

Transportation System Preparedness and to Extreme Weather Events and Natural Hazards

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Overview

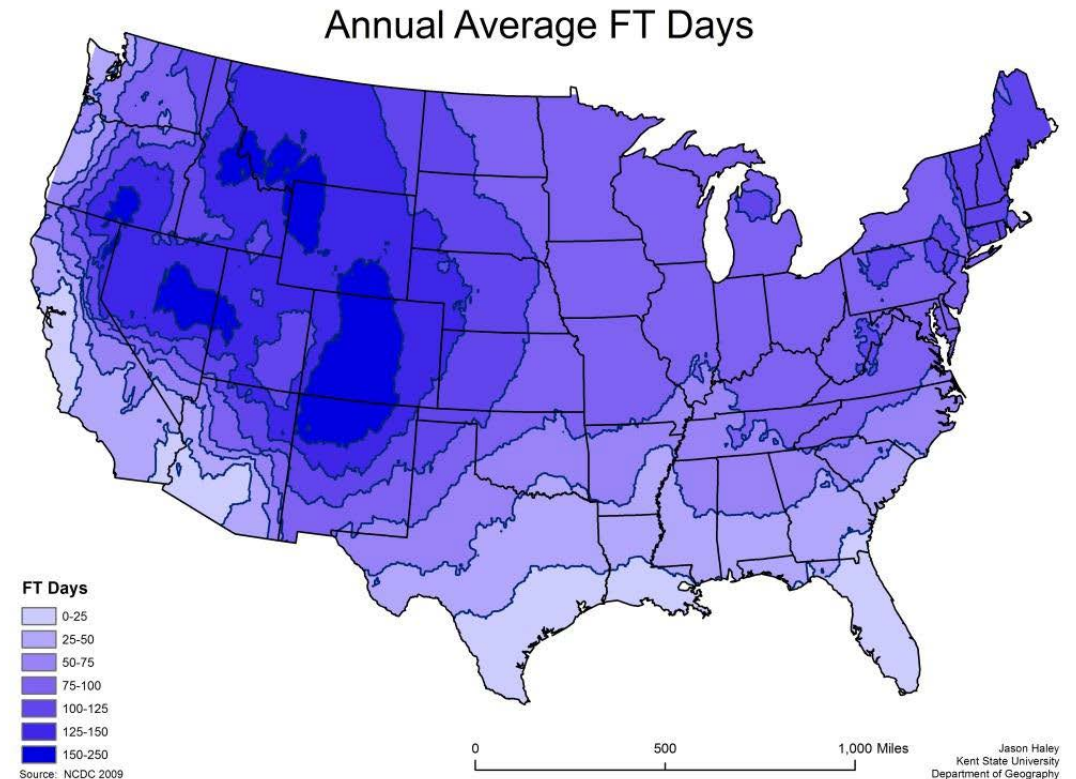
- In December of 2014, the Federal Highway Administration (FHWA) issued Order 5520 to establish a policy on preparedness and resilience to climate change and extreme weather events.
- As part of this directive, state transportation agencies are instructed to implement and evaluate risk-based and cost-effective strategies to minimize climate and extreme weather risks and protect critical infrastructure using the best available science, technology and information.

Project goals

- Perform a vulnerability assessment that identifies KYTC's assets that are at risk to extreme weather events and other natural hazards
 - Quantitative (existing data)
 - Qualitative (local knowledge)
- Identify assets that are at greatest risk
 - National Highway System
 - District 1
- Compile data and assessments into a GIS database
- Implement findings into KYTC's risk based asset management plan required under MAP-21

Transportation system hazards

- Extreme weather events
 - Flooding: regional flooding, flash flooding
 - Severe thunderstorm: wind, hail
 - Severe winter storm: snow, ice
 - Extreme temperature: heat, cold
 - Drought
 - Wildfire
 - Freeze/Thaw cycles
- Other natural hazards
 - Seismicity
 - Landslide
 - Karst



Average annual number of freeze/thaw days (Haley 2011).

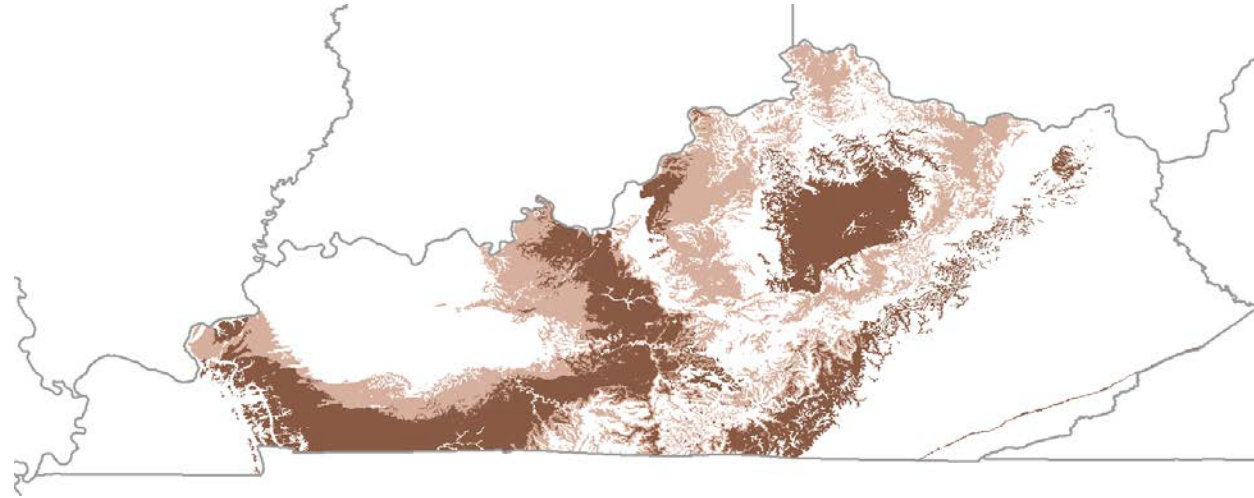
KYTC survey results, Fall 2015

- Extreme weather events
 - **Flooding: regional flooding, flash flooding**
 - Severe thunder storm: wind, hail
 - Severe winter storm: snow, ice
 - Extreme temperature: heat, cold
 - Drought
 - Wildfire
- Other natural hazards
 - **Seismicity**
 - **Landslide**
 - **Karst**



Data sources

- KYTC
 - Bridge inventory
 - Maintenance records
- KTC
 - Bridge seismic vulnerability ratings
- FHWA
 - Vulnerability assessment tools and research
 - Pilot Assessments
- KGS
 - Karst potential and existing sinkholes
- USGS
 - Seismic risk and peak ground acceleration rates






Karst potential in Kentucky (KGS).

Data Sources (cont.)

- FEMA
 - Floodplain Mapping
- National Weather Service
 - Historical Meteorological Data
- Midwest Regional Climate Center
 - Precipitation and Temperature trends
- Oak Ridge National Laboratory
 - Future climate projection
- Other Data Sources
 - Other State DOT Vulnerability Assessments
 - TRB Publications
 - Research Publications

Assessing criticality

Very Low to Low				Moderate		Critical to Very Critical			
1	2	3	4	5	6	7	8	9	10
Criticality of asset									
Notice that along with the qualitative terms there is an associated scale of 1 to 10, this is to serve as a facilitation tool for some people who may find it useful to think in terms of a numerical scale - although the scoring by each individual is of course subjective. The scale is a generic scale of criticality where "1" is very low (least critical) and "10" is very critical									
									
Typically involves: <ul style="list-style-type: none">• Non-NHS• Low AADT• Alternate routes available				Typically involves: <ul style="list-style-type: none">• Some NHS• Non-AADT• Low to medium AADT• Alternative for other state routes		Typically involves: <ul style="list-style-type: none">• Interstate• Lifeline• Some NHS• Sole access• No alternate routes			

Assessing vulnerability

Reduced Capacity			Temporary Operational Failure			Complete Failure			
1	2	3	4	5	6	7	8	9	10
Workshop Impact Rating Scale									

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Reduced Capacity

Results in little or negligible impact to asset. Asset would be available with full use within 10 days and has immediate limited use still available.

"Reduced Capacity" typically involves:

- Less convenient travel
- Occasional brief lane closures, but roads remain open
- Some vehicles may move to alternate routes



Temporary Operational Failure

Results in minor damage and/or disruption to asset. Asset would be available with either full or limited use within 60 days.

"Temporary Operational Failure" typically involves:

- Temporary road closure, hours to weeks
- Reduced access to destinations served by the asset
- Stranded vehicles

Possible temporary utility failures



Complete Failure

Results in total loss or ruin of asset. Asset may be available for limited use after at least 60 days and would require major repair or rebuild over an extended period of time.

"Complete end/or Catastrophic Failure" typically involves:

- Immediate road closure
- Travel disruptions
- Vehicles forced to reroute to other roads
- Reduced commerce in affected areas
- Reduced or eliminated access to some destinations

May sever some utilities. May damage drainage conveyance or storage systems.

District 1 Assets

- National Highway System Assets Assessed in District 1

- 317 Miles of Roadway
- 129 Bridges
- 29 Culvert Locations
- 140 Other Structures



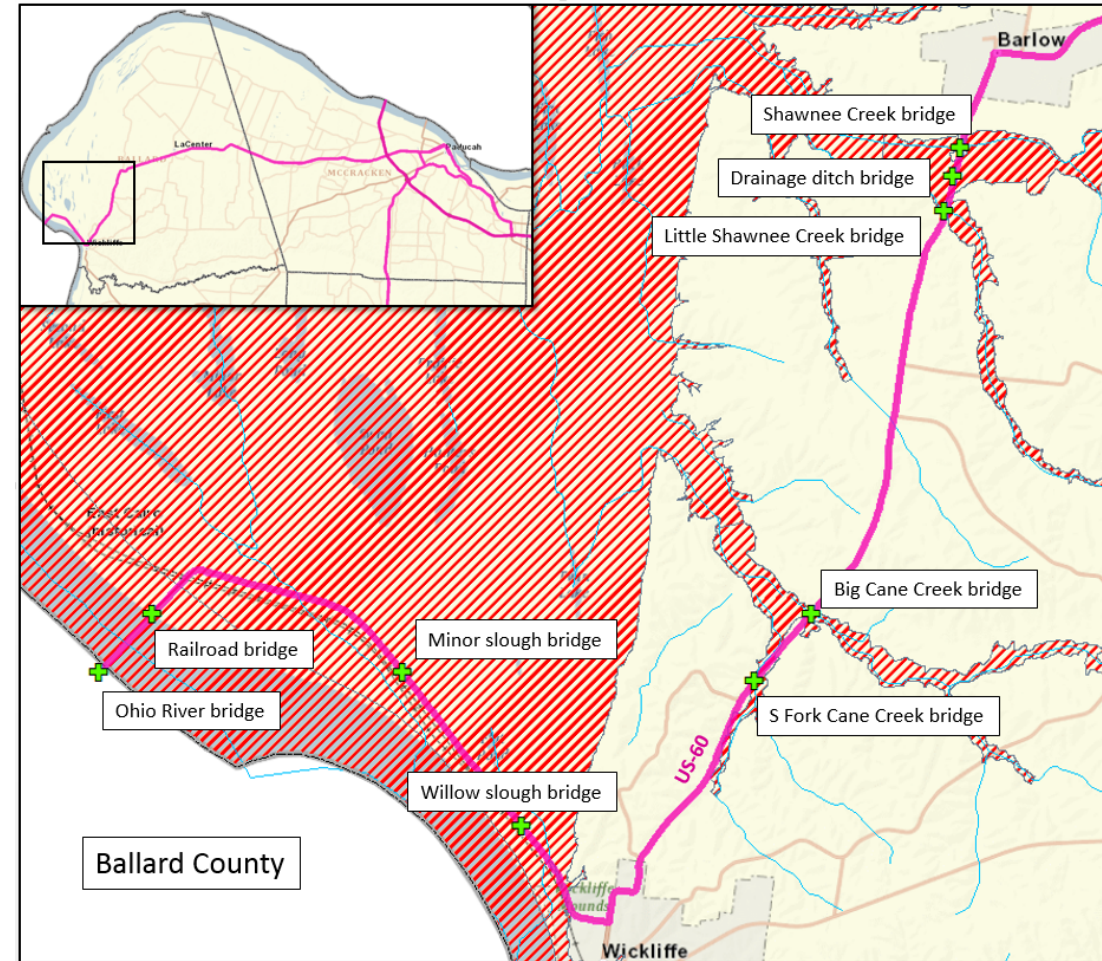
- Future National Highway System Assets Assessment Needed

- Lighting
- Guardrail
- Signals
- Signage



District 1 Workshop

- Assess vulnerability of National Highway System assets in District 1
- Focus on flooding, landslide, karst, and seismicity
- Detailed feedback and evaluation from local engineers and maintenance officials
- Identify segments and bridges most prone to disruption and/or damage



Project Goals

- Assess vulnerability of all National Highway System assets in Kentucky
- Workshops to be held at every district office
- Results will assist KYTC in mitigation efforts
- Results will also feed into KYTC's Asset Plan Management efforts

