

# WEATHER-SAVVY ROADS

## PATHFINDER CASE STUDY

### WEATHER-SAVVY ROADS

## Colorado's Pathfinder Process

The intent of this case study is to illustrate a successful Pathfinder process from the State of Colorado for organizations interested in implementing Pathfinder.

### Background

The Colorado Department of Transportation (CDOT) has always maintained a good working relationship with the weather forecasting community. The National Weather Service (NWS) has three forecast offices throughout Colorado—Boulder, Pueblo, and Grand Junction—that work together to formulate a statewide view of weather conditions. CDOT contracts with a private road weather forecaster, Iteris, Inc., to provide road condition forecasts during major weather events. The emergence of Pathfinder gave CDOT the opportunity to strengthen its relationships with the weather forecasting community and determine the impact that weather events have on State highways and interstates, and to ensure that travelers receive consistent messages regarding travel conditions.

### Process Overview

The Colorado Pathfinder process has five key steps, as illustrated in the figure below.



**Figure 1: The five key steps of the Colorado Pathfinder process.** (Source: CDOT)

The intended outcome of the Pathfinder process is to have a unified message of an incoming weather occurrence. This event will then be transmitted to alert the public about the forecasted event and expected roadway conditions. Prior to a severe weather event, a weather and road condition forecast briefing is prepared in PowerPoint by the Colorado NWS Forecast Offices, CDOT Road Weather Manager, Iteris, Inc., and the Colorado Avalanche Information Center (CAIC) and distributed to the key weather forecasters and CDOT staff. A pre-storm conference call occurs 24–48 hours prior to the weather event affecting Colorado's roadways and includes numerous people involved in responding to the storm or otherwise impacted. This same group formulates an implementation plan that involves maintenance operations strategies and communication of consistent messaging to the public. The plan is then executed and post-storm reviews conducted to learn how to improve next time.

Further details about these steps in the Colorado Pathfinder process are described below.

## 1. Weather and Road Condition Forecast Briefing

The weather and road condition forecast briefing highlights the weather event overview, conditions, and commutes affected. It is prepared by the NWS, CDOT Road Weather Manager, the CAIC, and Iteris, Inc. A sample of weather event conditions expected is provided to the right.

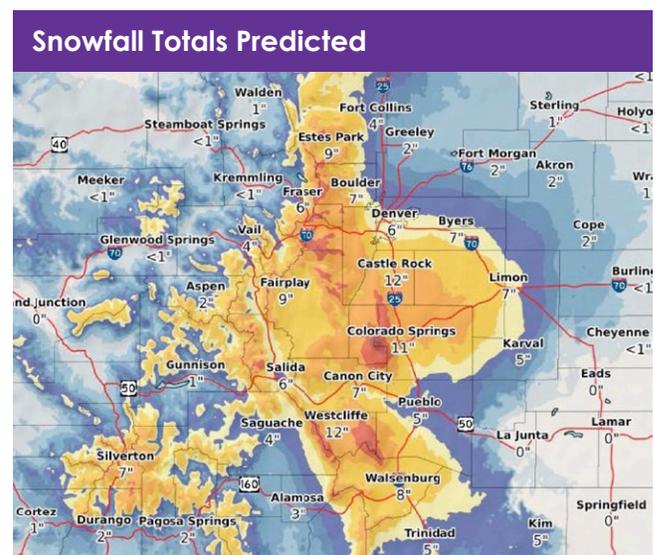
Forecasts of beginning and end times of the event, temperatures, precipitation types and amounts (e.g., snowfall rates and totals—see map to the right), and wind speeds are provided for 17 separate regions across the State. Additionally, avalanche concerns at various mountain pass locations are identified.

The briefing is provided to CDOT management and staff in the 5 regional offices, traffic

## CONDITIONS

*SNOW PACKED AND ICY ROADS ARE LIKELY ON THE MOUNTAIN PASSES BEGINNING THIS EVENING AND ON EAST FACING MOUNTAIN SLOPES AS EARLY AS FRIDAY AFTERNOON THROUGH SATURDAY MIDDAY. SLUSHY/SNOW PACKED ROADS POSSIBLE ACROSS I-25 URBAN CORRIDOR AND ALL ALONG THE FRONT RANGE FOOTHILLS AFTER MIDNIGHT SATURDAY THROUGH MIDDAY SATURDAY. I-25 ACROSS RATON AND PALMER DIVIDE COULD ALSO BECOME SNOW PACKED AND ICY.*

## CDOT Weather Briefing 03/30/2017



**Figure 2: A map of Colorado showing the predicted snowfall totals.** (Source: CDOT)

operations, maintenance, and communications functions, as well as the State Office of Emergency Management and other weather forecasters. The briefing also serves to inform stakeholders of a pending storm and its potential impact on travel. The forecast is reviewed by the road weather manager who gains a complete understanding of the event (type, level, geographic extent, duration, etc.) and hosts the pre-storm conference call, if appropriate.

## 2. Pre-Storm Conference Call

A pre-storm conference call occurs 24–48 hours prior to the weather event that will affect Colorado roadways. (Call attendees are shown in the information box to the right.) The call focuses on three key topics that together inform the development of a plan of action:

- Weather and road condition forecast information—updated from the weather and road condition forecast briefing. A storm level is agreed upon by the attendees, as well as the anticipated impact to the roadway and travel conditions.
- Assessment of operational readiness by CDOT maintenance sections throughout the State and the traffic management centers (TMC), such as the Hanging Lake Tunnel TMC, shown to the right. This includes assessment of staff, equipment, and materials by region needed to combat the weather event. Additionally, the department's approach to treat and maintain roads is established.
- Development of consistent, impact-based messages that will be communicated by both the DOT and NWS through their normal dissemination outlets, including the media. Additionally, public messages related to CDOT's treatment strategy, location, and timing are prepared and distributed.

The operational readiness assessment that occurs in this step is critical to CDOT maintenance preparation for, and response to, the pending weather event to ensure safe travel around and through Colorado.

### Pre-Storm Conference Call Attendees

- Upper Management (for larger storms).
- Road Weather Manager.
- NWS.
- Iteris, Inc.
- CAIC.
- Director of Highway Maintenance.
- Regional/Deputy Maintenance Superintendents.
- Regional Transportation Directors.
- Director of Emergency Management.
- Director of Transportation Systems Management and Operations.
- I-25 and I-70 Corridor Operations Managers.
- Operations Managers.
- Hanging Lake Tunnel.
- Eisenhower Johnson Memorial Tunnel I-70 Joint Operations Center.
- Traffic Management Center, Golden.
- Director of Communications.
- Regional Public Information Officers.



**Figure 3: The Hanging Lake Tunnel traffic management center.** (Source: CDOT Hanging Lake Tunnel TMC)

### 3. Implementation Plan Development

The outcome of the pre-storm conference call is an implementation plan. The plan includes actions, responsibility, and timing of activities. The actions can include:

- Approaches to coordinate and align participant activities.
- Allocation of maintenance forces to address the intensity and extent of the weather event and any readiness shortfalls. Also to specifically address any regional support needs.
- Plowing, treatment, and other specific maintenance strategies to keep the roadways open and safe to travel.
- Implementation of other operational strategies that focus on specific trouble spots around the State.
- Specific warnings, alerts, and messages (consistent and impact-based) that will be used by CDOT and NWS to inform the public of potential travel impacts—such as implementation of the chain law for improved vehicle traction.
- The timing, location, and content of dynamic message sign (DMS) use. The box to the right illustrates examples of road weather DMS messages. CDOT is currently reviewing and updating its DMS guidelines, with Pathfinder and other initiatives in mind, to improve its messaging approaches.
- Coordination with the media to disseminate agreed upon messages about the storm.

### 4. Plan Execution

The plan is executed by the responsible parties. The maintenance plan is executed to ensure roads are treated and maintained throughout the storm. The unified messages

#### Example DMS Messages

- Flooded road ahead.
- Blowing snow ahead.
- Dense fog ahead.
- Reduced visibility ahead.
- Road may be icy in spots.
- Road snowpacked.
- Snowslide ahead.
- High wind advisory, high profile vehicles use caution.



**Figure 4: A screenshot from CDOT's Twitter account.**  
(Source: CDOT)

are disseminated by the weather community, CDOT, and emergency management to ensure there is consistent communication about the upcoming storm. This includes CDOT messaging on its traveler information website, social media (example above), and on DMS. Additionally, messages informing the public of maintenance activities, and the location and timing of pre-treatment and snowplowing efforts are disseminated.

### 5. After Action Reviews

For significant storms, after action reviews focused on maintenance responses are conducted, documented, and shared with maintenance managers to continuously improve treatment strategies, readiness, and sharing of resources. The reviews are also shared with the Division of Emergency Management and the Division of Transportation System Management and Operations (TSMO) staff. Pathfinder processes are also reviewed and suggested improvements are expressed. These reviews have improved practices and addressed deficiencies.

### Helpful Practice: Documenting Business Processes

In the early days of implementing Pathfinder, CDOT discovered that work activities were inconsistently implemented because each region had a slightly different methodology and different assigned responsibilities. They embarked on an activity to document their business processes and found this to be a very useful way to understand activity and data flows, responsibilities, and timing.

Below is an example of the business process to communicate with stakeholders internal and external to CDOT.

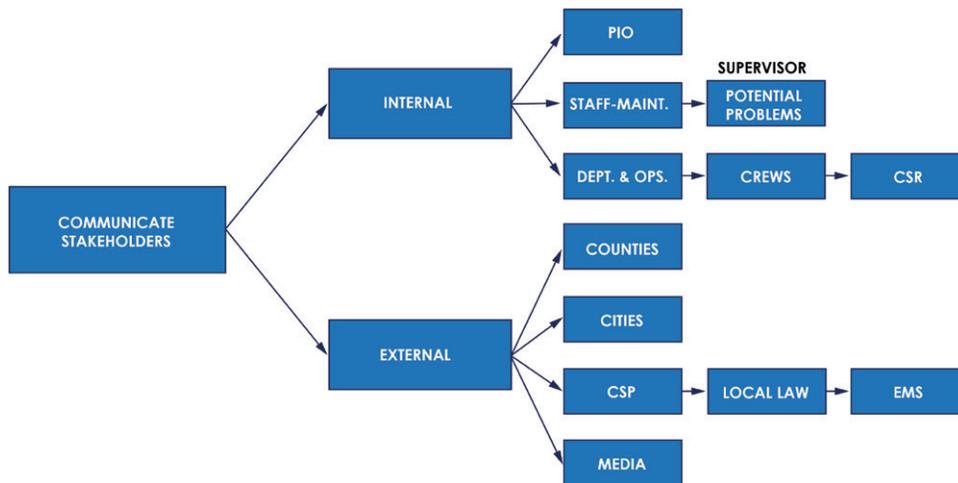


Figure 5: An example of the business process to communicate with stakeholders internal and external to CDOT (Source: CDOT)

### Benefits Realized

The benefits of the Pathfinder process are realized by CDOT maintenance operations with more focused and efficient storm treatment strategies, by CDOT traffic management to implement effective management approaches, and by the motoring public who are more clearly informed of the impacts on their travel with consistent, impact-based road weather forecasts.

An internal survey of maintenance managers indicated that the majority felt Pathfinder increased communications and collaboration during storm events. They would like some refinements in the timing, length, and regional/specific area focus on the calls. CDOT intends to continue refining the process and implement changes during the winter of 2017-2018.

CDOT is currently developing a public facing survey to learn how the Pathfinder information is benefiting the traveling public. The survey will focus on both maintenance activities (satisfaction with winter road maintenance) and travel information (sources, satisfaction with information, conditions as expected, etc.). This survey will be implemented during the winter of 2017-2018.

## Future Activities

### Performance Measurement Opportunities

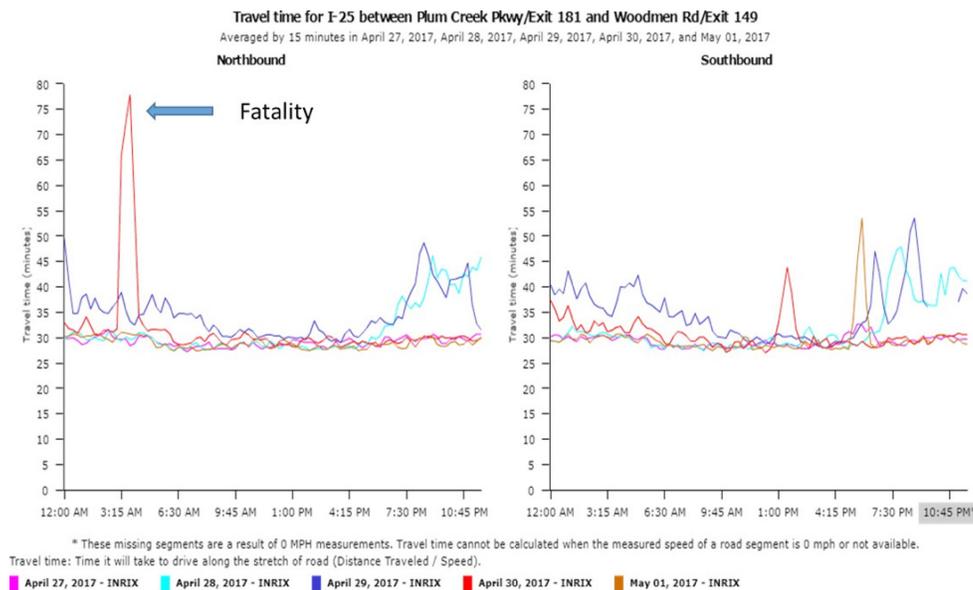
CDOT is continuing to find ways to measure the impacts of major weather events. One of those possible performance measures is travel time. The graph below illustrates some early work that CDOT is conducting to understand how weather events can impact travel time at key locations on urban areas interstates. This example is on I-25 between the cities of Colorado Springs and Castle Rock. The storm lasted approximately four days and the colored lines indicate travel time by day in each direction. Travel time can increase 50 percent or more during the most intense times of the storm. As indicated during the early morning hours for northbound I-25, a major crash or fatality can also have a significant impact on travel times.

## Coordination with Adjacent States

CDOT is reaching out to adjacent states to expand the Pathfinder approaches beyond the Colorado borders. Early efforts with Wyoming have been successful, and Nebraska and Kansas will also be engaged to coordinate maintenance activities and travel messages.

### Pathfinder Evolution

The strengthened collaboration between CDOT and weather forecasters has been a very positive experience in Colorado and significant progress has been made to implement Pathfinder. Colorado intends to continue evolving the Pathfinder program. An example is CDOT is upgrading their VMS Message Guidelines to improve language consistency. CDOT invites input and feedback from all stakeholders.



**Figure 6: Two graphs showing how weather events can impact travel time on I-25 between the cities of Colorado Springs and Castle Rock. (Source: CDOT)**

## For More Information

[www.fhwa.dot.gov](http://www.fhwa.dot.gov)

### FHWA

Paul Pisano, FHWA  
 paul.pisano@dot.gov  
 (202) 366-1301

### CDOT

Lisa Streisfeld, CDOT  
 lisa.streisfeld@state.co.us  
 (303) 757-9876

David Johnson, CDOT  
 c.david.johnson@state.co.us  
 (303) 757-9789



U.S. Department of Transportation  
**Federal Highway Administration**

FHWA-HOP-18-028