Albuquerque Overview

- Population: 890,000
- 8 Bridge Crossings
- 640 Traffic Signals
  - 264 ATSPM Ready
  - 65 Ready – Copper Comms
  - 291 Not High Res Controllers
- 100+ Miles of Fiber
Motivation for ATSPM in ABQ

- State-based model to **identify** and **deploy** proven but underutilized innovations to:
  - Shorten project delivery process
  - Enhance roadway safety
  - Reduce congestion
  - Improve environmental sustainability

- EDC Rounds: two year cycles
- 4 Rounds, 46 Innovations
Albuquerque Ongoing ATSPM Projects
Value at Any Level

```
<table>
<thead>
<tr>
<th>Time</th>
<th>Event Type</th>
<th>Parameter</th>
<th>Time As Decimal</th>
<th>Event Text</th>
<th>Parameter Text</th>
<th>Event Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:01:29 AM</td>
<td>90</td>
<td>8</td>
<td>7.02472</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:01:29 AM</td>
<td>90</td>
<td>8</td>
<td>7.02472</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:01:51 AM</td>
<td>90</td>
<td>8</td>
<td>7.03083</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:01:52 AM</td>
<td>90</td>
<td>8</td>
<td>7.03111</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:02:52 AM</td>
<td>90</td>
<td>6</td>
<td>7.04778</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:02:52 AM</td>
<td>90</td>
<td>6</td>
<td>7.04778</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:02:53 AM</td>
<td>90</td>
<td>6</td>
<td>7.04806</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:02:53 AM</td>
<td>90</td>
<td>6</td>
<td>7.04806</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:02:53 AM</td>
<td>90</td>
<td>6</td>
<td>7.04806</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:02:53 AM</td>
<td>90</td>
<td>6</td>
<td>7.04806</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:03:29 AM</td>
<td>90</td>
<td>6</td>
<td>7.05806</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:03:35 AM</td>
<td>90</td>
<td>8</td>
<td>7.05972</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:04:03 AM</td>
<td>90</td>
<td>6</td>
<td>7.06750</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:04:04 AM</td>
<td>90</td>
<td>6</td>
<td>7.06778</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:04:19 AM</td>
<td>90</td>
<td>6</td>
<td>7.07194</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:04:20 AM</td>
<td>90</td>
<td>6</td>
<td>7.07222</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:04:20 AM</td>
<td>90</td>
<td>6</td>
<td>7.07222</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
<tr>
<td>7:06:44 AM</td>
<td>90</td>
<td>8</td>
<td>7.11222</td>
<td>PedDetector On</td>
<td>DET Channel # (1-16)</td>
<td>Detector</td>
</tr>
</tbody>
</table>
```
Pedestrian Delay by Actuation

Ped Actuations (PA) = 5; Min Delay = 00:16; Max Delay = 02:05; Average Delay (AD) = 01:22
Coors Boulevard Project Goals

- Measure and Analyze Traffic Conditions
- Proactively Optimize Traffic
  - Reduce Delay Across the Corridor
  - Reduce Travel Time
- Implement Maintenance and Performance Alerts
Coors Boulevard Upgrades
Coors Boulevard Schedule Update

• Schedule
  ▫ June 2017
    • Detection Installed
  ▫ August 2017
    • ATSPM Server
  ▫ September 2017
    • Existing Condition Data Collection
  ▫ October 2017 – Present
    • Active ATSPM Management
  ▫ April 2018
    • 6 Month Project Status Report
Coors Boulevard Metrics
--No new missing record errors were found on 9/22/2017:

--No new force off errors were found between 1:00 and 5:00:

--The following signals had too many max out occurrences between 1:00 and 5:00:
  0377 - Coors Blvd NW & Bluewater Rd NW - Phase 2 (Max Outs 100%)
  0377 - Coors Blvd NW & Bluewater Rd NW - Phase 6 (Max Outs 100%)
  363 - Coors Blvd NW & Old Airport Ave NW - Phase 2 (Max Outs 100%)
  363 - Coors Blvd NW & Old Airport Ave NW - Phase 6 (Max Outs 100%)
  363 - Coors Blvd NW & Old Airport Ave NW - Phase 8 (Max Outs 100%)

--The following signals had unusually low advanced detection counts on 9/22/2017 between 17:00 and 18:00:
  363 - Coors Blvd NW & Old Airport Ave NW - Phase 2 (Count: 0)
  363 - Coors Blvd NW & Old Airport Ave NW - Phase 6 (Count: 0)
  377 - Coors Blvd NW & Bluewater Rd NW - Phase 2 (Count: 0)
  377 - Coors Blvd NW & Bluewater Rd NW - Phase 6 (Count: 0)

--The following signals have high pedestrian activation occurrences between 1:00 and 5:00:
  327 - Coors Blvd NW & Irving Blvd NW - Phase 4 (221 Pedestrian Activations)
ATSPM Metrics - Coordination

Coors Blvd and Montano Plaza Plaza SB
Friday November 10th - Before

AoG = 79%
ATSPM Metrics – Offset Improvement

Purdue Link Pivot Analysis

Report Options

- Route: Coors Blvd south of I-40
- Signals
- Cycle Length: 90
- Start Date: 09/12/2017
- End Date: 09/14/2017
- Start Time: 8:00 AM
- End Time: 9:00 AM

Approach Link Comparison

- Link: 377 Southbound, 378 Northbound
- Approaches: Upstream, Downstream
- Upstream AOG: Existing 1133, Predicted 1289
- Downstream AOG: Existing 1137, Predicted 1142
- Total Link AOG: Existing 2270, Predicted 2431

New Offset: 3
ATSPM Metrics - Coordination
Coors Blvd and Montano Plaza SB
Friday December 8th – After

AoG = 89%

Volume Per Hour
Detector Activation
Change to Green
Change to Yellow
Change to Red
AoG - Arrival On Green
GT - Green Time
PR - Platoon Ratio

Time (Hour of Day)
Volume Per Hour
Cycle Time (Seconds)
Green Phase
Red Phase
## Average Delay per Vehicle Analysis

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Before (October 2017)</th>
<th>After (February 2018)</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average Volume per day During Peak Hours (veh)</td>
<td>Average Delay per Vehicle During Peak Hours (sec/veh)</td>
<td>Average Volume per day During Peak Hours (veh)</td>
</tr>
<tr>
<td>Total</td>
<td>7,973</td>
<td>22</td>
<td>10,076</td>
</tr>
<tr>
<td>AM</td>
<td>NB 794</td>
<td>12</td>
<td>986</td>
</tr>
<tr>
<td></td>
<td>SB 733</td>
<td>9</td>
<td>938</td>
</tr>
<tr>
<td>MD</td>
<td>NB 1,515</td>
<td>10</td>
<td>1,941</td>
</tr>
<tr>
<td></td>
<td>SB 1,464</td>
<td>8</td>
<td>1,902</td>
</tr>
<tr>
<td>PM</td>
<td>NB 1,850</td>
<td>15</td>
<td>2,252</td>
</tr>
<tr>
<td></td>
<td>SB 1,617</td>
<td>10</td>
<td>2,057</td>
</tr>
</tbody>
</table>
Travel Time Analysis

- 6 Bluetooth Readers
- 5.5 Mile Segment
- 13 Signals
- 18,900 vpd During Coordinated Hours
- Before: October 2017
- After: April 2018
# Travel Time Analysis

<table>
<thead>
<tr>
<th>Peak Period</th>
<th>Direction</th>
<th>Average TT Before (min/veh vehicle)</th>
<th>Average TT After (min/veh vehicle)</th>
<th>Net Average TT Change Per User</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM Peak 7:30 AM - 8:30 AM</td>
<td>NB</td>
<td>0:09:43</td>
<td>0:09:43</td>
<td>0:00:00</td>
</tr>
<tr>
<td></td>
<td>SB</td>
<td>0:10:19</td>
<td>0:09:26</td>
<td>-0:00:53</td>
</tr>
<tr>
<td>MD Peak 11:00 AM - 1:00 PM</td>
<td>NB</td>
<td>0:09:37</td>
<td>0:09:41</td>
<td>0:00:04</td>
</tr>
<tr>
<td></td>
<td>SB</td>
<td>0:10:21</td>
<td>0:09:27</td>
<td>-0:00:54</td>
</tr>
<tr>
<td>PM Peak 4:30 PM - 6:30 PM</td>
<td>NB</td>
<td>0:09:55</td>
<td>0:10:05</td>
<td>0:00:11</td>
</tr>
<tr>
<td></td>
<td>SB</td>
<td>0:10:29</td>
<td>0:09:39</td>
<td>-0:00:50</td>
</tr>
</tbody>
</table>

Net Change: -0:02:22  
Average Change: -0:00:24
Cost Analysis

User and Non-User Benefit Analysis for Highways (AASHTO “Red Book”)

<table>
<thead>
<tr>
<th>Transportation Mode and Trip Purpose</th>
<th>Recommended Percent of Wage / Compensation (AASHTO Value)</th>
<th>Albuquerque Average Wages / Compensation (<a href="http://www.bls.gov">www.bls.gov</a>)</th>
<th>Average Vehicle Occupancy (AASHTO Value)</th>
<th>Value of Time per Hour (wage x percentage x occupancy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auto Drive Alone / Commute</td>
<td>50%</td>
<td>$22.08</td>
<td>1.50</td>
<td>$16.56</td>
</tr>
</tbody>
</table>

- **Average AWDT 2014 from MRCOG Data**: 49,000
- **Average Growth Rate 2010-2014 from MRCOG Data**: 7.77%
- **Forecasted 2017 AWDT (F=P(1+i)^n)**: 60,000
- **Percent of Vehicles Traveling between Quail Rd and Irving Blvd from Bluetooth Travel Time Readers**: 35%
- **Percent of Vehicles Traveling on Coors Blvd during Coordinated Hours from ATSPM Volume Metric**: 90%
- **Calculated Volume for Bluetooth Travel Time Analysis (=2017 AWDT x Volume During Coordination on Segment)**: 18,900
## Cost Analysis (Continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Travel Time Saved (seconds)</td>
<td>0:00:24</td>
</tr>
<tr>
<td>Vehicles During Coordinated Hours (AWDT)</td>
<td>18,900</td>
</tr>
<tr>
<td>Total Travel Time Saved per Day During Coordinated Hours (Hours)</td>
<td>126</td>
</tr>
<tr>
<td>Total Cost Savings Per Day During Coordinated Hours</td>
<td>$2,087</td>
</tr>
<tr>
<td>Total Cost Savings Per Year During Coordinated Hours Irving to Quail</td>
<td>$751,170</td>
</tr>
<tr>
<td>Total Cost Savings Per Signal Per Year (Coors Blvd)</td>
<td>$57,782</td>
</tr>
<tr>
<td>Total Cost Savings for 23 Signals on Coors Blvd Per Year</td>
<td>$1,328,986</td>
</tr>
</tbody>
</table>
Weekend Coordination Plan

- Operates PM Timing Plan on the Weekends
- Link Pivot Analysis for Saturdays in January 2018
- Quail to Coors Bypass

<table>
<thead>
<tr>
<th>Upstream Arrivals on Green</th>
<th>Downstream Arrivals on Green</th>
<th>Total Link Arrivals on Green</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Existing</strong></td>
<td><strong>Existing</strong></td>
<td><strong>Existing</strong></td>
</tr>
<tr>
<td>10,613</td>
<td>11,518</td>
<td>22,131</td>
</tr>
<tr>
<td>71%</td>
<td>71%</td>
<td>71%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Predicted</strong></th>
<th><strong>Predicted</strong></th>
<th><strong>Predicted</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>11,244</td>
<td>11,479</td>
<td>22,723</td>
</tr>
<tr>
<td>75%</td>
<td>71%</td>
<td>73%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Actual</strong></th>
<th><strong>Actual</strong></th>
<th><strong>Actual</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>12,048</td>
<td>11,652</td>
<td>23,700</td>
</tr>
<tr>
<td>77%</td>
<td>71%</td>
<td>74%</td>
</tr>
</tbody>
</table>
Coors Blvd Holiday Signal Timing

- Cottonwood Mall Shopping
  - Christmas Eve, Saturdays before Christmas
  - Identified worst movements:
    - Coors & Coors Bypass - WB left turn
    - Coors Bypass & Eagle Ranch – N-E left turn
    - Coors Bypass & Ellison – WB left turn
  - Significant Reduction in Split Failures
Coors Blvd and Coors Bypass Saturday December 9th - Before

Total Split Failures = 147
Coors Blvd and Coors Bypass Saturday December 23rd - After

Total Split Failures = 99
Coors Bypass and Eagle Ranch
Saturday December 9th - Before

Total Split Failures = 68
Coors Bypass and Eagle Ranch
Saturday December 23rd - After

Total Split Failures = 26
Coors Bypass and Ellison Dr
Saturday December 9th - Before

Total Split Failures = 79
Coors Bypass and Ellison Dr
Saturday December 23rd - After

Total Split Failures = 18
ART ATSPM

- Build upon the ART System Upgrades
- Installation of Advanced Radar Detection
- Complimentary to Transit Signal Priority (TSP)
  - Provide additional data to implementation designers
  - Active ATSPMs management
  - Develop TSP ATSPM statistics
ART ATSPM Metrics
## TSP Metrics – Data Logger

<table>
<thead>
<tr>
<th>Event Code</th>
<th>Event Description</th>
<th>Parameter</th>
<th>Description Parameter Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>112</td>
<td>TSP Check In</td>
<td>TSP #(1-10)</td>
<td>Set when request for priority is received.</td>
</tr>
<tr>
<td>113</td>
<td>TSP Adjustment to Early Green</td>
<td>TSP #(1-10)</td>
<td>Set when controller is adjusting active cycle to accommodate early service to TSP phases.</td>
</tr>
<tr>
<td>114</td>
<td>TSP Adjustment to Extend Green</td>
<td>TSP #(1-10)</td>
<td>Set when controller is adjusting active cycle to accommodate extended service to TSP phases.</td>
</tr>
<tr>
<td>115</td>
<td>TSP Check Out</td>
<td>TSP #(1-10)</td>
<td>Set when request for priority is retracted.</td>
</tr>
</tbody>
</table>
ART ATSPM Metrics - TSP

TSP Early or Extend Green Effects on Coordination

- TSP Early Green
- Coordination Transition Add Time
- TSP Extend Green
- Coordination Transition Subtract Time
ATSPM Benefits

• Increased Safety
  ▫ Proactive operations and maintenance practices

• Targeted Maintenance
  ▫ Provide actionable information, significant agency cost savings

• Improved Operations
  ▫ Active monitoring of signalized intersection performance

ATSPMs provide affordable and sustainable system improvements by leveraging existing resources more effectively
Thank you!

Chris Sobie, EI
csobie@lee-eng.com

Special Thanks to
Mark Taylor & UDOT
marktaylor@Utah.gov