TSM&O
Signal Upgrades in Rural Communities
October 2018
Rural Signals

Prescott and Prescott Valley
Semi-rural, isolated communities
• 30+ miles from major interstate
• Travel time of 40+ minutes
Population is growing
• Third largest in State behind Phoenix and Tucson
• 220,000 people (double 1990)
SR 69 Corridor

20 signals over 8.5 miles
- Average spacing: 0.45 mi
- Shortest spacing: 0.18 mi
- Longest spacing: 0.98 mi

25,000 – 40,000 ADT

2 Lanes/direction: 5.5 mi (65%)
3 lanes/direction: 3.0 mi (35%)
SR 69 Corridor
Issues

- Significant queuing and back-ups
  - Travel time upwards of 25 min
  - Customer complaints
- Crashes increasing annually
  - 197 (2015) to 250 (2017)
  - 13% annualized increase
  - Majority (89%) are multi-vehicle
Causes

- Population growth
  - Increase in volumes, limited street network
- Older signal equipment
  - TS1 controllers, inductive loops
- Outdated coordination plans
  - 10-years old, clock-based
- Access control
- Driver behavior
Solution

Improve Individual Signals
• Upgrade controllers
• Replace detection

Improve Corridor Operations
• Interconnect signals
• Utilize traffic management software
• Improve timing plans

Measure Performance
• Install ARID devices
• Install PTZ cameras
Improve Individual Signals

Update controllers
• Replace TS1 controllers with TS2 controllers
  • Programmable features
  • Flexibility with future add-ons
• Continue use of existing TS1 cabins
  • Cost savings

Replace detection
• Replace loops/video with radar
  • Increased flexibility
  • Presence and advanced detection
Improve Corridor Operations

Interconnect signals
- Direct connect fiber
  - 8 signals on east end
- Point-to-point radio
  - Three groups of 4 signals
  - Wireless modems to backhaul

Utilize traffic management software
- Centralized control
  - Online, accessible
- Manage remotely
  - Troubleshoot live or by record
- Systems approach on timing plans
Measure Performance

Install ARID devices
• 9 Wi-Fi locations
• Travel time and average speed
• Data for entire “trip”

Install PTZ cameras
• 6 cameras in corridor
  • Busiest intersections
• Visual verification
Installation

Internal forces
• Controllers
• Radios
• Fiber

Contractor
• Detection (radar)
• PTZ cameras

Total Cost = $1M

<table>
<thead>
<tr>
<th>Work Item</th>
<th>Cost</th>
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<tbody>
<tr>
<td>Signal controllers</td>
<td>$90,000</td>
</tr>
<tr>
<td>Detection (radar)</td>
<td>$700,000</td>
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<tr>
<td>Cameras/radios</td>
<td>$97,000</td>
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<tr>
<td>ARID devices</td>
<td>$34,000</td>
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<tr>
<td>Software license</td>
<td>$21,000</td>
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<tr>
<td>Fiber, switches, etc</td>
<td>$14,000</td>
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<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$956,000</strong></td>
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</tbody>
</table>
Results - Speed

Significant improvement
- Removal of queues
- Increased platoons
- No peak hour degradation

Driver behavior ++

Off-peak: 46 mph
Peak hours: 33 mph (min)
Results – Travel Time

Significant improvement
- 20-25 minute base condition
- 5-10 minute savings/direction

Time-value benefit = $13.5 M/year based on time savings

B/C of 70.5

Off-peak: 12 minutes
Peak hours: 16 minute (max)
Thank you