

# Rural Interstate Closure Gates State of the Practice 2013

*National Rural ITS Conference*

*August 28<sup>th</sup>, 2013*

*Erik Minge, P.E., SRF Consulting Group  
Sarah Tracy, P.E., P.T.O.E., Nebraska Department  
of Roads*



ENGINEERS  
PLANNERS  
DESIGNERS

# PRESENTATION OUTLINE

- Gate Overview
  - Types
  - Purposes
  - Locations
- Multi-state review of road closure gates
- Gate usage in Nebraska
  - Automated gate history
  - Road closure procedures & monitoring
  - Upcoming gate deployment project
  - Systems Engineering process

# Manual Gates

- Vertical drop down gate
- Horizontal swing style (cattle gate)
- Requires personnel on-site



# Automated Gates

- Vertical drop gates are typically light-weight version of railroad gates
- Gates can be operated remotely, but typically staff are on-site

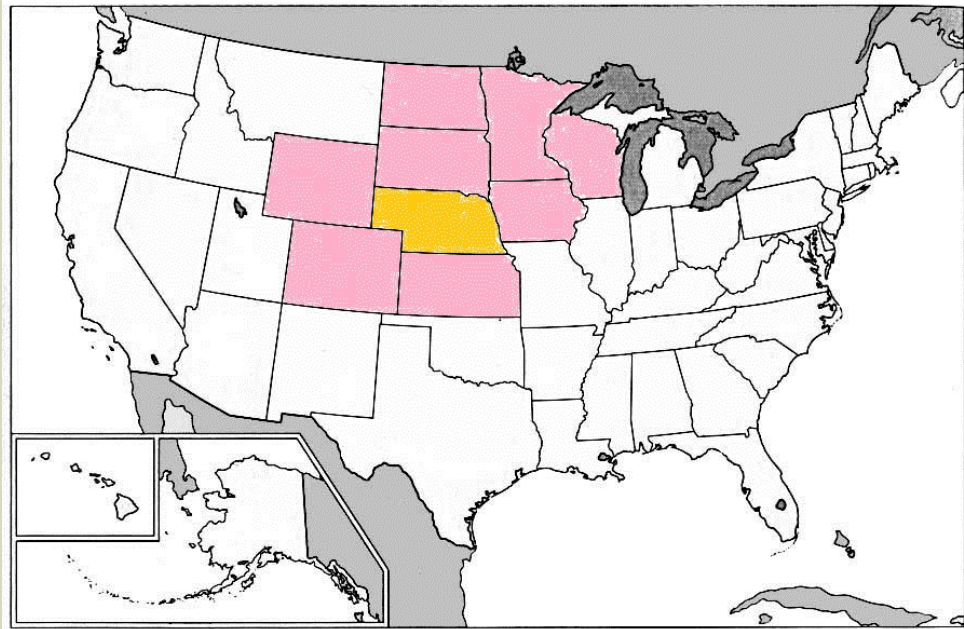


## Gate Purpose/Location/Practices

- Gates primarily used for winter weather closure
- Also used for incident management or traffic management
- Primarily used on Interstates and limited access roads
- Supplemental information via “Road Closed” signage, flashing beacons or advance signing
- Most agencies require on-site personnel to deploy gates
- Multiple gates may be needed
- Gates offer full or partial closure

# State Interviews

- State DOTs were interviewed to get a better understanding of gate usage
- Nine states interviewed total
  - Nebraska
  - Colorado
  - Iowa
  - Kansas
  - Minnesota
  - Wyoming
  - North Dakota
  - South Dakota
  - Wisconsin



# Gate Totals by State

State	# Automated Gates	# Manual Gates
<b>Nebraska</b>	<b>8</b>	<b>50+</b>
Kansas	0	6 Mainline, 10+ Ramp
Colorado	0	100+
Wyoming	4	300+
South Dakota	0	80
North Dakota	0	41 Mainline, 24 Ramp
Minnesota	28	80+
Iowa	8	100+
Wisconsin	0	410

# State Interviews

- **Wyoming**
  - Gates are used for winter weather 90 percent of the time
  - Gates have recently been used for traffic management
  - Highway Patrol is allowed to close gates without the use of advanced warning or flashers, if gates are manned by a trooper throughout the closure period
  - WYDOT conducted crash testing
- **Wisconsin**
  - Primarily winter weather use
  - Approximately 410 gates statewide that are manually operated vertical drop gates
  - Literature research on freeway ramps was conducted in 1998 and 2011



# State Interviews

- **Kansas**

- Gates located on I-70
- Primarily winter weather use
- Can close if hotel accommodations are lacking during winter storms
- KDOT utilized Wyoming crash testing research to deploy gates

- **Colorado**

- All gates used for inclement winter weather
- Gates primarily located in the eastern Colorado plains



# State Interviews

- **Minnesota**
  - Manual gates used for winter weather closures
  - Two automated gates in southwestern Minnesota on I-90 on-ramp are used for winter weather closures
  - Remaining automated gates are located in metro area for the reversible HOT lane along I-394
- **Iowa**
  - Automated gates on Interstate 35 are used for winter weather closures ('08/'09 storm closed I-80 for 3 days)
  - Gates used for incident management in Quad Cities

# State Interviews

- **North Dakota**
  - Winter weather only
    - NDDOT utilized Wyoming crash testing research to deploy gates
- **South Dakota**
  - Winter weather only

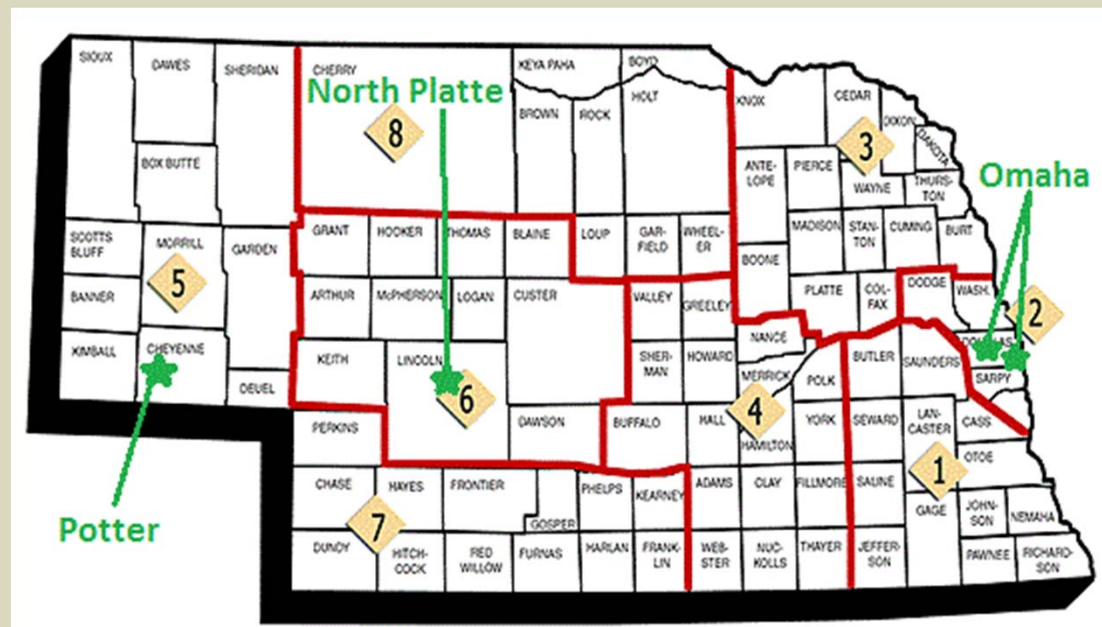


## Key Findings

- Most gates are either swing gates or crash-worthy vertical gates
- Most automated gates in interviewed states were issued by same vendor as Nebraska
  - Similar problems with automated capabilities arose in other states
  - Most states not pleased with gate performance
- Many states are looking for improved automated gate status
- Most State DOTs interviewed maintain the gates with internal forces
  - Iowa DOT contracts maintenance out to a contractor

# NDOR: Automated Gate History

- Four sets of automated gates were installed between 2006 and 2008
  - Two sets located in Omaha; used for traffic management
  - Two sets located in Western Nebraska are used for inclement weather and traffic incidents



## NDOR: Automated Gate History (Continued)

- Automated gates have several methods of closing
  - Central office control using ATMS Software
  - Short-distance DTMF radio control from NDOR vehicle
  - Push button on side of gate to lower
  - Manually using a drill and winch



ATMS Control System

## NDOR: Automated Gate History (Continued)

- Automated gates performed well initially
- Automated technologies began to fail after one year
  - Gate actuator water damage
  - ATMS communication breakdown
  - Coordination issues between NDOR, gate vendor
- Gates no longer operate as originally intended
  - Omaha gates no longer used
  - Western Nebraska gates now used like manual gates

# NDOR: Closure Procedures

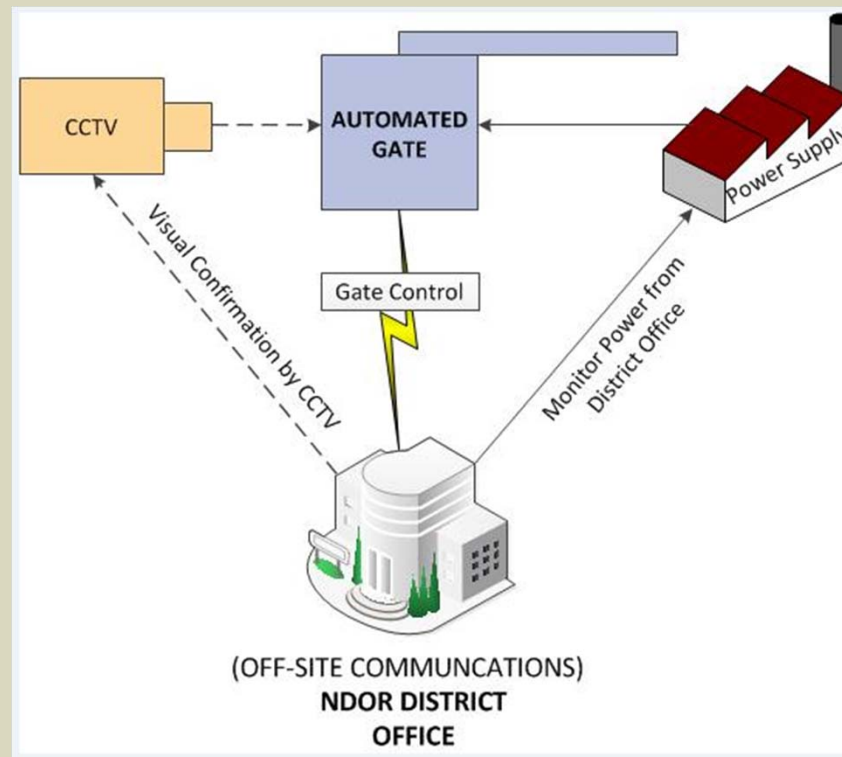
- NDOR Districts prepare road closures before weather rolls in
- ITS and other physical components deployed before gates close
  1. Dynamic Message Signs (DMS) turn on within I-80
  2. Flashing Warning Signs and arrow boards turn on, advising upcoming closure to drivers
  3. State Patrol use barrels to close specific ramps
  4. Gates closed





# NDOR: Road Closure Monitoring

- NDOR staff moves from gate to gate
- Automated Gates can be watched using Closed Caption Television (CCTV) observing the site



# PROJECT: 2014-2016 Gate Deployment

- Install automated gates along ramp entrances on I-80 corridor
- Update automated technologies to improve on previous installation



# PROJECT: Systems Engineering Process

- NDOR and SRF Consulting Group are performing Systems Engineering process
  - Project Plan
  - Systems Engineering Management Plan (SEMP)
  - Concept of Operations
  - Specifications and Verifications

# PROJECT: Deployment Plans

- New automated gate mechanism being developed by NDOR; hired 2 UNL students over the summer to assist
- 12 gates will be deployed in 2014
- Four gates planned to be deployed in 2016
  - All gates deployed will be automated and synced with ATMS Software



# CONTACT

Sarah Tracy, P.E., PTOE

Nebraska Department of Roads | Operations Division - ITS Section

Office Phone #: 402.479.4771

E-mail: [sarah.tracy@nebraska.gov](mailto:sarah.tracy@nebraska.gov)

Erik Minge, P.E.

SRF Consulting Group, Inc.

direct: 763.249.6739 | [eminge@srfconsulting.com](mailto:eminge@srfconsulting.com)

main: 763.475.0010