number of signalized intersections (Statewide: 1977, UDOT: 1176)
  - # connected by fiber: **Statewide: 1510. UDOT 1000. (90%)**
  - # connected by radio: **Statewide: 180. UDOT 65. (10%)**
  - # connected by twisted pair: None
  - # connected by cellular: 3 (owned by Logan City).
  - # not connected to comm.: **Statewide: 284. UDOT: 111**
Agency Factoids
(System/Comm.)

- Number of engineers/technicians devoted to signals
  - 27 UDOT Personnel
  - 4 Consultant Equivalents
  - 4 Contractor Equivalents
  
  **35 FTEs for 1176 traffic signals**

- Central System Vendor: **Intelight** – 1619 of 1674
  
  **SCATS** – 19 intersections

- # of signals collecting high resolution data: **1619 (82%)**.
- Years of experience with high resolution data: **3 ½ years**
SPM’s in Utah
Revision: January 24, 2016

# of Intersections by Metric - Utah

Note: Some Signals Have More than One Metric

<table>
<thead>
<tr>
<th>Metric</th>
<th># of Intersections Configured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Metrics</td>
<td>1619</td>
</tr>
<tr>
<td>P. Coord. Diagram</td>
<td>579</td>
</tr>
<tr>
<td>Approach Speed</td>
<td>550</td>
</tr>
<tr>
<td>Turning Move Ct.</td>
<td>235</td>
</tr>
<tr>
<td>Yellow Red Act.</td>
<td>89</td>
</tr>
<tr>
<td>P. Split Failure</td>
<td>9</td>
</tr>
</tbody>
</table>
http://udottraffic.utah.gov/signalperformancemetrics
Metric Usage Reports
February 23, 2013 to January 22, 2016

Note: These are only the logged entries. Usage is much higher than reported!

Metric: Usage Reports
Detection Requirements: None
Agency Usage Reports
February 23, 2013 to January 22, 2016

Note: These are only the logged entries. Usage is much higher than reported!

Metric: Usage Reports
Detection Requirements: None
## Types of Performance Metrics

<table>
<thead>
<tr>
<th>Controller high-resolution data only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purdue Phase Termination</td>
</tr>
<tr>
<td>Split Monitor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advanced Count Detection (~400 ft behind stop bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purdue Coordination Diagram</td>
</tr>
<tr>
<td>Approach Volume</td>
</tr>
<tr>
<td>Platoon Ratio</td>
</tr>
</tbody>
</table>
<pre><code>                                                             | Purdue Link Pivot     |
</code></pre>

<table>
<thead>
<tr>
<th>Advanced Detection with Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach Speed (Wavetronix Advance)</td>
</tr>
</tbody>
</table>
<pre><code>                                                             | Purdue Split Failure       |
</code></pre>

<table>
<thead>
<tr>
<th>Lane-by-lane Count Detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turning Movement Counts</td>
</tr>
<tr>
<td>Yellow &amp; Red Actuations</td>
</tr>
</tbody>
</table>

All detectors (except speed metric) can be radar, loops, video, pucks – it doesn’t matter.
Executive Reports & Prioritizing

- Are signal operations improving, staying the same, or getting worse and by how much?
- How does an agency most effectively prioritize resources and workload?
- What are our areas of most need?

Statewide Summary 24 hours / day in Utah for September 2015

<table>
<thead>
<tr>
<th>Month</th>
<th>Arrival on Red</th>
<th>Volume</th>
<th>Intersections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent</td>
<td>Platoon Ratio</td>
<td>Daily Average Per Approach</td>
</tr>
<tr>
<td>Sept. 2015</td>
<td>30%</td>
<td>1.12</td>
<td>9,540</td>
</tr>
</tbody>
</table>

- Region, corridor, and intersection summaries also available.
  - Prioritize coordination projects where they’re needed the most.
- Engineers could now directly measure what previously they could only estimate and model.

Metric: Executive Reports
Detection Requirements: Advance Counters
Percent of Vehicles Arriving on Green - **Riverdale Rd**

10:00 AM to 2:00 PM Monday through Friday

**Retiming Project**
Heavy rain rips apart I-15 in Nevada, forces freeway closure

By Ken Ritter, Michelle Rindels, Associated Press | Posted Sep 9th, 2014 @ 7:44pm
September 9, 2014 – September 12, 2014

I-15 Closed Southbound in Nevada for 4 days.

- Detour thru Cedar City
- Used ATMS
  - Signals on central system
    - Made Adjustments
  - CCTV, VMS, IMT, HAR
Optimization Example: Emergency Freeway Closure

Phase 4 shown – Freeway off-ramp
One week of data

Normal Traffic on Sunday and Monday

Increased traffic beginning Tuesday due to freeway washout in Nevada, as shown by more frequent force-off and higher split being used.

Implemented special timing plan to provide extra split.

Phase 4 shown – Freeway off-ramp

One week of data

200 N. (Cedar City) 1400 W/I-15 SB SIG#8223 Phase 4
Sunday, September 07, 2014 12:00 AM - Saturday, September 13, 2014 11:59 PM

Metric: Purdue Phase Termination Chart
Detection Requirements: None
Perceived Hierarchy of Signal Control – Not Always Correct

- Traffic Adaptive
  - In sync by adapting to changes in traffic

- Traffic Responsive
  - In sync by choosing a library of plans

- Coordinated
  - In sync with actuation on side streets

- Fully-Actuated
  - Detection on all approaches

- Semi-Actuated
  - Detection on side streets only

- Fixed Time
  - No Detection – Fixed Green Time
Perceived Hierarchy of Signal Control – Not Always Correct

- Traffic Adaptive
- Traffic Responsive
- Coordinated
- Fully-Actuated
- Semi-Actuated
- Fixed Time

UDOT's Park City signals
Adaptive Is Not Always the Best Option

Some jurisdictions have asked for a full refund from the adaptive systems they have previously purchased.
SPMs May Be the Best Option

SPMs can be used to manage and optimize all modes of operation, can outperform adaptive control and is much cheaper and simpler.
Why Model What You Can Measure?

“Our success will not be measured by how much data we collect, but instead how we use the data to improve the operation of our transportation network.”

– Steve Kuciemba - Parsons Brinckerhoff

“Well measured results that show a high return-on-investment is the key to receiving additional resources and sustained support.”

– Rob Clayton – Utah Department of Transportation
Questions?

Mark Taylor