COLORADO
Department of Transportation

RESILIENCY PLANNING:

Preparing Colorado in advance for natural hazards makes good sense!

Why being resilient matters

Colorado's 2013 flood along the front range caused CDOT to think more deliberately about ways that we can reduce the risks of disasters. The flood spanned 2,380 square miles from Fort Collins down to Colorado Springs. More than 3,000 residents were evacuated. Damage to the roadway network was severe, impacting roughly 500 miles of road and 50 bridges - whose repairs totaled over $700 million. CDOT, businesses and the traveling public all felt the financial impact and inconvenience.

Building on lessons learned from this and other events, CDOT has begun assessing its risk to threats to better prepare the transportation system in advance. Every day the system faces threats large and small – like floods, high winds, avalanches, and rockfall. CDOT is planning for these adverse events to ensure our system is resilient - meaning it's better able to withstand the impact of events and recover quickly when they happen. In particular, we are targeting improvements to the system where building resilient infrastructure and making operational changes provide the greatest return on investment – where spending $1 now avoids a more significant recovery cost in the future.

Preparing our transportation network is especially important. These are the routes we use to access our homes, businesses, schools, and hospitals. And, in the event of a disaster, they are how we are reached by emergency personnel or become our evacuation routes.

How disasters can affect local businesses

- According to the Federal Emergency Management Agency (FEMA), almost **40%** of small businesses **never reopen** their doors after a disaster. *(1)*

- And **90%** of smaller companies **fail** within a year unless they can resume operations within **5 days.** Blocked/closed roads have a direct impact on businesses' chances of survival. *(1)*

- **60%** of all losses from natural disasters are **uninsured** in the U.S. *(2)*

- Rockfall events along I-70 in 2004 and 2010 caused an estimated **$40 million in economic impacts** each. In average years rockfall impacts on Colorado highways cost roughly $30 million.

- A rockfall blockage along I-70 in Glenwood Canyon will cause travelers and freight traffic to **detour 187 miles** (and up to **four hours**) on state highways 13 and 131.

- Depending on the product being shipped, **delays cost** carriers an additional **$25 to $200 per hour** of delay. *(3)*

How investments in resiliency pay off

Every **$4** spent on proactive resiliency measures, saves an estimated **$25** dollars in repairs. *(4)*

The breakdown:

$1 ▶ $4 $1 spent improving **utilities, roads, highways and railroads** saves $4

$1 ▶ $6 $1 spent **using federal grants for mitigation** saves $6

$1 ▶ $11 $1 spent **meeting recommended building codes** saves $11

$1 ▶ $4 $1 spent **exceeding recommended building codes** saves an additional $4

Nationally, the past 23 years of federally-funded natural hazard mitigation will ultimately prevent 600 deaths, **1 million** nonfatal injuries, and **4,000** incidents of post-traumatic stress disorder. *(4)*

Sources: 1) FEMA   2) Assessment of the Economic Impacts of Landslides and Other Climate-Driven Events (2018)   3) FHWA   4) Natural hazard mitigation Saves Report by the National Institute of Building Sciences

SO WHAT CAN CDOT DO ABOUT IT?

Examples of CDOT investments in resiliency

Metro Denver/Foothills
Hazard: Rockfall
Preventative Project: Install nets along high-risk rock sheds on mountain roadways
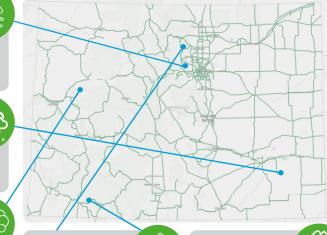
Southeastern Colorado
Hazard: Winter Storm
Preventative Project: Optimize snow plow routes and positioning of anti-icing materials for faster response

Northwestern Colorado
Hazard: High Winds and Avalanche
Preventative Projects: Install wind fences and conduct preemptive avalanche blasting

Northeastern Colorado
Hazard: Flooding
Preventative Project: Install larger culverts and cross-culverts to increase flow capacity

Southwestern Colorado
Hazard: Wildlife VehicleCrashes
Preventative Project: Install wildlife under- and over-passes, fencing, and warning lights

Statewide
Hazard: Flooding/Debris Flow
Preventative Project: 2019 Flood Plan for dfYj Ybh]j Y˙a YUgj fYg following year of high snowpack and wildfires

How do we decide which strategies to implement?

1. Identify locations most at risk to hazards.

2. Determine the probability of this hazard/disaster occurring each year.

3. Considering the condition of the asset, determine the likelihood that the asset will fail if a hazard/disaster were to occur.

4. Calculate how much would it cost to repair, and the cost to travelers of delay/detour.

5. Multiplying the cost of repairs by the probability of occurrence and the vulnerability of the asset - calculate CDOT and the traveling public's annual financial risk from hazards.

6. Identify strategies and mitigation tools that can reduce the damage from the hazard, or the chances that it could occur.

7. Implement the most cost-effective strategies in high-risk locations

Resiliency strategies can be physical or operational

Capital Improvements

- Build bridges in high risk flood zones to withstand higher than average flood events
- Prepare alternate routes for highways at high risk of closure
- Install wind fence in areas prone to gusty winter storms
- Up-size or repair culverts in areas at high risk for debris flow or flooding
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Operational

- Pre-position debris-clearing equipment near areas where wildfire has removed vegetation that controls erosion
- Include asset risk in the scoring process when prioritizing investment decisions
- Prepare incident management plans for corridors at high risk of natural disasters
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77% of Americans support a requirement that federally funded infrastructure in flood-prone areas be constructed to better withstand the impacts of flooding.
source: The Pew Charitable Trusts

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