

4.1 Iowa's Resiliency Toolbox

A multifaceted approach that includes strategies, countermeasures, and research will be implemented to mitigate the hazards prioritized by the Resiliency Working Group (RWG). Collectively, this combination of activities will represent Iowa's Resiliency Toolbox and will serve as a planning level resource in identifying approaches for each hazard. As discussed in Chapter 3, hazards have been prioritized into three different response categories based on their risk scores and preferred mitigation approaches. The Tier 1 hazards, which have the highest risk scores, are the primary focus of the toolbox. Iowa's Resiliency Toolbox also includes both typical roadway improvements (grey infrastructure) and natural infrastructure improvements (e.g., native plantings and bioretention).

The strategies, countermeasures, and research initiatives align to the 4 Rs first identified in Chapter 2, with each R icon used to designate which topic each tool relates to most strongly.

Figure 4.1: The four Rs of resiliency

<p>Robust</p>	<p>The system is strong enough to withstand a given level of stress or demand without suffering degradation or loss of function.</p>	<p>Redundant</p>	<p>Elements of a system exist that are substitutable and capable of satisfying the functional requirements of the system in the case of disruption.</p>
<p>Resourceful</p>	<p>There are resources (e.g., monetary, physical, technological, and informational) available that can be leveraged in the process of recovery.</p>	<p>Responsive</p>	<p>There is capacity to meet priorities and achieve goals in a timely manner in order to minimize losses, recover functionality, and avoid future disruption.</p>

Many of the ideas listed in Iowa's Resiliency Toolbox benefit the operation of the transportation system beyond mitigation of the specific hazards they are listed for. For example, shoulder improvements may mitigate the impact flowing water has on the roadway, but they also serve as a safety benefit by allowing users space to recover from departing their lane. Stewardship of the transportation system means that increased consideration should be given to the improvements that are co-beneficial to our mission of keeping users safe on the system.

Tier 1 Hazards

-Highest risk scores

-Preferred mitigation method:

Take proactive steps to address these hazards

Flooding



Winter Storms



Freeze/Thaw



Flooding Strategies



Strategies



S1. Approve resiliency policy in the Bridge Design Manual and plan for increased precipitation events, water elevations, and flow.



S2. Engage internal and external stakeholders regarding watershed management, flood preparation, and emergency protocols.



S3. Allow more ponding at certain “control” structures.



S4. Determine critical routes for emergency routing during flood events at known areas of vulnerability.



S5. Develop a Flood Operations Plan to support in the response of future flood events.



S6. Proactively stockpile flood fighting material and assets including AquaDam and wrapped revetment bags.



S7. Partner with the Iowa Department of Homeland Security and Emergency Management (HSEMD) on projects that reduce road damage from flooding and erosion through stream channel improvements.



S8. Partner with HSEMD and local jurisdictions on comprehensive flood mitigation planning that considers watershed approach or green infrastructure options, then implement planned projects to mitigate flood damage to roads by installing watershed approach practices (e.g. upstream detention), retrofitting bridges, elevating roads, or installing culverts.



S9. Develop a comprehensive statewide flood mitigation strategy that considers flood buy-outs, watershed approach flood mitigation, levees, and other solutions and outlines where, and under what, conditions these different strategies are best applied.



S10. Evaluate key locations to increase waterway capability including widening upstream bench and channelization of the waterway.
















Flooding Countermeasures and Research

Countermeasures



- C1. Roadside and waterway erosion protection – Use engineered (e.g., concrete blocking or Flexamat) or natural (e.g., bio-retention or native planting) materials to control or stop the movement of soil along slopes.
- C2. Native plantings on roadsides – Certain native grasses and plants have deep roots that make them drought-resistant and can reduce soil erosion and flooding.
- C3. Bridge pier scour protection – Bridge scour is the removal of sediment from around bridge abutments. Countermeasures can include concrete armoring, spurs, revetments, wire enclosed riprap, etc.
- C4. Bridge/culvert conveyance improvements – Adequate sizing of bridges and culverts to ensure the proper conveyance of water through the channel and floodplain with the consideration of future increased precipitation.
- C5. Dikes/levees – Embankments of stone, cement, or soil that protect roadways and land during significant rainfalls and flooding.
- C6. Roadway/bridge grade raise – Increasing the elevation grade of a roadway or bridge to reduce overtopping due to flooding conditions.
- C7. Shoulder improvements – Increasing the width or improving the type of shoulder can mitigate the impacts of flowing water across roadways in low-lying areas.
- C8. Median crossover – Add median crossovers at key locations to allow for continued operations during flood events.
- R1. Develop and populate a Riverine Infrastructure Database that supports real time flood flow and levels across Iowa.
- R2. Develop a benefit/cost analysis tool to evaluate cost effectiveness of resilience improvements.
- R3. Research how native plantings can support flood mitigation for Iowa’s transportation system.

Winter Storms Strategies, Countermeasures, and Research

Strategies		
		S11. Design roadways that are less prone to blowing/drifted snow and winter drainage issues.
		S12. Plan for operational impacts of significant winter and ice events.
		S13. Plan a winter operations peer exchange or summit with neighboring states to share best practices and coordinate responses.
		S14. Develop internal guidance or policies for pre-staging winter operations assets in advance of storms.
		S15. Proactively remove vegetation along the Primary Highway System that could break during winter or ice storms.
		S16. Consider bridge design methods that mitigate the impact of ice accumulation on bridges and structures.
		S17. Evaluate recruitment strategies for part-time snowplow drivers to fill critical vacancies.
Countermeasures		
		C9. Snow fencing – Installation of engineered or natural materials that serve as windbreaks from blowing and drifted snow.
		C10. Anti-icing applications – The use of salt and water in precise concentrations known as brine to prevent ice formation on roadways.
		C11. Median crossover – Adding median crossovers at key locations to allow for improved snowplow operations during winter events.
Research		
		R4. Research low visibility navigation technology for Iowa's snowplows.
		R5. Continue to research the best material use and products for ice mitigation (melt).

Freeze / Thaw Strategies, Countermeasures, and Research

Strategies		S18. Develop methods to better maintain pavement joints during intense freeze/thaw cycles.
		S19. Continue to monitor pavement condition throughout the state and implement asset management techniques to minimize the impacts of freeze and thaw cycles.
		S20. Monitor subdrain performance and placement to ensure proper drainage during freeze and thaw cycles.
Countermeasures		C12. Crack and joint cleaning and sealing – Cleaning and sealing with joint sealer to ensure water does not enter and undermine the integrity of pavement or asphalt during freeze and thaw cycles.
		C13. Improve subgrades and subdrains – Improving subgrades and subdrains in key locations supports the facilitation and movement of excess water away from the roadway and minimizes damage.
		C14. Integral bridge abutments – Integral bridges contain no expansion joints and span monolithically from abutment to abutment. This allows thermal expansion without damage to the structure.
Research		R6. Research how freeze/thaw cycles have changed and what we can anticipate in the future.



Tier 2 Hazards

-Medium risk scores
 -Preferred mitigation method:
 Have reactive strategies in place to respond when these hazards occur

Tornado/Windstorm



























Hail/Thunderstorms



Drought



Tier 2 Strategies and Countermeasures

-   S21. Ensure Iowa DOT owned structures and signs are designed to withstand high wind events.
-   S22. Develop internal guidance or policies on clearing or trimming trees that could fall on the roadway.
-   S23. Purchase vegetation management equipment specifically for debris removal on the Primary Highway System.
-   S24. Develop internal plan to pre-stage Iowa DOT assets in support of debris and vegetation removal following tornados or windstorms.
-   S25. Engage with local communities regarding the resources and assets the Iowa DOT possesses to support debris removal and cleanup after significant events.
-   C15. Underground utilities – Storage and coordination of utilities underground to ensure continued service during significant tornados and windstorms.
-   C16. Solar as primary or backup electrical – Installation of solar arrays for traffic controls or facilities as a primary or backup energy source.
-   C17. Generator backup – Purchase of backup generators to provide energy for traffic controls or facilities during major tornados or windstorms.
-   S26. Improve roadway design to accommodate increased precipitation events.
-   S27. Plan for operational impacts of severe weather and continue to enhance communication of rapid weather changes to the public.
-   S28. Develop regulations or waivers to ease in the transport of water, livestock feed, etc. during drought conditions.
-   S29. Coordinate across public and private sectors during times of low water levels to help facilitate shifts of bulk transportation from rivers to railroads or highways.

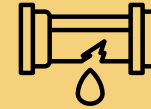
Tier 3 Hazards

-Lowest risk scores
 -Preferred mitigation method:
 Monitor hazards and support mitigation methods where appropriate

Excessive Heat

















Dam/Levee Failure



Landslide



Tier 3 Strategies

-   S30. Consider strategies to reduce the impacts of excessive heat on vulnerable transportation users.
-   S31. Consider strategies to mitigate the effects of excessive heat on construction workers.
-   S32. Be prepared to address issues such as pavement buckling during heatwaves throughout the state.
-   S33. Coordinate with the new Office of Levee Safety within HSEMD to plan for and support the levees throughout Iowa.
-   S34. Regularly review traffic incident management plans and detour routing plans around critical assets.
-   S35. Develop internal guidance for land management practices (e.g., removing bluffs, terracing, etc.) that prevent landslides.
-   S36. Stage equipment strategically if conditions such as an area's topography and recent weather result in an increased likelihood of rockfalls or landslides.

