Fleet Management Analytics Peer Exchange Workshop
October 27, 2016
CDOT BUILDS, MAINTAINS & OPERATES

- 23,000 Total lane miles of highway
- 1,480 Geohazard sites
- 2,350 Congestion ahead intelligent transportation system (ITS) devices
- 3,439 Bridges
- 6,062 Culverts
- 3,227 Vehicles
- 1,174 Buildings
- 21 Tunnels

Source: Colorado Department of Transportation, 2015
COST TO MAINTAIN THE SYSTEM

IN FY2016
ASSET MANAGEMENT PROGRAMS ACCOUNTED FOR $327.5 MILLION

IN FY2016
HIGHWAY MAINTENANCE ACTIVITIES COST A TOTAL OF $270 MILLION

Source: Colorado Department of Transportation, 2015 Annual Report.
From 2013 to 2040:

- Population: +47%
- 7.8 million Coloradans
- Vehicle Travel: +47%
- 41.8 billion miles traveled
- Avg. Traffic Delay on congested corridors: 2 to 3 times during peak hours (if we do nothing)
Purpose: Provide Freedom, Connection, and Experience through Travel

Summit: Best Department of Transportation in the Nation

Peaks:
- Technology
  - Help Our People with Technology
  - Improve Travel Experience with Technology
- People
  - Develop Leaders
  - Internal Customer Focus
- System
  - Asset Condition
  - Improve the Customer Experience

Base Camps:
- Big Data
Self Driving Truck

- October 20th truck load from Fort Collins Budweiser Plant to a distributor in Colorado Springs.
- The 120 mile trip was conducted on I-25 overnight.
Selection Process

AVL Systems Researched

- IWAPI
- Network Fleet
- Infusion
- Zonar
- Ameritrak
- Delcan

Systems Tested

- 100 units of Network Fleet in the Denver Metro Area
- 100 units of Zonar on the I-70 Mountain Corridor
- 25 units of Infusion
- Existing 333 IWAPI units
December 2014

• The first week of Dec 2014 we started pulling reports from the Network Fleet and Zonar solutions.

• From the Idle Time report in the Zonar System, we identified 3 heavy fleet vehicles that idled for 23 hours straight out of a sample size of 100 vehicles.

• This event caused us to reconsider our priorities and realize the opportunity for Fleet efficiencies, Fuel efficiencies, and Fleet utilization.
Zonar AVL/Telematics

Zonar is configured for Fleet Management

• Pre and Post Trip Inspections
• A very robust vehicle diagnostic program
• Fuel Management Program
Ruggedized Portable Tablet

- Zonar designed, Android based
- Core applications:
  - Conduct verified vehicle inspections
  - Communicate with two-way messaging
  - Commercial vehicle navigation
- Other CDOT uses current/planned:
  - Forms-based messaging
Electronic Vehicle Inspection Report

- Patented verified RFID technology
- Streamlines vehicle inspection process
- Improve maintenance process
- Eliminates paperwork errors
Heavy Fleet Telematics

Working with Zonar to develop 5 projects

- Fuel Controls Project
- Developing a Winter Operations
- Dispatching app
- Integration with SAP Software for mobile work orders and timesheets
- Integration with truck control systems; Certified Power, Force America, and Cirus
Light Fleet Telematics – Verizon Network Fleet

- Used in the entire light fleet (3/4 ton and below)

- Integrated with WEX to provide fuel exception reporting to managers through a Sharepoint dashboard

- Exception reporting process alerts managers to potential issues with fuel purchases, speed, and idle time
- Our system consists of:
  - VNF unit
  - Key Fob
  - WEX fuel card
  - Driver Pin #
  - WEX report
  - Sharepoint site

- Notifications:
  - Idle Time
  - Mechanical faults
  - Recalls
  - Location / Geo-fence
  - Driver behaviors as determined by leadership
Multiple Management Reports

- Comprehensive reporting suite
- Run reports on individual units, group of vehicles or entire fleet
- Report scheduling
- Access 365 days worth of data (data beyond 365 days can be provided upon request at no charge)

- Activity Alerts Report
  - Geofence Violation Alert
  - Hard Braking/Hard Acceleration Alert
  - Idle Time Alert
  - Lost Power Alert
  - Odd-Hour Alert
  - Sensor Alert
  - Service Alert
  - Speed Violations Alert

- Activity Detail Report
- Alerts Report
- Begin/End of Day Report
Network Fleet Benefits

- Emissions
- Fuel Costs
- Operating Costs
- Unauthorized Use
- Vehicle Loss
- Vehicle Downtime
- Accountability
- Driver Safety
- Response Times

***PLUS: Thousands of hours of time saved due to the streamlining of fuel receipt reconciliation***
Network Fleet Fuel Economy Benefits

Fuel Gallons

<table>
<thead>
<tr>
<th>Month</th>
<th>Fuel Gallons Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>18,643.50</td>
</tr>
<tr>
<td>Feb</td>
<td>25,360.56</td>
</tr>
<tr>
<td>Mar</td>
<td>30,865.39</td>
</tr>
<tr>
<td>Apr</td>
<td>30,382.89</td>
</tr>
<tr>
<td>May</td>
<td>29,314.95</td>
</tr>
<tr>
<td>Jun</td>
<td>30,782.54</td>
</tr>
<tr>
<td>July</td>
<td>33,660.20</td>
</tr>
<tr>
<td>Aug</td>
<td>38106</td>
</tr>
</tbody>
</table>
## Data Point Comparison

<table>
<thead>
<tr>
<th>Function</th>
<th>IWAPI</th>
<th>Verizon</th>
<th>Zonar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver Data</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Location Data</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Mileage Data</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fuel Data</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Speed Data</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Pre and Post Trip Inspections</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Engine Diagnostics</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Material Information/Application Rates</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plow Status Information</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capability to handle SAP Work Manager</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Fuel Exceptions for Location and Time</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Capability to handle Asset Management functions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Idle Data</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Controller Data</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
## AVL Cost Comparison

### Zonar AVL Annual Service Cost

<table>
<thead>
<tr>
<th>Service</th>
<th># of Units</th>
<th>Annual Cost Per Unit</th>
<th>Annual Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Track, Trace, Idle, I/O &amp; Diagnostic</td>
<td>1104</td>
<td>$311.88</td>
<td>$344,315.52</td>
</tr>
<tr>
<td>Annual 2020 EVIR CSA Inspection</td>
<td>1104</td>
<td>$84.00</td>
<td>$92,736.00</td>
</tr>
<tr>
<td>Annual 2020 NAV &amp; Messaging</td>
<td>1104</td>
<td>$96.00</td>
<td>$105,984.00</td>
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<tr>
<td>Per Unit Subtotal</td>
<td></td>
<td>$491.88</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$543,035.52</td>
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</tbody>
</table>

### Verizon NetFleet AVL Annual Service Cost

<table>
<thead>
<tr>
<th>Service</th>
<th># of Units</th>
<th>Annual Cost Per Unit</th>
<th>Annual Fleet Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Track, Trace, Idle, I/O &amp; Diagnostic</td>
<td>913</td>
<td>$239.40</td>
<td>$218,572.20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$218,572.20</td>
</tr>
</tbody>
</table>

**Grand Total** $761,607.72
# Heavy Fleet ROI

<table>
<thead>
<tr>
<th>Savings Bucket</th>
<th>Minimum Reduction Savings</th>
<th>Maximum Reduction Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet &amp; Maintenance Savings</td>
<td>$932,577</td>
<td>$1,885,057</td>
</tr>
<tr>
<td>Utilization Based Savings</td>
<td>$262,520</td>
<td>$822,040</td>
</tr>
<tr>
<td>Fuel Savings</td>
<td>$160,938</td>
<td>$472,532</td>
</tr>
<tr>
<td>Compliance / Risk MGMT</td>
<td>$56,124</td>
<td>$78,624</td>
</tr>
<tr>
<td>Labor Based Savings</td>
<td>$349,716</td>
<td>$621,424</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td><strong>$1,761,875</strong></td>
<td><strong>$3,879,677</strong></td>
</tr>
</tbody>
</table>

Fleet of 776
AVL Projects

- Automated Fuel Control through exception reporting with both Network Fleet and Zonar solutions
- Heavy Fleet winter operations data points for mobile observations
- Snowplow tracker Application
Fuel Transaction Monitoring

Fuel Exception Reports:
- Driver Count (excessive number of “swipes” or transactions in one day)
- Non-fuel purchases (washer fluid, motor oil, 1 car wash per month okay)
- Out of state transactions (without prior approval)
- Exceeded tank capacity of vehicle in one transaction

AVL Exception Reporting:
- Key fob and RFID tags assign drivers to the vehicles
- WEX card identifies the vehicle to transaction
- AVL system correlates location of vehicle and ID of driver
- These data points confirm vehicle, driver, and credit card were all at the pump at the time of the transaction
- Unusual activity generates an exception report, which must be investigated and explained
SharePoint Division/Region Dashboard

Transactions and Exceptions - Statewide

Exceptions - Statewide
*Since March 1 Implementation

Costs - Statewide
SharePoint Statewide
Exception Dashboard

Exception Types - Month to Month

Drill Down by Division
- Aeronautics
- DAF
- DAS
- DHM
- DPS
- DTD/DTR
- DTM
- CTS
- Region 1
- Region 2
- Region 3
- Region 4
- Region 5
Benefits Realized:

- Fuel Exception Reporting is much easier, quicker, and fewer exceptions to investigate
- Reduced number of improper purchases with fuel cards
- Reduced idle time = less fuel used
- Positive impact on driver behaviors (speeding, improper use)
- Automatic capture of mileage
- Timely awareness of recalls
- Improved awareness of faults, more timely repairs
- Ability to geofence CNG stations, and monitor / encourage their use
- Has been used to protect our drivers from false / erroneous accusations by the public
Development with the Zonar Solution

Open API Data Calls

- Enhancing CDOT 3rd party software applications
  - Reliable telematics data
  - Remote forms based messaging
  - Nice integration for Dispatcher communications during snow plow operations
    - Driver Name
    - Phone
    - Call Sign
    - Asset Number
    - Recent location
  - Other snow plow operation integrations planned
    - MDSS (Iteris)
    - SAP
Connecting the Snowplow

- SpreadSmart, Zforms, and V3 gather data
- Zonar decodes and Iteris consumes
- Iteris decision support link to operators

Four Legs
- Leg 1 - Data to Zonar
  - ZForms
  - SpreadSmart
- Leg 2 - Zonar to Iteris
- Leg 3 - View Iteris
- Leg 4 - SAP App
Snow Plow Tracker
Heavy Fleet Forms Based Messaging

- Snow Plow Taper Log Form.
  Ensure completion prior to & during route
- Accident/Incident Form. (Planned)
  Remote multi-purpose required reporting by driver
- Dispatch Operator Radio Call Form (planned)
GIS Integration

- Mobility
  - GEO.e
  - Plant MTCE
  - SAP ECC 6.0

- GIS for all Roadway Assets
- ESRI adjustments and data cleanup
Questions?