

# SHRP2 L01 Organizing for Reliability

## Case Study Example (Final)

January 29, 2018

Case Study: Colorado DOT Pathfinder Implementation for Road Weather Management

### Overview/Background:

Heavy rain, snow, and other storms can have significant impacts on the safety, mobility, and productivity of road users. Pathfinder is a collaborative strategy for proactive transportation system management ahead of and during adverse weather events. Colorado DOT (CDOT) implemented Pathfinder starting in the 2016-2017 winter season and established a process to increase stakeholder communications and improve responses to an adverse weather event. Through Pathfinder, CDOT, the National Weather Service (NWS), and private weather service contractors work together to share and translate weather forecasts and road conditions into consistent transportation impact messages for the public to increase reliability during adverse weather events.

### Step 1: Influences

The influence to improve road weather management processes in CDOT was event-driven. In Spring of 2016, a winter storm and multiple avalanches stranded vehicles for some time. Additionally, near-blizzard conditions along a segment of I-25 resulted in trucks without chains colliding. There was also miscommunication during the event among the key stakeholders including CDOT, Colorado State Patrol (CSP), and Douglas County. Each entity was focused on responding individually and not working together in a coordinated manner.

### Step 2: Define the Specific Reliability Goals

CDOT identified and defined reliability goals to measure the effect of implementing Pathfinder to improve travel time reliability. These reliability goals include:

- Identify average time to clear / time to get to bare pavement;
- Establish Level of Service (LOS) goals relative to weather event incident level;
- Maintain overall reliability during severe weather event relative to non-weather conditions;
- Provide consistent, timely and accurate traveler information;
- Maintain LOS B for severe weather events;
- Minimize numbers and durations of event-driven road closures (note that these are different from safety-based closures);
- Increase public education and outreach regarding road weather management (e.g., why there are safety closures);
- Increase road weather-related technology coverage (e.g., RWIS, friction sensors); and
- Integrate the information and data flow into the road weather management and decision-making processes.

### Step 3: Identify and Document Current Business Processes

Before the 2016-2017 winter season, CDOT would conduct internal pre-event preparation calls before a winter storm occurred, but these interactions did not include stakeholders outside of CDOT. CDOT adopted Pathfinder starting in the 2016-2017 winter season. Pathfinder provided a more consistent process to implement statewide coordination among stakeholders. As a result of applying Pathfinder

principles, stakeholders—such as CDOT Maintenance, Traffic Operations Center (TOC), Regions, Colorado State Patrol, Colorado Avalanche Information Center (CAIC), the CDOT’s Maintenance Decision Support System (MDSS) provider, and the NWS—now share information through a series of calls conducted before a major storm.

Statewide coordination calls are conducted before major weather events that are anticipated to impact the majority of the state. The NWS forecast, the Maintenance Decision Support System (MDSS) pavement forecast, and avalanche mitigation strategies are discussed, as well as the operational readiness of maintenance regarding personnel, materials, and equipment. These calls include key stakeholders and are used to develop an action plan, address resource allocation strategies as needed, and help the public information officer create a consistent message for press releases.

Regional coordination also occurs to facilitate targeted preparation as a weather event approaches. Local agencies, ski resorts, and local police departments are invited to participate when there is a major snow event. These targeted interactions are used to provide a forecast for the Region and communicate specific application suggestions for plow drivers. Regional calls typically include 20-30 participants from key stakeholder organizations. Additional updates are sent via email and follow-up calls conducted, as needed, to communicate shifts in the storm timeline or location.

Figure 1 shows an example business process map for CDOT road weather management preparation and response efforts carried out from a regional perspective for a major snow event.

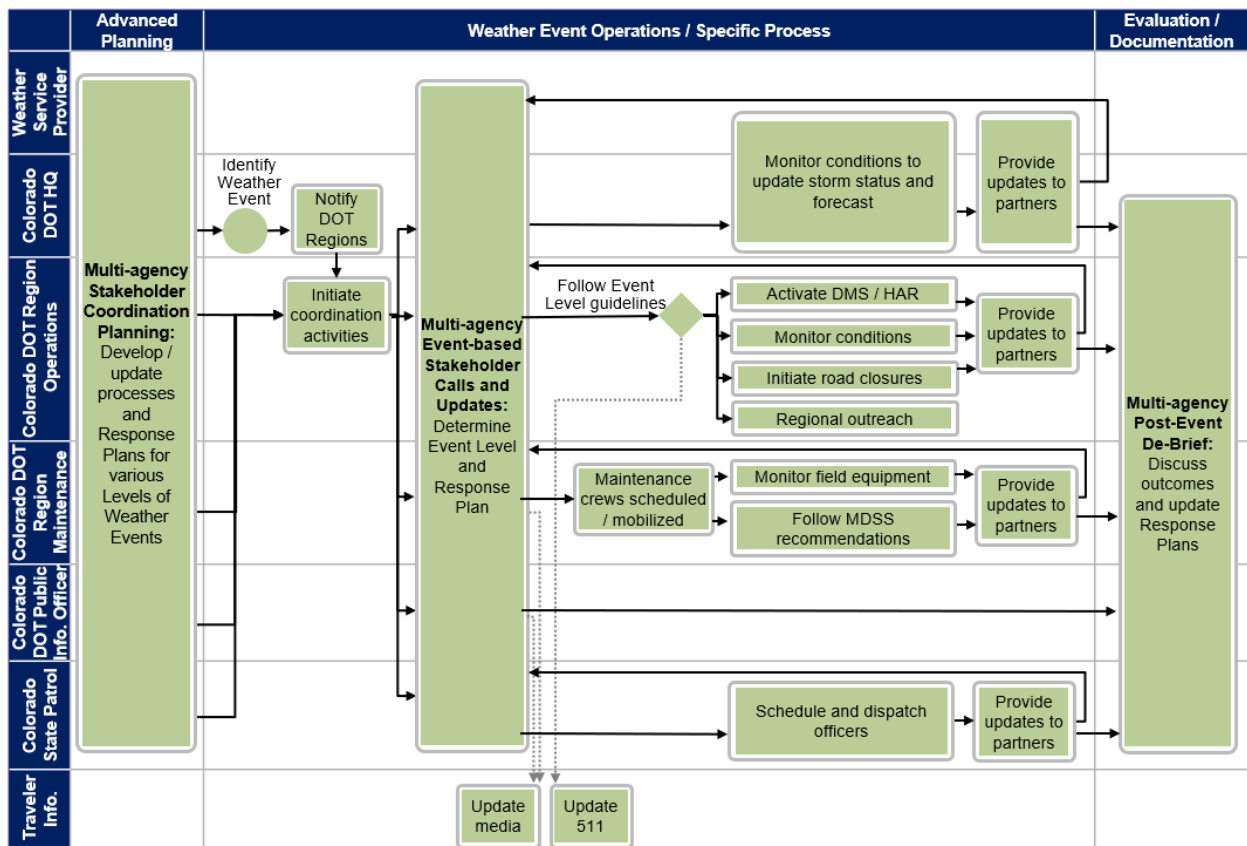


Figure 1: Detailed Business Process Diagram of CDOT Regions Road Weather Management

#### **Step 4a: Develop/Change Process**

The business processes related to Pathfinder that were implemented in the 2016-2017 winter season are a foundation for CDOT to refine and improve the road weather management approaches in a variety of areas in order to advance their practices. CDOT has identified some changes to improve the process in the short- and long-term.

Overall, CDOT is aiming to increase coordination and information sharing (e.g., action plans, pre-stationing of CSP) among stakeholders. Additionally, CDOT hopes to improve information flows between CDOT Regions and the TOC and across state and local jurisdictional boundaries.

CDOT recognizes a need to increase data collection and develop targeted goals, objectives, and performance measures that focus on both timely, consistent information to the public, as well as user satisfaction with road clearance. Metrics would be developed by each CDOT Region, by roadway segment, and by storm intensity. However, the metrics would consider that CSP and local responders control the duration to clear an event. These measures would be used to assess performance after implementing Pathfinder to document the value Pathfinder brings to stakeholders, identify future improvements, and help reduce “bad areas” identified in the CSP plans (e.g. increase the number of patrol passes per hour, install snow fences, identify engineering design changes, assess if products for de-icing need to be changed).

CDOT is moving toward a more science-based approach for measuring performance. Currently, CDOT maintenance staff complete work order reports showing the level of service following a route. CDOT would like to implement mobile friction sensors as an unbiased data set to measure roadway surface conditions. In addition, CDOT would like to improve the consistency of messages to the public. This includes increased coordination with the NWS on guidelines for forecast-related messages to post on traveler information mechanisms. Other practices CDOT would like to improve include improving the user-friendliness of traveler information (e.g., routes plowed, routes not plowed and why); and addressing differences between urban, mountains, and plains areas in the business process.

#### **Step 4b: Implement Process**

The primary approach to implementing the identified changes involves a focus on improved coordination and integrating the new processes and performance measures. Specifically, CDOT has identified the need for enhanced coordination between Headquarters and CDOT Regions, CDOT Regions and CDOT TOC, and state and local jurisdictional stakeholders to successfully implement the additional processes and improvements identified above.

#### **Step 5: Assess Process**

CDOT performed after-action reviews following a weather event as needed. For example, a review might be conducted when CDOT felt they did not react appropriately or the level of service was less than what was desired. Key stakeholders were included to identify how to improve processes and recommend next steps.

There were no all-encompassing performance measures or targeted goals for the first year of the Pathfinder implementation due to insufficient data being collected. However, an internal survey was completed to gather feedback on statewide calls and Pathfinder activities. Additionally, CDOT provides an end of season report that includes performance metrics and conducts a meeting with key stakeholders.

CDOT understands the value of performance measurement and has identified a number of ways to enhance data collection for the development of metrics and assessment of Pathfinder activities to determine benefits and areas for improvement. A focus on science-based performance measures, such as the use of mobile friction sensors and other science-based approaches, are being incorporated into assessment protocols.

#### **Step 6: Document Process**

CDOT developed high-level business process flows for each region to identify roles and responsibilities as part of a business process mapping workshop that was conducted in February 2017. In addition, CDOT documented Incident Levels that were developed based on storm duration and severity, and performed an RWIS gap analysis and mapped known roadway problem areas.

CDOT conducts a Pathfinder call before the winter season as a way of keeping stakeholders informed of Pathfinder processes, roles, and responsibilities. Key stakeholders regularly participate in Pathfinder calls over the course of the winter season and become familiar with their roles and responsibilities.

#### **Step 7: Institutionalize Process**

CDOT implemented Pathfinder prior to the 2016-2017 winter season and is currently working to refine and institutionalize these processes. Pathfinder meetings have generated ongoing participation from agencies, regions, and jurisdictions around the state that are critical for maintaining the momentum of Pathfinder efforts in the future. The number of improvements identified and programmed for future winter seasons reflects the level of interest at CDOT in continuing Pathfinder activities. CDOT has a Pathfinder Director to oversee these efforts and encourage ongoing participation and refinement of coordination activities.

In addition, the efforts of Pathfinder have been applied to summer events such as the Lunar Eclipse in the Summer of 2017 as well as utilizing weather forecast information to inform CDOT construction staff and contractors of approaching tornadic activity.

*Note: The information presented in this case study was gathered during the February 1, 2017 SHRP 2 Colorado DOT Improving Business Processes for More Effective Transportation Systems Management and Operations Workshop and updated through phone interviews in January 2018 with the Colorado DOT Winter Operations Manager.*