Weather Information Systems in Arizona

presented by:
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“Presenters from Arizona will highlight the public-private partnership ADOT developed to receive weather information services from a private provider”

Does the Arizona Department of Transportation Have a Business Need for Environmental Sensor Station Information?
1992: First RWIS Installations in Arizona
2001: Mohave County ALERT
2002: NTCIP Compliant RWIS
2006: Feasibility Assessment
2007: WIS
2008: Rural Safety Innovation
A Well Known Approach

- Design: P, S & E
- Procurement: A low bid
- Construction: A highway contractor
- Acceptance Test: Everything works Now!!
- Maintenance: A good idea
A New Approach?

- Service Provider Model
- Compensation Tied to Data Delivery
- Let Experts Worry about the Hardware
Arizona Facts

- Population 6 Million
- Highest Elevation: 12,600 Feet
- Land Area: 114,000 Square Miles
- Land area above 5,000 Feet: 41%
- Land Area Above 3,000 Feet: 65%
Expect the Unexpected

The Nation’s Southern Most Cross Country Interstate Highway

<table>
<thead>
<tr>
<th>Injury Severity</th>
<th>Number of Occurrences</th>
<th>Crashes per 100 Million VMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>7</td>
<td>3.4</td>
</tr>
<tr>
<td>Injury (8 incapacitating, 26 non-incapacitating and 14 possible injury)</td>
<td>44</td>
<td>23.4</td>
</tr>
<tr>
<td>Property Damage Only</td>
<td>96</td>
<td>46.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>147</td>
<td>73.7</td>
</tr>
</tbody>
</table>
The Desert
Reduced Visibility
Outside: A Severe Dust Storm
“If motorists see a dust storm crossing the road or are engulfed in one, they should pull off the highway a safe distance and wait for the dusty conditions to pass. When stopped, turn off lights; set the emergency brake, and make sure the brake light is off.”
Inside the Storm
24% of the Fatal Crashes on I-10 in Eastern Arizona occur during reduced visibility conditions.
The Aftermath remains Long After the Storm has Cleared
Arizona Dust Storm Kills 10

Published: April 12, 1995

Bowie, Arizona The high wind that is common in Arizona this time of year became a smothering force when a 24-car pileup occurred on Sunday. A 5-year-old boy and 13-year-old girl died on Monday night from injuries in the crash, bringing the death toll to 10, the authorities said today.

Five people remained hospitalized, including the children's two brothers and parents, who are from Deming, N.M.

The wreck occurred when swirling dust cut visibility to less than a car length along a half-mile stretch of Interstate 10 near Bowie, a southeastern Arizona town 25 miles west of New Mexico and 170 miles southeast of Phoenix.

Bowie lies along a 60-mile stretch of Interstate 10 between Willcox and the New Mexico line that is considered one of three dust traps in Arizona.

Source: New York Times
Flash Flooding

• Mohave County Alert System in North Western Arizona
• 27 ALERT Stations focused on Stream Gauging
• Install by Mohave County Public Works
• Funded in part by ADOT through an intergovernmental agreement
• A locally developed program
• Low cost sensor stations
The ALERT System
Needs Assessment Summary

- Detect Winter Conditions
- Detect Dust Storms
- Detect Flooding
- Deliver Reliable Data 24/7
- Provide Assistance in Interpreting Data and Formulating Action Plans
- Provide Forecasting
- Deliver Information to Maintenance Supervisors Anywhere
ADOT Business Needs

- Winter Maintenance & Snowplowing
- High Wind / Low Visibility Advisory
- Remote Visual Inspection
- Simple – Reliable – Usable
- Inexpensive
ADOT Business Needs

User Interface Needs

- Forecasting Service
- Integration with Other Data Sources
- Standards Based Solutions
- Turnkey Service
  - 5 to 15 Year Lifecycle
- No Up-Front Capital Costs
Data Quality

- More Frequent Updates: (5 to 20 minutes)
- Basic Range Checking and a Data Quality Flag
- Suitable for Upload to Clarus
- % Availability Specification
- Maximum Outage Duration Specification
- Sensor Accuracy Specification
- Sensor Longevity Specification
Remote Visual Inspection

- High Quality Snapshot Images
- Good images during poor weather
- Infrared Illuminators or Luminaires
- Multiple Views: Up to 8 Snapshots?
- Pan-Tilt with Presets?
- 40 kb per image typical
User Interface Requirements

- Web Based
- Easy to Access
- E-mail and Pager Alerts Available
- XML Export to AZ511.com
- Arizona at Your Service Requirements?
- Primary Web Server Provided/Maintained by Vendor?
IT Issues

- ADOT must own data from RWIS sites and be able to distribute it immediately and freely.
- Archiving: ADOT will handle archiving of data, vendor should hold 90 day rolling.
- Current data file name should always be the same.
- Vendor should put data on secure FTP site for ADOT to go get the data.
Engineer, Furnish, Install & Test Environmental Sensor Stations for each Owner Selected Site.

Own, operate, and maintain the ESS sites for the term of the agreement.

Provide telemetry services for each ESS site.
Communications & Power
Monthly Reporting

- Detailed Management Reporting
- Vendor Compensation tied to Data Availability
- Monthly vendor compensation is prorated to when data availability is between 50 and 100%
- Vendor is not penalized for short duration outages
- Vendor loses all monthly compensation when a site is reporting data less than 50% of the time.
- Primary vendor compensation is monthly fee for service.
Weather Information Services: Scope of Work

- Mohave County Alert Interface
- E-mail Alerts
- Clarus Data Export
- Quarterly PM
- Lens Cleaning
- Annual Calibration
- Seasonal Forecasting Services

Adequately maintain all equipment needed to provide the contractually required ESS data to the Department.

Remove ESS hardware placed within ADOT ROW upon expiration of the term.
Hardware Owned by the Service Provider

- The Supplier shall own and operate all supplier-furnished hardware including but not limited to hardware placed in ADOT ROW. As the Owner of the hardware, the supplier shall be responsible for all risks of loss which may result from any peril that could impair the performance of the hardware or the operation of the system as a whole.

- The supplier shall be responsible for failure to deliver weather information services due to any peril except the known intentional acts of ADOT and its Contractors performing pavement preservation work such as milling, crack sealing and asphalt overlay work. Perils that the Owner of the hardware shall be responsible for include, but are not limited to, theft, mysterious disappearance, vandalism, malicious mischief, vehicular impact, fire, high winds, lightning, electro static discharge, flooding, earthquake, failures of third party service providers contracted by the supplier and business interruption due to any cause.
Construction
17 Sites Now Reporting
Pavement Sensors
Remote Access Data Access

Blackberry

PDA

ITS Engineers & Constructors
Forecasting Service

**SCAN*Cast: FRK**

**Forecast Period**

<table>
<thead>
<tr>
<th>SCAN*Cast FRK</th>
<th>Forecast Period</th>
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</thead>
<tbody>
<tr>
<td>Group: Arizona DOT Statewide (622000)</td>
<td>Starting: 08/22/2007 06:00</td>
</tr>
<tr>
<td>Site: I-40 Fort Rock @ MP 91.5 (622000)</td>
<td>Ending: 08/23/2007 06:00</td>
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<tr>
<td>Sensor: EB Drive Lane (5)</td>
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</table>

**SCAN*Cast Table**

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Precip &amp; Cloud Cover</th>
<th>Snow Accumulation</th>
<th>Wind</th>
<th>Rel. Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temps (F)</td>
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**Wind (MPH)**

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<tbody>
<tr>
<td>SE</td>
<td>S</td>
<td>S</td>
<td>NW</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>6:00</td>
<td>9:00</td>
<td>12:00</td>
<td>15:00</td>
<td>18:00</td>
<td>21:00</td>
</tr>
</tbody>
</table>

**Cloud Cover, Rel Hum & Precip Prob (%)**

<p>| | | | | | |</p>
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<tr>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Cloud Cover</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Precip Prob</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Rel Hum</td>
<td>30</td>
<td>20</td>
<td>13</td>
<td>13</td>
<td>15</td>
</tr>
</tbody>
</table>

**Precipitation**

No Significant Precipitation in Forecast

**Snow Accumulation (in)**

No Significant Snow Accumulation in Forecast

**Forecast Discussion**

**MOSTLY SUNNY TODAY. MOSTLY CLEAR TONIGHT. MOSTLY SUNNY TOMORROW.**

**MORNING.**
User Feedback

- I-10 Corridor: RSIP Grant for Expansion
- US-93 Kingman Area: Local ALERT Program
  Highly Cost Effective
- I-40 Corridor: Seligman DTN Forecasting
  Service Very Helpful
- I-40 Corridor: Limited buy in from Plow Drivers
  and their Supervisors.
- I-40 Corridor: Seligman continues to use
  information from DTN and find it very helpful.
- Having a professional weather forecaster would be a real benefit to our operations.
SPR 615: Rural ITS Progress Study Plan (2006)

- Participate in Clarus
- Collect Weather Information from WIS Plan Locations
- Low Visibility Detection & Warning Program
- Develop IGAs with County Flood Control Districts to Monitor Flood Prone Areas
- Deploy Low Cost Weather Stations at Maintenance Camps
- Employ a Statewide Highway Focused Meteorologist
- Deploy Bridge Deck Anti-Icing and Monitoring Systems
<table>
<thead>
<tr>
<th>Deployment Concept</th>
<th>Opinion of Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarus</td>
<td>$500K</td>
</tr>
</tbody>
</table>
| Weather Information System Implementation  
5 Year Life Cycle Cost 42 sites at $100K/each  
$16K initial Cost + $1600 month for 60 Month) | $4.2 Million    |
| Statewide Meteorologist (per annum)                                               | $85K            |
| Low Cost Weather Stations (40 at $2,500 each)                                     | $100K           |
| Low Visibility Sensing and Warning Systems  
10 Sites at $75K per site)                                                        | $750K           |
| Develop ALERT System IGAs with Countys for Stream Flow  
Monitoring on State Highways  
8 Agencies at $60K/agency                                                             | $480K           |
| Willows Bridges Bridge Deck Anti-Icing                                             | $300K           |
Reporting to Clarus

17 Sites Collecting Weather Information per Plan

Low Visibility Detection & Warning Program through RSIP Grant

IGA with Mohave County Flood Control District Established
Questions
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