Nevada DOT/USDOT FHWA
Road Weather Integrated Mobile Observations (IMO 1, 2 & 3) Projects
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2C</td>
<td>Center to Center</td>
</tr>
<tr>
<td>DSRC</td>
<td>Dedicated Short Range Communication</td>
</tr>
<tr>
<td>EDACS</td>
<td>Enhanced Digital Access Communication System</td>
</tr>
<tr>
<td>IMO</td>
<td>Integrated Mobile Observations</td>
</tr>
<tr>
<td>JSON</td>
<td>JavaScript Object Notation</td>
</tr>
<tr>
<td>MADIS</td>
<td>MADIS (Meteorological Assimilation Data Ingest System)</td>
</tr>
<tr>
<td>MDSS</td>
<td>Maintenance Decision Support System</td>
</tr>
<tr>
<td>mESS</td>
<td>Mobile Environmental Sensor Station</td>
</tr>
<tr>
<td>MMS</td>
<td>Material Management System</td>
</tr>
<tr>
<td>NCAR</td>
<td>National Center for Atmospheric Research</td>
</tr>
<tr>
<td>NDEX</td>
<td>Nevada Data Exchange</td>
</tr>
<tr>
<td>NIMO</td>
<td>Nevada Integrated Mobile Observation</td>
</tr>
<tr>
<td>NNG 511</td>
<td>Nevada Next Generation 511</td>
</tr>
<tr>
<td>OBU</td>
<td>On-Board Unit</td>
</tr>
<tr>
<td>RSU</td>
<td>Road Side Unit</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>RWMP</td>
<td>Road Weather Management Program</td>
</tr>
<tr>
<td>TMDD</td>
<td>Traffic Management Data Dictionary</td>
</tr>
<tr>
<td>TMS</td>
<td>Traffic Management System</td>
</tr>
<tr>
<td>TSMO</td>
<td>Traffic Systems Management and Operations</td>
</tr>
<tr>
<td>WSDL</td>
<td>Web Services Description Language</td>
</tr>
<tr>
<td>WxDE</td>
<td>Weather Data Environment</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
<tr>
<td>XSD</td>
<td>XML Schema Definition</td>
</tr>
</tbody>
</table>
Nevada Integrated Mobile Observations (NIMO) Project

Nevada DOT
- Denise Inda
- Rod Schilling
- Jim Whalen
- Israel Lopez
- Gary Molnar
- Mark Aragon
- Ambere Angel
- And others

University of Nevada, Reno
- Jeffrey LaCombe
- Eric Wang
- Pablo Rivera
- JP Braz
- Amanda Nelson
- Destiny Phan
- Tamzin Atkins
- Kyle Gorsiski
- Cody Zampella
NIMO Project

1. NIMO 1 Project Overview
2. NIMO 2 Project Overview
3. NIMO 3 Project Overview
4. Cost Comparison
5. Moving Forward
6. Pikalert Overview

2. Objectives were to establish an effective and sustainable IMO program and fully incorporate, test, and evaluate the use of Dedicated Short-Range Communications (DSRC) & cellular for telemetry data as part of the IMO system using DSRC along the I-580 corridor between Reno and Carson City; cellular only in the Lake Tahoe area.

3. Modular system installed in ten vehicles.
Geo-fencing: Cradlepoint vs. DSRC RSU
DSRC Site Locations

18 Locations along I-580

1. I-80
2. Mill Street
3. Plumb Lane
4. Moana Lane
5. Peckham Lane
6. Neil Road
7. Exit 61, Virginia St
8. Arrow Creek
9. SR 431, Mt. Rose Hwy
10. Galena Forest
11. Steamboat Hills
12. Galena Creek
13. Brown’s Creek
14. Parker Ranch
15. Bower’s
16. Washoe Valley
17. Arrowhead Dr
18. 5th Street
Vehicle Routes

18 DSRC Locations
32 Miles DSRC
54 Miles Cellular
IMO 2272
FSP
IMO 0267
IMO 3200
NIMO 3 Vehicles

- 9 Snow plows with instrumented spreader motors and 1 freeway service patrol vehicle
  - 5 in Reno
  - 3 in Carson City

District II IMO Inventory

<table>
<thead>
<tr>
<th>UNIT #</th>
<th>YEAR</th>
<th>MAKE</th>
<th>MODEL</th>
<th>DESCRIPTION</th>
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<tr>
<td>2272</td>
<td>2007</td>
<td>PETERBILT</td>
<td>357</td>
<td>TANDEM AXLE DUMP TRUCK</td>
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<tr>
<td>1915</td>
<td>2007</td>
<td>PETERBILT</td>
<td>357</td>
<td>TANDEM AXLE DUMP TRUCK</td>
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<tr>
<td>0763</td>
<td>2009</td>
<td>PETERBILT</td>
<td>367</td>
<td>TANDEM AXLE CAB AND CHASIS</td>
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<tr>
<td>2275</td>
<td>2007</td>
<td>PETERBILT</td>
<td>357</td>
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<tr>
<td>3200</td>
<td>2007</td>
<td>PETERBILT</td>
<td>357</td>
<td>TANDEM AXLE DUMP TRUCK</td>
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<tr>
<td>2274</td>
<td>2007</td>
<td>PETERBILT</td>
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<td>3319</td>
<td>2009</td>
<td>PETERBILT</td>
<td>367</td>
<td>TANDEM AXLE CAB AND CHASIS SWL</td>
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<td>0323</td>
<td>2007</td>
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<td>TANDEM AXLE CAB AND CHASIS</td>
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<tr>
<td>0267</td>
<td>2001</td>
<td>INTERNATIONAL</td>
<td>5000</td>
<td>AWD</td>
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<tr>
<td>R1</td>
<td>2012</td>
<td>FORD</td>
<td>E240</td>
<td>FREEWAY SERVICE PATROL VAN/PU</td>
</tr>
</tbody>
</table>
NIMO 3 On Board Units (OBU)

Arada Locomate
- DSRC
- Wi-Fi
- GPS

Comet T7511 Ethernet
- Weather Sensor Head
  - Barometric Pressure
  - Air Temperature
  - Humidity

Roadwatch
- Air Temperature
- Surface Temperature

Technologic Systems
- CPU (Main computer)

Cradlepoint IBR1100
- Cellular Modem, GPS

Adam 6051
- Ethernet DIO/counter

Custom Sensors
- Windshield Wiper Sensor
- Spreader Rate Sensor
- Spreader Material Sensor
Example Snow Plow Installation

Use of COTS components. Only software is “custom” (no custom electronics)
- Pilot will have 10 vehicles
- Retrofits of IMO phases 1 & 2 installs to follow
- Typical mount on back wall of passenger cabin behind seats
- Transmission frequencies vary with the telemetry mode, ranging from ~10 seconds to 5 minutes
- No driver interface/display
- No imagery/video

GPS Antenna
DSRC Antenna
Road Temperature Sensor
Air Sensor
Spreader Sensor

~24”
~18”
# NIMO 3 Sensor Package Inventory

<table>
<thead>
<tr>
<th>Sensor ID</th>
<th>Manufacturer</th>
<th>Source Unit of Measure</th>
<th>Target Observation Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIAmar</td>
<td>Airmar</td>
<td>Temperature Celsius</td>
<td>NTCIP 1204 ESS Air Temperature</td>
</tr>
<tr>
<td>RTRoadwatch</td>
<td>Roadwatch</td>
<td>Temperature Celsius</td>
<td>NTCIP 1204 ESS Surface Temperature</td>
</tr>
<tr>
<td>PRAirmar</td>
<td>Airmar</td>
<td>Atmospheric Pressure Bar</td>
<td>NTCIP 1204 ESS Atmospheric Pressure</td>
</tr>
<tr>
<td>PROomega</td>
<td>Omega</td>
<td>Atmospheric Pressure kPa (kilopascal)</td>
<td>NTCIP 1204 ESS Atmospheric Pressure</td>
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<tr>
<td>GPGGA</td>
<td>Cradle Point</td>
<td>NMEA 0183 Sentence GPGGA</td>
<td>NMEA 0183 Sentence GPGGA</td>
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</tbody>
</table>
Plow On-Board Hardware

- Mirror Mounted Multi-band Diversity Antenna
- Mirror Mounted Air Temp - Atmospheric Pressure Comet Sensor
- Mirror Mounted Air/Pavement Temp – Roadwatch Sensor
- Rear Mounted Spreader Rate Custom Sensor
- Behind Passenger Seat Mounted OBU – ARADA System
- Cell, WIFI & GPS Mobile Mark Sensor
FSP Van On-Board Hardware

- Under Front Bumper Mounted Air/Pavement Temp – Roadwatch Sensor
- Inside Van Rack Mounted OBU – ARADA System
IMO Data and Future Data Distribution Points

Nevada
Integrated
Mobile
Observations

Material Management System

Enhanced Maintenance Decision Support System

Additional Information for
• Freight Carriers
• Emergency Responders
• DMS, 511 Motorist Advisories
• Variable Speed Limits
• MADIS/WxDE
NIMO System Architecture

In-Vehicle Equipment
- Weather sensors
- Vehicle sensors (OBU, CANBus)
- Equipment sensors (spreader)
- Location sensor (GPS)
- Radio(s)

Multi-Mode Receiving Station
- Receives data from mobile vehicles
- Archives and forwards data

Applications
- Current conditions
- Weather data environment
- Forecasts
- Material usage tracking
- Road maintenance recommendations

Data received at frequency of a message every eight seconds
Map the Dataset

1. Wave Short Message Protocol (WSMP)
2. Same “payload” over DSRC and cellular

- Date
- Time
- Location (lat., long.)
- Speed
- Altitude
- Air Temp
- Barometric Pressure
- Humidity
- Dew Point
- Road Temp
- Wiper Status
- Spread Rate
## NIMO 3 Sensor Package Inventory

<table>
<thead>
<tr>
<th>Sensor Id</th>
<th>Manufacturer</th>
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<th>Target Observation Type</th>
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</thead>
<tbody>
<tr>
<td>ATAirmar</td>
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<td>NTCIP 1204 ESS Air Temperature</td>
</tr>
<tr>
<td>RTRoadwatch</td>
<td>Roadwatch</td>
<td>Temperature Celsius</td>
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<td>NMEA 0183 Sentence GPGGA</td>
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</table>
# mESS Uses National Standards

(Mapped Data Sets / Data Dictionary)

<table>
<thead>
<tr>
<th>5.1.4</th>
<th>Target Observation Type</th>
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<th>Requires at least one of following.</th>
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<td>NTCIP 1204</td>
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<td>5.1.4.6</td>
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<td>SAE J2735</td>
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<tr>
<td>5.1.4.8</td>
<td>SAEJ2735_DE_TractionControlState</td>
<td>M</td>
<td>SAE J2735</td>
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<td>5.1.4.9</td>
<td>SAEJ2735_DE_StabilityControlStatus</td>
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<td>SAE J2735</td>
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<td>5.1.4.16</td>
<td>mESS_WiperCount</td>
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</table>
mESS / NDEX Implementation Phases

**Phase 1**
- Instrumented Maintenance Vehicles
  - EDACS Radio
  - 3G/4G
  - DSRC
- IMO Server (UNR)
- CSV File
- NCAR (National Center for Atmospheric Research)

**Phase 2**
- Mobile ESS (mESS) Database
- NCAR (National Center for Atmospheric Research)

**Phase 3**
mESS / NDEX Data Architecture

Owing Center
- EDACS Radio
- 3G/4G
- DSRC

Instrumented Maintenance Vehicles

External Centers
- NCAR
  National Center for Atmospheric Research
- WxDE
  Weather Data Exchange

IMO Server

Mobile ESS (mESS) Database
Supported NDEX Messages

Device Types:
- Detector Station
- CCTV
- Dynamic Message Sign (DMS)
- Environmental Sensors (ESS)
- Mobile Environmental Sensors (mESS) – (No National Standard)
- Highway Advisory Radio (HAR)
- Incidents/Events
- Ramp Meter
- Node, Link, Traffic Network

NDEX messages include inventory and device status
NDEX Supported Services

1. Need to authenticate access
2. Need to support request-response
3. Need to support error handling
4. Need to share IMO vehicle inventory
5. Need to share IMO sensor inventory from any vendor-specific sensor
6. Need to share IMO observations
7. Need to preserve vendor-specific sensor data
Only the owning center may control field devices.
NDEX Architecture

NDEX receives data from the owning center

Field Devices

control

status

TMS
District 2
(Owner Center)

publish

subscribe
NDEX Architecture

- Field Devices
  - control
  - status

- TMS
  - District 2
  - (Owner Center)

- NDEX
  - subscribe
  - publish

- NNG 511
  - (External Center)

NDEX shares data with external centers
NDEX works with multiple centers that provide data.
External centers require security authentication to access NDEX.

Enhanced Security

HTTPS certificate from Certificate Authority

subscribe

NNG 511 (External Center)
NDEX Architecture

NDEX provides data summary reporting capability

Field Devices

TMS District 2 (Owner Center)

Enhanced Security

Nevada DOT Active Directory

HTTPS certificate from Certificate Authority

subscribe

NNG 511 (External Center)

NDEX provides data summary reporting capability.
Source Value is Stored in the NDEX along with the associated NTCIP 1204 ESS/RWIS value.
IMO References

- DSRC SAE J2735 DSRC Message Set Dictionary
- NTCIP 1204 ESS Interface Protocol
- https://wxde.fhwa.dot.gov/
- https://www.its.dot.gov/data/
NDEX Key Stakeholders (Users)

- Traffic Management Centers (D2 Reno, D3 Elko, & D1 FAST / Las Vegas)
- External Centers (UNR, UNLV, UC Davis, & DRI)
NDEX Key Stakeholders (Users)

- Other County and City TMCs (RTC South / Seeing Orange)
- NDOT 511 (VoltDelta), Nevada Highway Patrol (NHP), and Waze
- Future integration: NOAA / Weather Data Environment (WxDE), and RTC North (Washoe County)
mESS / NDEX Lessons Learned

• Data
  – Do not use XML due to the size (a single message from a single vehicle can be up to 4k in size)
  – JSON is compact and in a readable format
  – When implementing DSRC very carefully consider the 3Vs in data storage: velocity, variety, and volume
  – Expect messages at a frequency of every 8 seconds or less
  – Consider your fleet size into your data storage calculations
  – 1 TB of stored and backed up data is equivalent to 2.3 TB of data
  – Consider technologies as NoSQL for data storage
  – Carefully consider a realistic data retention policy
DSRC FCC & FCC License

DSRC FCC/FAA Site Registration: All site registrations completed.

1. I580 / Mill Street  FAA Determination completed, FCC ASR and registration completed.
2. I580 / Plumb Lane  FAA Determination completed, FCC ASR and registration completed.
3. I580 / Neil Road    FAA Determination completed, FCC ASR and registration completed.
4. I580 SB before exit 59 FAA Determination completed, FCC ASR and registration completed.
5. SR431 WB / DMS#4   FAA Determination completed, FCC ASR and registration completed.
6. I580 / Parker Ranch FAA Determination completed, FCC ASR and registration completed.
7. I580 / Bower’s DMS#1 FAA Determination completed, FCC ASR and registration completed.
8. I580 / Washoe Valley FAA Determination completed, FCC ASR and registration completed.
9. I580 / Galena Creek Bridge FAA Determination completed, FCC ASR and registration completed.
10. I580 / Steamboat Hills FAA Determination completed, FCC ASR and registration completed.
11. I580 / Northgate (Carson) FAA Determination completed, FCC ASR and registration completed.
12. I580 / Exit 61 (Virginia St) FAA Determination completed, FCC ASR and registration completed.
13. I580 / Exit 63 (Peckham) FAA Determination completed, FCC ASR and registration completed.
15. I580 / Brown’s Creek FAA Determination completed, FCC ASR and registration completed.
16. I580 / 5th St (Carson) FAA Determination completed, FCC ASR and registration completed.
17. I580 / Moana FAA Determination completed, FCC ASR and registration completed.
NIMO Lessons Learned

• Phase 3
  – Modular architecture design
  – Multi-modal capable
  – Retrofit capable for EDACS low-bandwidth trunked radio where necessary
  – Application on the server to interface with the Nevada Data Exchange (NDEX) utilizing the Traffic Management Data Dictionary (TMDD)
  – Data exchange with WxDE and MADIS
  – Proprietary/research equipment have a short shelf life (resources)
# NIMO Cost Comparison

<table>
<thead>
<tr>
<th>Item</th>
<th>IMO 1</th>
<th>IMO 2</th>
<th>IMO 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Processor System</td>
<td>$800</td>
<td>$100</td>
<td>$400</td>
</tr>
<tr>
<td>EDACS capable radio</td>
<td>$900</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Device Multiplexer</td>
<td>$0</td>
<td>$173</td>
<td>$0</td>
</tr>
<tr>
<td>Custom Weather Sensor</td>
<td>$0</td>
<td>$75</td>
<td>$200</td>
</tr>
<tr>
<td>Roadwatch sensor w/RS232</td>
<td>$750</td>
<td>$750</td>
<td>$750</td>
</tr>
<tr>
<td>Airmar GPS/weather sensor</td>
<td>$1,000</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>OBD/J1939 Scan Tool</td>
<td>$625</td>
<td>$150</td>
<td>$0</td>
</tr>
<tr>
<td>Comet sensor</td>
<td>$600</td>
<td></td>
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<tr>
<td>Arada Locomate</td>
<td></td>
<td>$1,200</td>
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<td>Cradlepoint cellular modem</td>
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<td>$800</td>
<td></td>
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<td>Custom cabling</td>
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<td>$150</td>
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<tr>
<td>Custom mounting hardware</td>
<td>$150</td>
<td></td>
<td>$150</td>
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</table>

**Non-Recurring Totals:**
- IMO 1: $4,325
- IMO 2: $1,248
- IMO 3: $4,250

**Recurring Data Expenses**
- $36/month
- $15/month

**Does NOT include costs of instrumenting spreader**
Moving Forward

Dedicated Short Range Communication
For Rural ITS
Jackson, Wyoming
May 18, 2018
NIMO Moving Forward

• Complete the UNR transition to NDOT
• Final Report to FHWA
• National IMO Standard
• EDC4 commitment for Pathfinder
  – Pathfinder (Assessment/Institutionalized)
    – NDOT will focus on getting more consistent actionable messages out to the public.
    – NDOT would like to host a workshop or peer-exchange with the NDOT PIO’s, NWS PIO’s, and other state experts that have a strong formalized program
• EDC4 commitment for IMO
NIMO Moving Forward

IMO (Institutionalized)

- NDOT as part of the initial IMO pilot is finalizing it’s assessment of the data collection and is developing the needs/requirements for the MDSS and MMS

- NDOT participated in a peer exchange with PikAlert and will utilize the open source platform for its current data to provide an enhanced MDSS and to assist traveler’s information dissemination.

• Tasks: NDOT Maintenance to contract with NCAR for MDSS and MAW
  - MDSS
    - GIS segments to NCAR
    - IMO vehicle data verified to NCAR
    - NCAR review maintenance treatments
    - RWIS data through the web services

1/24/2019
Pikalert

http://dot.rap.ucar.edu/emdss/?state=nevada
Pikalert
Vehicle: 0267

- Observed at: 9:19 on 3/16
- Speed: 25 mph
- Heading: Unknown
- Air Temperature: 32 F
- Road Temperature: Unknown
- Front Wiper Status: Not Specified
- Anti-Lock Brake Status: Not Specified
- Traction Control Status: Not Specified
- Longitude: -119.7776
- Latitude: 39.3915
Pikalert US 50 Spooner Summit
Pikalert US 50 Spooner Summit
**Pikalert US 50 Spooner Summit**

<table>
<thead>
<tr>
<th>Forecast</th>
<th>Treatments</th>
<th>Alerts</th>
<th>Road Segment Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thurs 3/22 10:00 am</td>
<td>Treatment: Plow and Apply Preset Caliber at Concentration 6.415</td>
<td></td>
<td>Condition: Road temp: 32, Explanation: Treatment exceeds maximum. May need additional plowing.</td>
</tr>
<tr>
<td>Thurs 3/22 11:00 am</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 12:00 pm</td>
<td>Treatment: Plow and Apply Preset Caliber at Concentration 6.977</td>
<td></td>
<td>Condition: Road temp: 33, Explanation: Treatment exceeds maximum. May need additional plowing.</td>
</tr>
<tr>
<td>Thurs 3/22 1:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 2:00 pm</td>
<td>Treatment: Plow and Apply Preset Caliber at Concentration 7.917</td>
<td></td>
<td>Condition: Road temp: 51, Explanation: Normal anti-icing operations.</td>
</tr>
<tr>
<td>Thurs 3/22 3:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 4:00 pm</td>
<td>Treatment: Plow and Apply Preset Caliber at Concentration 9.337</td>
<td></td>
<td>Condition: Road temp: 30, Explanation: Treatment exceeds maximum. May need additional plowing.</td>
</tr>
<tr>
<td>Thurs 3/22 5:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 6:00 pm</td>
<td>Treatment: Plow and Apply Preset Caliber at Concentration 9.167</td>
<td></td>
<td>Condition: Road temp: 33, Explanation: Treatment exceeds maximum. May need additional plowing.</td>
</tr>
<tr>
<td>Thurs 3/22 7:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 8:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 9:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 10:00 pm</td>
<td>Treatment: Plow and Apply Preset Caliber at Concentration 14.22</td>
<td></td>
<td>Condition: Road temp: 29, Explanation: Normal anti-icing operations.</td>
</tr>
<tr>
<td>Thurs 3/22 11:00 pm</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fri 3/23 0:00 am</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fri 3/23 1:00 am</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fri 3/23 2:00 am</td>
<td>No treatment recommended at this time</td>
<td></td>
<td></td>
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</tbody>
</table>
### Pikalert US 50 Spooner Summit

<table>
<thead>
<tr>
<th>Site Name</th>
<th>NV ROAD SEGMENT US50 111</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Type</td>
<td>Road Segment</td>
</tr>
<tr>
<td>Mean Air Temp</td>
<td>40 deg F</td>
</tr>
<tr>
<td>Model Air Temp</td>
<td>35 deg F</td>
</tr>
<tr>
<td>Model Dewpoint Temp</td>
<td>33 deg F</td>
</tr>
<tr>
<td>Radar Reflectivity</td>
<td>26.00 dBZ</td>
</tr>
<tr>
<td>Dual Pol Digital Hybrid Reflectivity</td>
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</tr>
<tr>
<td>Mean Barometric Pressure</td>
<td>missing</td>
</tr>
<tr>
<td>Model Barometric Pressure</td>
<td>767 mb (22.66 inch Hg)</td>
</tr>
<tr>
<td>Dual Pol Hybrid Hydrometeor Classification</td>
<td>40.00</td>
</tr>
<tr>
<td>Mean Vehicle Speed</td>
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<td>Number of Valid Speeds</td>
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<tr>
<td>Mean Vehicle Air Temp</td>
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<tr>
<td>Mean Vehicle Barometric Pressure</td>
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<tr>
<td>Mean Vehicle Surface Temp</td>
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<tr>
<td>Number of Wipers On</td>
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<tr>
<td>Number of Wipers Off</td>
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</tbody>
</table>
## Pikalert US 50 Spooner
### Summit

<table>
<thead>
<tr>
<th>Forecast</th>
<th>Treatments</th>
<th>Alerts</th>
<th>Road Segment Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thurs 3/22 9:35 am</td>
<td></td>
<td><strong>Advisory:</strong> Precip: moderate rain. Pavement: wet, Visibility: low</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 10:00 am</td>
<td></td>
<td><strong>Advisory:</strong> Precip: heavy snow. Pavement: wet, Visibility: low</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 11:00 am</td>
<td></td>
<td><strong>Warning:</strong> Precip: heavy snow. Pavement: slick, icy, Visibility: blowing snow</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 12:00 pm</td>
<td></td>
<td><strong>Warning:</strong> Precip: light snow. Pavement: slick, icy, Visibility: blowing snow</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 1:00 pm</td>
<td></td>
<td><strong>Warning:</strong> Precip: light snow. Pavement: wet, Visibility: blowing snow</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 2:00 pm</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 3:00 pm</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 4:00 pm</td>
<td></td>
<td><strong>Advisory:</strong> Precip: moderate snow. Pavement: wet, Visibility: low</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 5:00 pm</td>
<td></td>
<td><strong>Warning:</strong> Precip: heavy snow. Pavement: slick, icy, Visibility: heavy snow</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 6:00 pm</td>
<td></td>
<td><strong>Advisory:</strong> Precip: light snow. Pavement: wet, Visibility: normal</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 7:00 pm</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 8:00 pm</td>
<td></td>
<td><strong>Warning:</strong> Precip: light snow. Pavement: slick, icy, Visibility: normal</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 9:00 pm</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Thurs 3/22 10:00 pm</td>
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<tr>
<td>Thurs 3/22 11:00 pm</td>
<td></td>
<td><strong>Clear</strong></td>
<td></td>
</tr>
<tr>
<td>Fri 3/23 0:00 am</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Fri 3/23 1:00 am</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
<tr>
<td>Fri 3/23 2:00 am</td>
<td></td>
<td>Clear</td>
<td></td>
</tr>
</tbody>
</table>
Pikalert March 22, 2018
Pikalalert March 22, 2018

Vehicle: 0287

- Observed at: 9:01 on 3/22
- Speed: 10 mph
- Heading: Unknown
- Air Temperature: 33 F
- Road Temperature: Unknown
- Front Wiper Status: Not Specified
- Anti-Lock Brake Status: Not Specified
- Traction Control State: Not Specified
- Longitude: -119.8782
- Latitude: 39.3395