

Resiliency



5. Resiliency

The state's transportation system provides connectivity within and through the state and is a critical link in the economic and social viability of its residents and businesses. Any disruption to the performance of this system could result in serious impacts, including costs extending beyond those associated with a road closure or repair. Potential disruptions to the state's transportation system could come from a range of natural hazards (flooding, snowstorms, extreme heat, earthquakes) and man-made hazards (accidents, hazmat spills, cyber-attacks, terrorism, etc.), which all need to be considered and planned for as part of a comprehensive process. The state's transportation system needs to be resilient to shocks or impacts from hazards or other disruptions to reduce/eliminate the broader effects. The state has established a resiliency goal, which is to "Proactively assess, plan and invest in the state's transportation system to ensure that our infrastructure is prepared to sustain and recover from extreme events and other disruptions."

GOAL



Proactively assess, plan and invest in the state's transportation system to ensure that our infrastructure is prepared to sustain and recover from extreme events and other disruptions.

WHAT IS RESILIENCY?

Resiliency involves understanding how changing environmental conditions and human threats could impact IDOT assets and then taking action to address identified issues. Impacts to understand include present day concerns – like how land development and the loss of impervious surfaces has impacted localized flooding – as well as likely conditions in the future when changing weather patterns, due to climate change, will increase the frequency of system disruptions from flooding and other hazards. Technological advances in automobile operation or intelligent transportation systems, including signals, may also introduce new vulnerabilities over what is found today (e.g., from cyber-attack). A long-term perspective on resiliency is critical for transportation infrastructure as decisions made today have implications for decades to come given the long lifecycles of transportation assets.

Achieving this goal requires consideration from various perspectives. FHWA, in identifying the definition of resilience, noted that, “Resilience is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.” From IDOT’s perspective, this requires action from maintenance, operations, planning, design and emergency response staff to achieve resiliency across the department. Efforts need to be proactive and coordinated to achieve the state’s goal of reducing system disruptions.

FHWA, in identifying the definition of resilience in the context of the transportation system, states that:



Resilience is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.¹

FHWA has been helping to lead the dialogue on resiliency in the transportation profession and their resilience website (<https://www.fhwa.dot.gov/environment/sustainability/resilience/>) provides a wealth of information. The site contains the results of a number of resiliency pilot studies conducted across the country, climate projections geared towards transportation professionals, detailed case studies showing how resiliency can be incorporated into transportation projects, and syntheses of best practices in this emerging and rapidly developing field of study.

5.1 RESILIENCY AND IDOT

Illinois has experienced a range of impacts to its transportation system from various natural and man-made disasters over the past decades. Notable events include the 1993 flooding along the Mississippi River, the November 2015 snowstorm in the northern part of the state, the July 2017 flooding in Chicago’s northern suburbs (see Figure 1), and the July 2017 oil train derailment in Plainfield (see Figure 2). While IDOT responded efficiently to these events, there is always room for improvement. Better mitigation techniques and closer collaboration with local officials will dramatically reduce the impacts of extreme events on the transportation system. A commitment to taking a proactive approach to avoiding or reducing impacts from similar events in the future will be required to achieve the goal outlined in this plan.

IDOT has taken a first step towards this goal with the completion of the Illinois All-Hazards Transportation System Vulnerability Assessment in October 2017.

This assessment established a framework for evaluating the vulnerability of the state’s transportation system to various natural and man-made hazards. Man-made hazards studied included chemical, biological, radiological, and nuclear incidents; explosives and small arms attacks; electro-magnetic pulse; and cyber-attacks. Natural hazards studied included precipitation, temperature, wind, and geologic threats (landslides, earthquakes, etc.). Natural hazards were evaluated under both current and future climate conditions. Impacts to state transportation assets were evaluated and the consequences assessed (based on asset criticality and sensitivity) to assign a vulnerability score to each asset.

The resulting scores can be used by IDOT to determine where to prioritize resiliency activities.

- ✓ **Critical** an asset is to the transportation network;
- ✓ **Exposed** an asset would be to a defined hazard; and
- ✓ **Sensitive** an asset is to each hazard. The resulting scores can be used by IDOT to determine where to prioritize resiliency activities².

The resulting scores can be used by IDOT to determine where to prioritize resiliency activities.

¹ <https://www.fhwa.dot.gov/legsregs/directives/orders/5520.cfm>, accessed September 28, 2017

² Illinois All Hazards Transportation System Vulnerability Assessment, October 2017

1.6%
BRIDGES

3.4%
ROAD
CORRIDORS

4%
RAIL
CORRIDORS

9.5%
OPERATIONS

5.2 IMPORTANCE OF RESILIENCY

Illinois' transportation system provides critical connectivity within and through the state and is a key link in the economic and social viability of its residents and businesses. Any disruption to this system could result in serious impacts, including costs extending beyond those associated with a road closure or repair. The state's transportation system needs to be made resilient to such shocks from either natural hazards or other human-caused disruptions to reduce/eliminate negative effects for residents, businesses and users.

While detailed asset and location cannot be provided due to security reasons, the vulnerability assessment performed as part of the recently completed **Illinois All-Hazards Transportation System Vulnerability Assessment** concludes that the following percentage of IDOT's assets should be given priority as part of the state transportation planning process, based on the importance of and risk to the asset.



State Route 132 (Grand Avenue) in Lake County was closed to traffic at the Des Plaines River in July 2017 after several inches of rain fell on the area. Many arteries in Chicago's northern suburbs, including many major east-west roads crossing the Des Plaines River, were closed due to flooding, causing travel headaches and disrupting commutes. (Image source: Paul Valade, Associated Press)




An oil train derailed in Plainfield in July 2017 shutting down a Canadian National rail line and many roads in the area including State Route 126. About 40,000 gallons of oil leaked from ruptured rail cars. Fortunately, no fire or explosion occurred as the result of the accident, limiting the effects. (Image source: Fox 32 News)

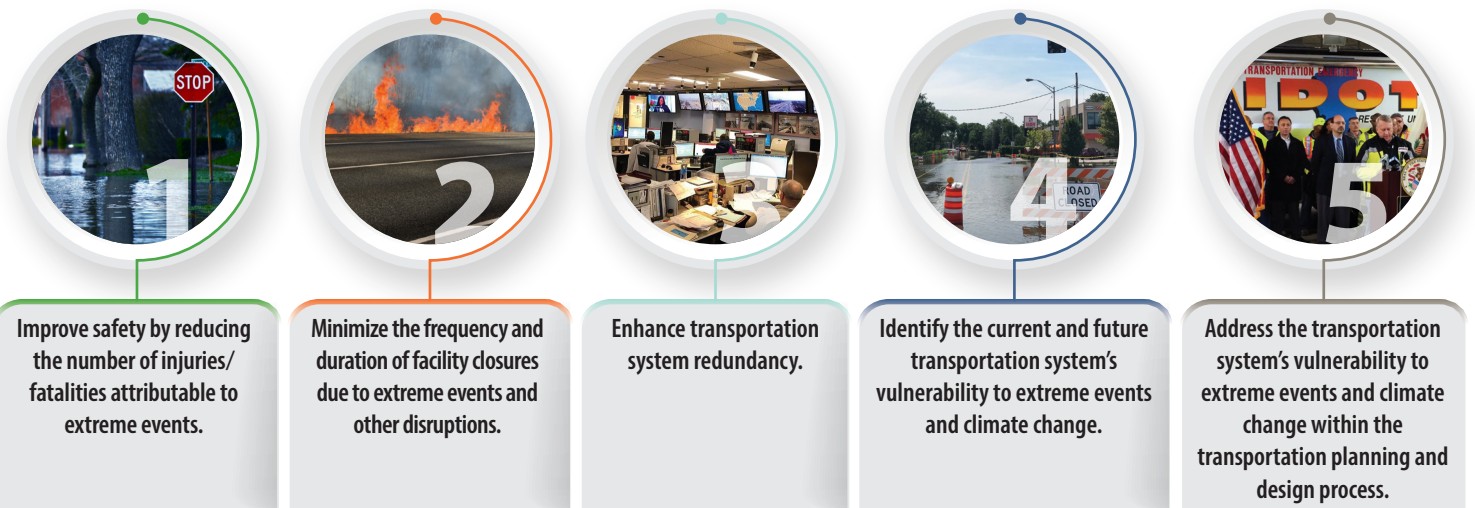
Resilience should be represented in major policy considerations, as well as in system operation and management. The following describes the importance of resiliency as it relates to the other LRTP goals:

- **Safety** – Resiliency involves providing a safer transportation system for system users, while also reducing the dangers for first responders
- **Mobility** – Resiliency involves minimizing disruptions which can impact the user experience, causing delays and/or major inconveniences
- **Economy** – Resiliency involves minimizing the socioeconomic costs of disruptions caused by impairment of travel/goods movement
- **Stewardship** – Resiliency involves minimizing long-term costs for infrastructure repair/maintenance

5.3 OBJECTIVES AND STRATEGIES

IDOT has developed five objectives to guide its actions on resiliency across the agency. These objectives will assist in increasing the resilience of the transportation system to both natural and man-made hazards. Each objective contains a list of recommended actions, performance measures and implementation strategies that IDOT will pursue. The LRTP content as a whole will be considered guidance for programming decisions; however, each objective below also denotes some of the more specific recommended actions/strategies that will be used to guide programming decisions. These have been denoted with  in Section 5.3.1.

The five objectives identified for the resiliency section include:



5.3.1 OBJECTIVES, STRATEGIES, PERFORMANCE MEASURES, AND IMPLEMENTATION

OBJECTIVE 1.

Improve safety on the Illinois transportation system by reducing the number of injuries/fatalities attributable to extreme events

**RECOMMENDED ACTIONS/STRATEGIES:**

- **Engage in close coordination with operations stakeholders to reduce injuries and fatalities from extreme events.**

IDOT has worked hard to assure readiness for extreme events and will continue to work closely with highway safety, maintenance, traffic operations and state police personnel to implement effective strategies to reduce injuries and fatalities statewide. IDOT has also worked with the Federal Emergency Management Agency (FEMA), Homeland Security, and other federal, state, and local agencies to prepare and respond to extreme events.

- **Increase use of preemptive road closures for extreme events.**

IDOT will increase the use of preemptive road closures during flooding and major snowfalls to improve safety. This could include the use of immovable barriers to block roads that have been closed due to flooding to prevent attempts at bypassing them. IDOT and its partners will also refine the use of dynamic message boards and cellphone applications to provide the motoring public with the most up-to-date road conditions and closures. With the implementation of ITS technology, weather-dependent variable speed limits can be used based on real time conditions.

- **Address known and/or recurring roadway flooding areas**

Known and recurring roadway flooding areas will be prioritized for improvement, including upgrading drainage, addressing low capacity bridges and culverts so they can handle greater flood flows, and, in limited cases, raising the profile and/or using more damage-resistant materials for roadways in low-lying and flood-prone areas. (P)

PERFORMANCE MEASURES:

- ✓ **Number of flood-flow deficient bridges and culverts**

IDOT will maintain an inventory of flood-flow deficient bridges and culverts. Near-term maintenance and longer-term opportunities to efficiently and effectively address these facilities will be identified and prioritized to improve safety and provide cost-effective benefits.

- ✓ **Number of state route closures due to flooding**

Closures of state routes could have safety, economic, and mobility impacts. IDOT will track the number of state routes closed due to flooding. This will include the information associated with the closure, such as rainfall amount, extent of flooding, the duration of road closure, and methods used to communicate and implement the road closure.

- ✓ **Number and proportion of extreme events for which outreach/social media campaigns are undertaken**

Social media has the ability to quickly and broadly reach the traveling public. The use of outreach/social media during extreme events by IDOT to inform and encourage the public to avoid closed roads will be tracked.

IMPLEMENTATION:

- ✓ **Enhance the roadway closure and detour information available to travelers during extreme events so as to increase traveler's ability to make informed decisions.**

Lead: IDOT Office of Communications

Partners: IDOT Bureau of Operations, IDOT Districts

- ✓ **Improve and enhance coordination between IDOT maintenance leads and traffic operations/incident management staff, and local and state emergency response professionals to identify any conclusions to be drawn from extreme event response activities.**

Lead: IDOT Bureau of Operations

Partners: IDOT Districts , Local and State Emergency Response Professionals

- ✓ **Hold annual multi-department and multi-agency coordination meetings to discuss emergency response methods and available tools and develop a plan to increase detour planning efforts and improve system outage communication efforts.**

Lead: IDOT Bureau of Operations, Bureau of Traffic

Partners: IDOT Districts, IDOT Office of Communications, State Police, FEMA, Illinois Emergency Management Agency

OBJECTIVE 2.

Minimize the frequency and duration of facility closures due to extreme events and other disruptions



RECOMMENDED ACTIONS/STRATEGIES:

- **Improve capabilities for dealing with extreme events by enhancing real-time traffic operations capabilities.**

IDOT was an early adopter of real-time traffic operations/ incident management techniques, including the long-standing Emergency Traffic Patrol (Minutemen) service, highway advisory radio, real-time road condition websites, dynamic message signs, road weather information systems, as well as extensive snow removal equipment and procedures. New technologies, such as Active Transportation and Demand Management and smart corridors provide integrated strategies to dynamically manage and control traffic, as well as broadened use of current ITS technology will facilitate traffic operations management for road closures.

- **Enhance emergency response plans that consider strategic planning for events.**

IDOT will partner with other federal, state, and local agencies to enhance emergency response plans to broaden planning for extreme events. A critical component is the real-time communication and coordination with IDOT partners required to prepare and respond to these events.

- **Continue active involvement in the critical infrastructure sub-committee of the Illinois Terrorism Taskforce.**

The Illinois Terrorism Taskforce includes a Critical Infrastructure Committee. These groups have broad composition ranging from institutions and industry representatives to emergency responders and labor organizations. The Illinois Terrorism Task Force is addressing prevention, protection, mitigation, response, and recovery capabilities. For example, potential recovery strategies for addressing extreme events could include having extra materials/components/ equipment on hand in noted areas of concern and putting contracts in place with private contractors and/or local/state governments to assist with repair as needed after events to eliminate any contracting lag.

PERFORMANCE MEASURES:

- ✓ **Number of facility closures (or capacity limitations) attributable to extreme events**
IDOT will annually track damage from extreme events, such as flooding, extreme heat, or landslides on the IDOT system normalized by the number of events and their severity.
- ✓ **Number of response plans incorporating natural or man-made disasters**
IDOT will track the number of enhancements to response plans that incorporate natural or man-made hazards.

IMPLEMENTATION:

- ✓ **Coordinate with maintenance staff and consult the All Hazards vulnerability assessment to identify regular/recurring flood conditions on state highways and have design engineers utilize that information to act to improve flooding conditions through the capital improvement program.**
Lead: IDOT Bureau of Operations, IDOT Bureau of Design and Environment
Partners: IDOT Districts, IDOT Office of Planning and Programming
- ✓ **Develop contractor emergency response on-call contracts and agreements with local governments and surrounding states to provide response and recovery support during future events.**
Lead: IDOT Districts, IDOT Bureau of Operations
Partners: IDOT Office of Planning and Programming, Illinois Emergency Management Agency
- ✓ **Develop a severe storm index, which will allow IDOT to better understand the frequency of extreme weather events.**
Lead: IDOT Office of Planning and Programming
Partners: IDOT Bureau of Design and Environment
- ✓ **Enhance coordination with maintenance staff and emergency response staff to identify AND implement strategies for reducing the impact of events, and develop and document a set of strategies for reducing the impact of events on the transportation system.**
Lead: IDOT Bureau of Operations
Partners: IDOT Districts

OBJECTIVE 3.

Enhance transportation system redundancy

RECOMMENDED ACTIONS/STRATEGIES:

- **Coordinate with appropriate state and local agencies to update emergency response plans**

IDOT will coordinate with its partners to update emergency response plans to include a comprehensive detour routing and communication plan for all state facilities, including methods to coordinate outages early to purveyors of mapping software applications which provide routing information for drivers.

- **Create a comprehensive system of detour routes and closure plans for major roadways**

IDOT will develop a comprehensive statewide system of detour routes by IDOT District beginning with interstates, freeways, and expressways, and followed by other principal arterials, which includes scenarios for outages in at-risk areas.

- **Coordinate activities across agencies and modes to create comprehensive and consistent multimodal response plans.**

IDOT's comprehensive system of detour routes will include coordination across agencies and emergency response documents and incorporation of multiple modes, since the potential for modal changes exists during extreme events.

- **Create a signing and digital information plan for detours.**

IDOT currently prepares traffic control and detour plans for construction projects. To specifically address detours resulting from extreme events, IDOT will develop a plan for signing and digital information for detour routes, and investigate the potential for web-based interactive detour route mapping.

- **Enhance the resiliency of new projects by considering system redundancy and emergency operation **

During the planning and design process, IDOT will consider system redundancy and emergency operations, including detour requirements to better incorporate resiliency into its projects.



PERFORMANCE MEASURES:

- ✓ **Number of major roadways with at-risk areas having pre-planned detour routes/closure plans and similar measures for other modes**

Based on the identification of at-risk areas on major roadways from the *All Hazards Transportation System Vulnerability Assessment*, detour plans will be developed that include alternate routings and coordination/ integration of other modes, as applicable.

- ✓ **Total length of major roadways with at-risk areas having detour route signage (or plans for rapid reaction temporary signage)**

Based on the identification of at-risk areas on major roadways from the *All Hazards Transportation System Vulnerability Assessment*, detour route signage plans will be developed and sufficient rapid reaction temporary signage will be available for these signage plans.

IMPLEMENTATION:

- ✓ **Develop detour plans for at-risk areas on major state routes based on information from the All Hazards Transportation System Vulnerability Assessment.**

Lead: IDOT Bureau of Operations

Partners: IDOT Districts, IDOT Bureau of Design and Environment

- ✓ **Develop detour signage and digital information plans for at-risk areas on major state routes based on information from the All Hazards Transportation System Vulnerability Assessment.**

Lead: IDOT Bureau of Operations

Partners: IDOT Districts, IDOT Bureau of Design and Environment

OBJECTIVE 4.

Identify current and future transportation system vulnerabilities to extreme events and climate change

**RECOMMENDED ACTIONS/STRATEGIES:**

- **Better define system vulnerabilities from current extreme events.**

The vulnerability of an asset is based on its importance (criticality), and the risk (exposure and sensitivity) to a given event. IDOT will continue to refine and improve the determination of vulnerability based on these factors for a range of potential natural and man-made hazards.

- **Prioritize next steps from the vulnerability analysis that need addressing.**

A number of next steps were identified in the All-Hazards Transportation System Vulnerability Assessment. These next steps will be systematically prioritized by IDOT to provide the most effective improvements to the vulnerability analysis.

- **Expand the assessment to additional assets and stressor types.** 

IDOT's transportation system vulnerability analysis will continue to be improved by incorporating recent comprehensive asset inventory data as it becomes available, and newer, improved climate and other hazard information in order to better define vulnerabilities for all system assets.

- **Develop a prioritization scheme through internal coordination to enable action in addressing noted system vulnerabilities.** 

IDOT will develop prioritize assets based on their vulnerability and develop near and longer-term improvement programs to create a more resilient transportation system that meets current and future concerns.

PERFORMANCE MEASURES:

- ✓ **System-wide vulnerability analysis results that are based on the latest information.**
Number of database systems, system-wide vulnerability analysis results are integrated within.

IMPLEMENTATION:

- ✓ **Identify actions needed to incorporate climate change into decision-making by coordinating with climate scientists and other state adaptation planning efforts to get an official set of projections for use in IDOT activities, educating staff on climate science basics and findings of vulnerability analysis, and getting broad agency-wide buy-in on recommended methodology and prioritization systems.**

Lead: IDOT Bureau of Design and Environment, IDOT Office of Planning and Programming

Partners: IDOT Districts, IDOT Bureau of Operations

- ✓ **Apply official climate projections for use by project-level staff.**

Lead: IDOT Bureau of Design and Environment

Partners: IDOT Districts, IDOT Bureau of Operations

- ✓ **In coordination with the state climatologist, develop educational materials on incorporating resiliency and climate change into efforts across IDOT.**

Lead: IDOT Office of Planning and Programming, IDOT Bureau of Design and Environment

Partners: IDOT Districts, IDOT Bureau of Operations

OBJECTIVE 5.

Address transportation system vulnerabilities to extreme events and climate change within the transportation planning, design, and asset management processes

**RECOMMENDED ACTIONS/STRATEGIES:**

- **Address noted system vulnerabilities to extreme weather and climate change effects.** 

IDOT's All-Hazards Transportation System Vulnerability Assessment evaluated the resiliency of the transportation system in terms of its ability to both handle stresses and quick recover when those stresses result in damage. IDOT is beginning to address these identified vulnerabilities through a wide range of planning, design and asset management strategies, including retrofitting or upgrading facilities, updating design standards, incorporation into maintenance cycles, network redundancy, real-time information systems, and rapid rebuilding readiness.

- **Incorporate prioritization of resiliency needs into transportation planning process and project scoring systems.** 

IDOT's All-Hazards Transportation System Vulnerability Assessment classified the state's transportation assets for vulnerability in terms of both the importance of the asset and risk to the asset. This vulnerability information will be used to identify and assess adaptation and mitigation strategies in the transportation planning process and incorporated into IDOTS PBPS tool to ensure appropriate consideration of resiliency in the programming process.

- **Develop a risk-based design approach for new projects, considering climate change projections and the need for adaptation.**

IDOT will develop a process for better incorporating resiliency into their design approach for new projects. This will include a risk-based approach for incorporating the best available and actionable scientific and engineering data. For example, for hydraulic design, consideration of the changes in the frequency and severity of storms and floods that might result from a changing climate is needed. IDOT will also incorporate potential adaptation options in the design process to address the vulnerabilities identified in the All-Hazards vulnerability assessment. These design approach improvements will be incorporated into the IDOT Bureau of Design and Environment Manual.

- **Undertake detailed adaptation analysis on all high-vulnerability facilities.**

Based on the All-Hazards Transportation System Vulnerability Assessment, IDOT is focusing on adaptation efforts for those assets identified as most at-risk or vulnerable. Adaptation is responsible risk management and represents a more holistic planning approach. Adaptation strategies for these vulnerable assets can include a wide range of solutions, including natural, structural, or policy-based adaptation strategies, and can range from site-specific to regional adaptation strategies. The many different adaptation options have differing costs and benefits. IDOT also recognizes the importance of engaging stakeholders in analyzing adaptation strategies.

- **Incorporate system resiliency measures into project design efforts and the asset management system.** 

Typical asset management systems rely on gradual, predictable deterioration curves based on the past performance of assets. It is now necessary to include preparation for the unpredictable impacts of major external threats. This necessitates a risk-based asset management program that considers redundancy, robustness, and resiliency. IDOT will develop a risk-based approach for planning and asset management that incorporates resilience through potential processes, including mitigation and adaptation programs, prioritization process for restoring asset functionality, and emergency response contracts for rapid mobilization.

PERFORMANCE MEASURES:

- ✓ **Number of and funding amount for resiliency-related projects.**
IDOT will track the amount of funding and number and types of projects that are resiliency-related.
- ✓ **Number/weight of resilience factors in the performance-based project selection tool.**
IDOT will incorporate resilience factors in their PBPS tool. Initially, the focus for incorporation of resilience will be related to transportation assets with high vulnerability classifications.
- ✓ **Number of design projects using a risk-based design approach, considering climate change projections.**
IDOT will track the number of design projects that use a risk-based design approach that considers climate change projections.
- ✓ **Number of specific asset types of high-vulnerability assets for which a detailed adaptation analysis has been conducted.**
IDOT will track the number of specific asset types for which adaptation analysis has been performed.
- ✓ **Number of extreme weather risks identified and addressed in the asset management plan.**
IDOT will track the number of extreme weather risks that are identified and addressed in the asset management plan.

IMPLEMENTATION:

- ✓ **Commit IDOT resources to begin a broader roll-out of the concepts of resiliency to climate change and extreme weather by holding an informational event with representation from planning, design, operations, asset management and maintenance to define requirements, targets and required actions.**
Lead: IDOT Office of Planning and Programming
Partners: IDOT Bureau of Design and Environment, IDOT Bureau of Operations, IDOT Districts
- ✓ **Incorporate potential facility disruptions as a part of all ongoing maintenance and asset management, and facilitate activities and implement strategies to reduce future system impacts.**
Lead: IDOT Office of Planning and Programming, IDOT Bureau of Operations
Partners: IDOT Districts
- ✓ **Incorporate resiliency into ongoing practices and develop projects that address identified system vulnerabilities.**
Lead: IDOT Office of Planning and Programming
Partners: IDOT Districts, IDOT Bureau of Design and Environment
- ✓ **Coordinate with the project scoring system team to develop and implement a project scoring method and risk-based design approach to project design.**
Lead: IDOT Office of Planning and Programming
Partners: IDOT Bureau of Design and Environment
- ✓ **Coordinate with asset management team to incorporate climate change and extreme events into their activities.**
Lead: IDOT Office of Planning and Programming
Partners: IDOT Districts

5.3.2 IMPLEMENTATION SUMMARY

Implementation of IDOT’s resiliency goal to proactively assess, plan and invest in the state’s transportation system to ensure that our infrastructure is prepared to sustain and recover from extreme events and other disruptions will require the development of new internal policies, and more targeted coordination with partner agencies at the federal, state and local levels. IDOT will take the following actions to realize the goals and objectives laid out in this chapter. The following (**Table 5.1**) are proposed to successfully implement the overarching resiliency goal and its five objectives:

TABLE 5.1: Implementation Actions

IMPLEMENTATION ACTION	LEAD EQUITY	PARTNERS
Improve safety on the Illinois transportation system by reducing the number of injuries/fatalities attributable to extreme events		
Enhance the roadway closure and detour information available to travelers during extreme events so as to increase traveler’s ability to make informed decisions.	IDOT Office of Communications	IDOT Bureau of Operations, IDOT Districts
Improve and enhance coordination between IDOT maintenance leads and traffic operations/incident management staff, and local and state emergency response professionals to identify any conclusions to be drawn from extreme event response activities.	IDOT Bureau of Operations	IDOT Districts, Local and State Emergency Response Professionals
Hold annual multi-department and multi-agency coordination meetings to discuss emergency response methods and available tools and develop a plan to increase detour planning efforts and improve system outage communication efforts.	IDOT Bureau of Operations, Bureau of Traffic	IDOT Districts, IDOT Office of Communications, State Police, FEMA, Illinois Emergency Management Agency
Minimize the frequency and duration of facility closures due to extreme events and other disruptions		
Coordinate with maintenance staff and consult the All Hazards vulnerability assessment to identify regular/recurring flood conditions on state highways and have design engineers utilize that information to act to improve flooding conditions through the capital improvement program.	IDOT Bureau of Operations, IDOT Bureau of Design and Environment	IDOT Districts, IDOT Office of Planning and Programming
Develop contractor emergency response on-call contracts and agreements with local governments and surrounding states to provide response and recovery support during future events.	IDOT Districts, IDOT Bureau of Operations	IDOT Office of Planning and Programming, Illinois Emergency Management Agency
Develop a severe storm index, which will allow IDOT to better understand the frequency of extreme weather events.	IDOT Office of Planning and Programming	IDOT Bureau of Design and Environment
Enhance coordination with maintenance staff and emergency response staff to identify and implement strategies for reducing the impact of events, and develop and document a set of strategies for reducing the impact of events on the transportation system.	IDOT Bureau of Operations	IDOT Districts
Enhance transportation system redundancy		
Develop detour plans for at-risk areas on major state routes based on information from the All Hazards Transportation System Vulnerability Assessment.	IDOT Bureau of Operations	IDOT Districts, IDOT Bureau of Design and Environment
Develop detour signage and digital information plans for at-risk areas on major state routes based on information from the All Hazards Transportation System Vulnerability Assessment.	IDOT Bureau of Operations	IDOT Districts, IDOT Bureau of Design and Environment

IMPLEMENTATION ACTION	LEAD EQUITY	PARTNERS
Identify current and future transportation system vulnerabilities to extreme events and climate change		
Identify actions needed to incorporate climate change into decision-making by coordinating with climate scientists and other state adaptation planning efforts to get an official set of projections for use in IDOT activities, educating staff on climate science basics and findings of vulnerability analysis, and getting broad agency-wide buy-in on recommended methodology and prioritization systems.	IDOT Bureau of Design and Environment, IDOT Office of Planning and Programming	IDOT Districts, IDOT Bureau of Operations
Apply official climate projections for use by project-level staff.	IDOT Bureau of Design and Environment	IDOT Districts, IDOT Bureau of Operations
In coordination with the state climatologist, develop educational materials on incorporating resiliency and climate change into efforts across IDOT.	IDOT Office of Planning and Programming, IDOT Bureau of Design and Environment	IDOT Districts, IDOT Bureau of Operations
Address transportation system vulnerabilities to extreme events and climate change within the transportation planning, design, and asset management processes		
Commit IDOT resources to begin a broader roll-out of the concepts of resiliency to climate change and extreme weather by holding an informational event with representation from planning, design, operations, asset management and maintenance to define requirements, targets and required actions.	IDOT Office of Planning and Programming	IDOT Bureau of Design and Environment, IDOT Bureau of Operations, IDOT Districts
Incorporate potential facility disruptions as a part of all ongoing maintenance and asset management, and facilitate activities and implement strategies to reduce future system impacts.	IDOT Office of Planning and Programming, IDOT Bureau of Operations	IDOT Districts
Act to incorporate resiliency into ongoing practices and develop projects that address identified system vulnerabilities.	IDOT Office of Planning and Programming	IDOT Districts, IDOT Bureau of Design and Environment
Coordinate with the project scoring system team to develop and implement a project scoring method and risk-based design approach to project design.	IDOT Office of Planning and Programming	IDOT Bureau of Design and Environment
Coordinate with asset management team to incorporate climate change and extreme events into their activities.	IDOT Office of Planning and Programming	IDOT Districts