



DATE: September 21, 2017

TO: Transportation Commission Resiliency Committee

FROM: Lizzie Kemp, I 70 Pilot Project Manager and Joshua Laipply, P.E. Chief Engineer

SUBJECT: CDOT Resiliency Activities

Purpose

To present a fact sheet on the I-70 Risk and Resilience Pilot (previously requested from the Committee), and provide an overview of CDOT activities related to resiliency.

Action

Information only. Provide feedback on the attached materials.

Background

At its last meeting, the Committee requested staff to prepare a “fact sheet” to explain the purpose and results of the I-70 Risk and Resiliency Pilot project. Attached is a draft two-page document responding to this request for your review. Our goal was to explain the Pilot in plain english in a document that Commissioners and CDOT staff can use when speaking with general public audiences.

Also attached is a draft “Roadmap” and “Timeline” of various CDOT efforts related to resiliency. These documents describe CDOT activities ranging from 2013 Flood Recovery, to involvement in various state and federal committees addressing transportation resiliency, to proactive efforts underway to better prepare CDOT and its facilities for future events. The intent of these documents is to inform the Committee about the various ways that CDOT staff is working on improving resiliency of our transportation system.

Next Steps

Staff will refine the outreach materials based on Commission feedback. The I 70 Pilot is nearing completion, with a final report to the Resiliency Committee planned for October. We also plan to return shortly to the Committee for guidance on future proposed efforts related to risk and resiliency planning.

Attachments

I 70 Pilot Fact Sheet

CDOT Resiliency Roadmap

Timeline of CDOT Resiliency Efforts



Putting the Brakes on Future Disasters:

Colorado Takes Leadership Role In Protecting Against Future Risks.



In September 2013, flood damage on US-34 destroyed an entire section of roadway.



In February 2016, a rockfall closed I-70 in Glenwood Springs for two weeks.



In May 2017, a fire on I-25 closed roadway during rush hour and damaged pavement.

BACKGROUND

The September 2013 flood event in Colorado lasted seven days, and left behind a path of destruction that spanned some 2,380 square miles. More than 3,000 evacuations were carried out, over 17,000 homes damaged, and an estimated 1,800 homes completely destroyed. The Colorado roadway network suffered severe damage, requiring more than \$700 million in repairs.

Unfortunately, Colorado has experienced six major declarations of disasters in the past seven years. Since the 2013 flood event, Colorado endured a major rockfall event in 2016 that closed I-70 in the Glenwood Canyon for approximately two weeks. Alternative routes not designed to accommodate the detouring traffic also experienced damage. In May 2017, a tanker truck carrying fuel crashed and caught fire resulting in several hours of closure of all lanes in the Metro Denver area. The fire burned off several inches of asphalt resulting in emergency repairs.

Building on the lessons learned from these events, the Colorado Department of Transportation (CDOT) and the Colorado Division Office of Federal Highway Administration (FHWA) have developed a data driven approach to proactively identify and address vulnerabilities of the system from potential physical threats such as rockfall, flooding, and landslides.

PROACTIVE MANAGEMENT OF THREATS

The I-70 Risk and Resilience (R&R) Pilot began in August 2016, and builds on the work completed by CDOT in the wake of the 2013 flood event. It is a first-of-its kind approach, one meant to address vulnerabilities in Colorado's highway infrastructure before they ever become a concern. 450 miles of I-70 from the Utah border in the west to the Kansas border in the east have been analyzed for the potential of future damage and closures from physical threats. The Pilot covers an incredibly diverse range of geographies and climates in both urban and rural areas, and considers multiple significant threats—ranging from avalanche to wildfire, as well as human-made threats, such as high-vehicle bridge strikes.

The decision to initiate this work is not unlike the everyday, commonsense choices made by Coloradans in their personal lives. Installing an alarm system in your home, or purchasing a car with air bags, protects you and your loved ones while simultaneously reducing insurance premiums. It pays to plan ahead.

CDOT Project Manager
Lizzie Kemp Herrera
CDOT Region 1 Planning
and Program Management
303.757.9629

CDOT Co-Project Manager
Heather Paddock, PE
CDOT Region 4
Central Program Engineer
970.290.8723

Principal Investigator
Aimee Flannery, Ph.D., PE
AEM Corporation
703.328.2423



I-70 RISK AND RESILIENCE FINDINGS

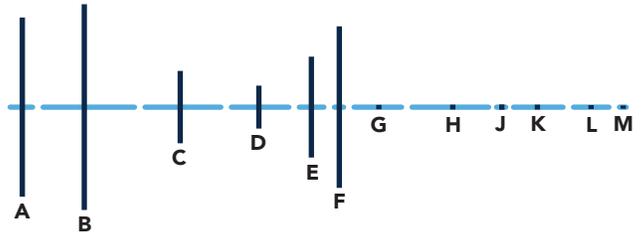
STUDY AREA

I-70 CORRIDOR



TOTAL ANNUAL RISK PER LANE MILE

USER RISK + OWNER RISK FROM ALL THREATS



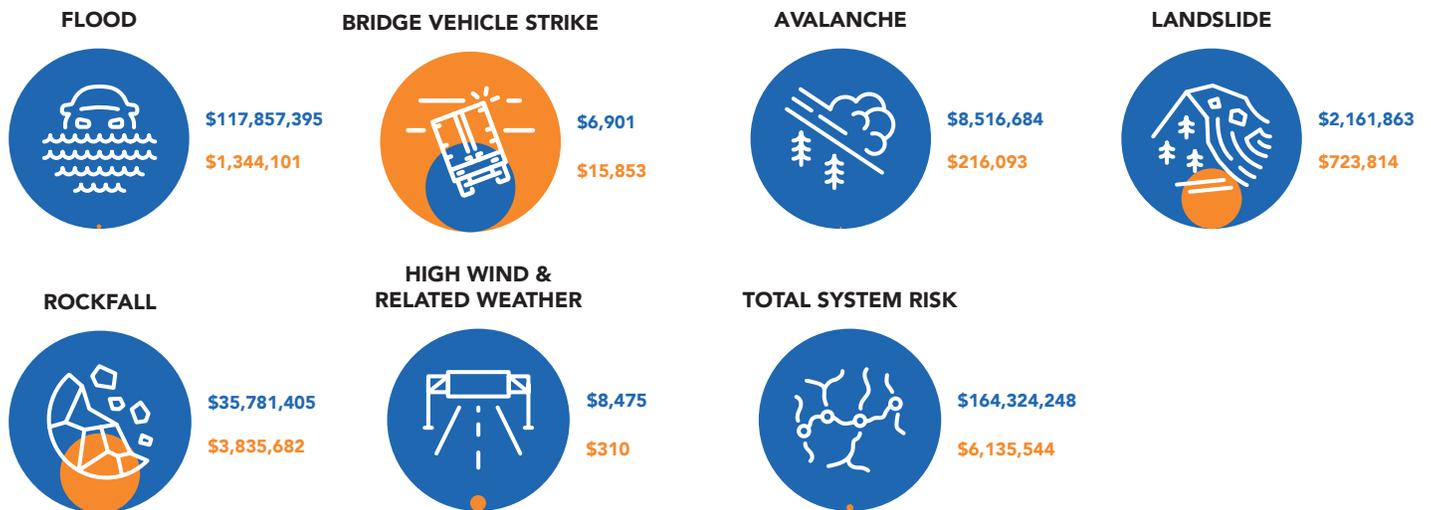
The I-70 corridor was analyzed as a series of segments that reflect on and off points to the facility for the traveling public onto CDOT maintained roadways.

ANNUAL RISK BY THREAT

TOTAL RISK I-70

● **USER RISK**
(Delay Costs)

● **OWNER RISK**
(Rebuilding Costs)



All of the relevant threats to the I-70 corridor were included in the study, with annual risks to both CDOT (as owners of the highway facilities) and the traveling public calculated as shown in the above graphic. The most significant physical threats to I-70 include rockfall and flooding. Other potential events that could damage I-70 and impact travel on the corridor include avalanches, landslides, and high-vehicle bridge strikes. Armed with a better understanding of these threats, CDOT will now begin to identify the most cost-effective solutions that can be implemented at specific sites to reduce the risk of damage from future events. Resilience measures could include new roadway/bridge design, identification of a new alternate route, operational plans or improved maintenance.

NEXT STEPS

CDOT is currently analyzing the findings of the Pilot and determining how best to address at-risk locations. This analysis includes an assessment of a range of mitigation measures and includes benefit-cost analysis of potential mitigation measures to identify potential risk reduction and system resilient solutions. Next the agency will determine other corridors to be a part of the risk and resilience process, and how to use the results to inform day-to-day asset management, design, operations and maintenance decisions.



Resiliency Roadmap

INVOLVEMENT

Transportation Commission Resilience Subcommittee
(Fall 2016 to Present)

I-70 Pilot Project has presented to the subcommittee.

GOVERNOR'S OFFICE

Colorado Resiliency and Recovery Office (CRRO)

Colorado Resiliency Working Group (CRWG)
(September 2014 to Present)

Coordinate efforts, create opportunities, establish priorities and provide guidance to improve resiliency and sustainability across the State.

Sector Involvement
(September 2014 to Present)

Provide support to the Infrastructure, Watershed, and Community sectors of the CRWG.

NATIONAL EFFORTS

Interviewed for Case Studies

**AASHTO
TRB/NCHRP
FHWA
CRRO**

AASHTO
Committee Involvement
The Special Committees on Transportation Security and Emergency Management and Resilient and Sustainable Transportation Systems are merging and will be lead by Mike Lewis.

Presented I-70 Pilot Project

TRB

Conferences

Sponsoring the TRB Transportation Resiliency Summit in Fall 2018.

RESILIENCY PLANNING

I-70 Risk and Resilience Pilot Project
(2016 to Present)

Assess hazards along the I-70 corridor to pro-actively identify areas with high probability of losses from a range of natural and direct threats.

Moving Forward: CDOT has applied for an Accelerated Innovation Deployment (AID) grant from FHWA to expand the I-70 Pilot to I-25 as well as to parallel routes to I-70 and I-25. CDOT is also working with AEM to incorporate the lessons learned from the Pilot intomaintenance practices, training, policies, and procedures.

Geohazard Rating System
(May 2014 to October 2014)

Rock slope design

Risk Based Asset Management Plan
(December 2013 to Present)

Incorporating asset management into current CDOT procedures.

Sustainability Program
(2005 to Present)

CDOT division committed to developing and supporting a sustainable organization and transportation system.

Emergency Response Framework
(2016 to Present)

Formulization of ER policies and procedures

RESILIENT RECOVERY

Risk and Resiliency (RnR)
(December 2013 to Present)

Modified cost and benefit analysis utilized for emergency repairs.

Hydrologic Re-evaluations
(December 2013 to September 2014)

Post-Flood hydrology updates that informed the design and construction of Flood Recovery Projects.

Flood Recovery Office
(September 2013 to Present)

Emergency repairs, both temporary repairs directly after the flood event, and permanent/long-term repair and reconstruction projects.

Timeline of CDOT Resiliency Efforts

