
Transportation Resilience
A Systems-Based Approach to Transportation Planning and Design
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FELSBURG HOLT & ULLEVIG


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Explore Iowa's Climate Risks
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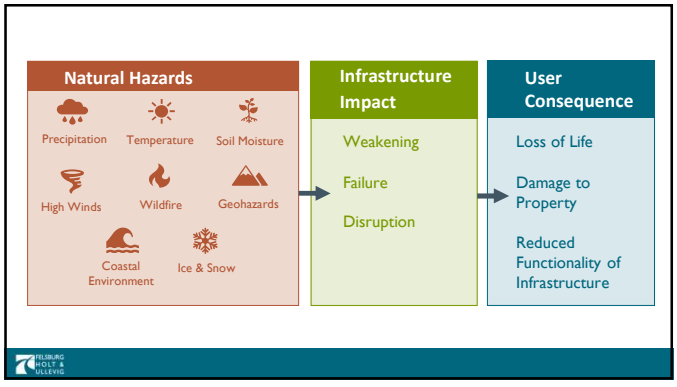
Understand Infrastructure and System Impacts
3
Rethink Resiliency beyond the asset
4
Design Solutions and Strategies
5
Apply to a Case Study
Objectives


Explore
Iowa's Climate Risks

Iowa's climate is becoming warmer, wetter, and more variable.

- **Wetter** — More intense precipitation/flooding
- **Hotter** — Rising temperatures/extreme heat
- **More Extreme** — Severe storms/wind/hail
- **More Variable** — Drought + changing winters



Risk Isn't Just the Hazard

Hazard **x** Exposure **x** Vulnerability **x** Consequence **=** Risk

Hazard	**Exposure**	**Vulnerability**	**Consequence**
What happens	What's in harm's way	How susceptible it is	What happens if it fails

The question is changing:

Traditional Question

What has this location experienced historically?

Resiliency Question

What conditions are likely to happen over this asset's useful life?

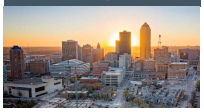
Three Scales of Resilience

Resilience is more than a strong asset. It's about keeping the system—and the communities that depend on it—functioning when disruption occurs.

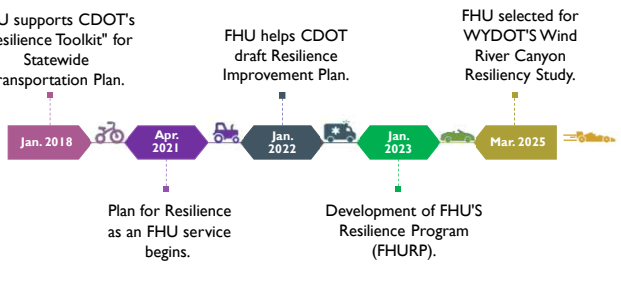
Asset Level
Build robust designs

Corridor/ Network Level
Keep the route functioning

System/ Community Level
Make it stronger



At FHU, our goal is to be as resilient as the people we serve!



***Reducing risk* and limiting disruptions to critical infrastructure.**

Break the cycle by designing resilient infrastructure that minimizes the amount of time spent on emergency response.

Source: AASHTO Committee on Transportation System Security and Resiliency

— Design
Solutions and Strategies

The Four R's of Resilience

What a resilient transportation system looks like.

Robust	**Redundant**	**Resourceful**	**Responsive**
Built strong to withstand hazards.	Multiple options so we can keep people and goods moving.	There are resources available that can be leveraged in the process of recovery	Capacity to meet targets efficiently to avoid loss of functionality and future disruptions.

The Scenario:

A storm drops 7 inches of rain in 12 hours.

- Bridge A is closed for scour inspection
- The downtown arterial is flooded
- Several signals lose power
- A secondary route is blocked by debris
- Access to the hospital is constrained
- Freight traffic is being diverted through neighborhoods

Your Goal:

Use the Four R's to invest **$8M** and create a more resilient system.

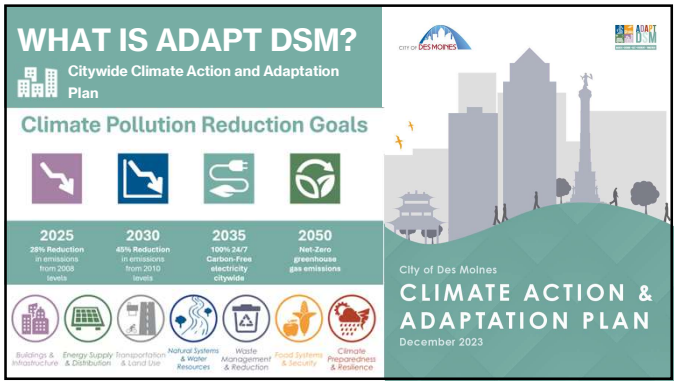
Your Task:

1. Review the Scenario and Map
2. Choose Investments
3. Apply the Four R's
4. Define your Strategy
5. Prepare to Share

Let's Practice!

INVESTMENT MENU
(STAY UNDER $8M)

Replace/raise vulnerable bridge	$5.0M
Upsize drainage along arterial	$3.0M
Improve secondary river crossing	$4.0M
Harden traffic signals and backup power	$1.0M
Create signed emergency detour network	$0.5M
Install flood sensors and real-time monitoring	$0.5M
Improve alternate neighborhood connection	$2.0M
Emergency response/interagency coordination program	$0.5M
Install Green infrastructure upstream	$2.0M
Real-time travel information system	$1.0M



Climate Adaptation & Resilience Goals

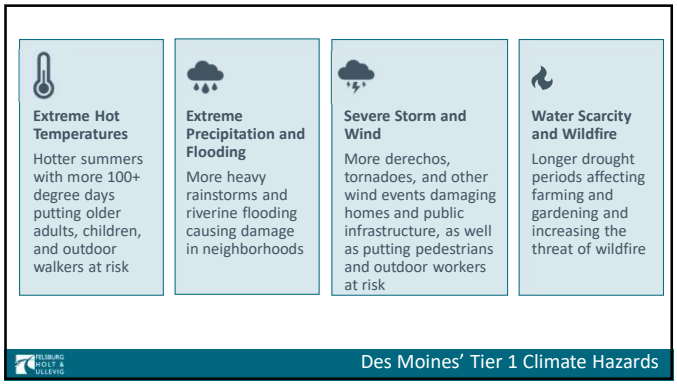
2030

- **Reduce vulnerability and increase capacity of Des Moines** to be resilient to future climate risks including extreme hot temperatures, extreme precipitation and flooding, severe storms and wind, and water scarcity and wildfire.
- Ensure every resident has **reasonable access to a Resilience Hub** (facility that supports community members during and after emergencies.
- **Develop and maintain plans** that address climate risks and vulnerabilities for 100% of major municipal government facilities.
- Become nationally and/or internationally recognized as a **safe and welcoming climate migration destination**.

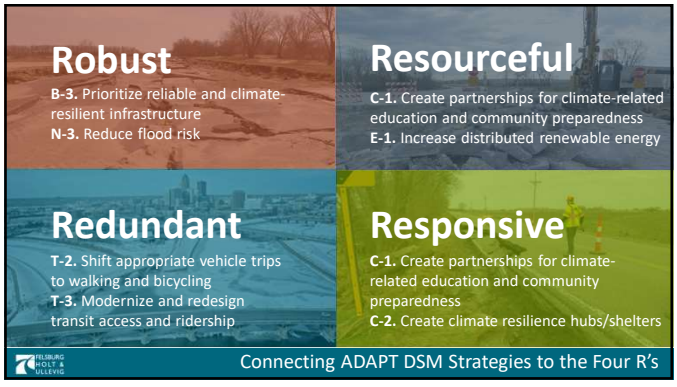
2045

- **Achieve 32% tree canopy cover** per the Urban Forest Master Plan.

Risk and Vulnerability Assessment

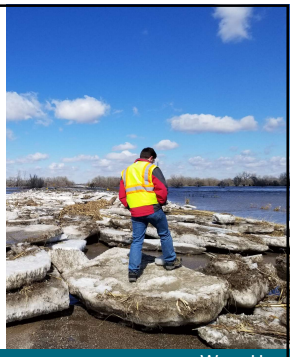

Extreme Hot Temperatures
Hotter summers with more 100+ degree days putting older adults, children, and outdoor walkers at risk
Extreme Precipitation and Flooding
More heavy rainstorms and riverine flooding causing damage in neighborhoods
Severe Storm and Wind
More derechos, tornadoes, and other wind events damaging homes and public infrastructure, as well as putting pedestrians and outdoor workers at risk
Water Scarcity and Wildfire
Longer drought periods affecting farming and gardening and increasing the threat of wildfire
Des Moines' Tier 1 Climate Hazards


Buildings and Infrastructure
Environment
Community and Economy
Vulnerable Systems


Robust
B-3. Prioritize reliable and climate-resilient infrastructure
N-3. Reduce flood risk
Resourceful
C-1. Create partnerships for climate-related education and community preparedness
E-1. Increase distributed renewable energy
Redundant
T-2. Shift appropriate vehicle trips to walking and bicycling
T-3. Modernize and redesign transit access and ridership
Responsive
C-1. Create partnerships for climate-related education and community preparedness
C-2. Create climate resilience hubs/shelters
Connecting ADAPT DSM Strategies to the Four R's

Two Truths and a Lie

1. If the infrastructure survives, the system is resilient.
2. The best resilience investment may be outside the roadway itself.
3. A resilient system balances robustness, redundancy, resourcefulness, and responsiveness.



Wrap Up

Questions?

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