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## Theme #7: Weather, Climate, Resilience and Environment

### Context Sensitive Design

1. Identify best practices for managing erosion and sedimentation impacts on rural roads due to changes in climate and land use (AFB30).
2. Identify strategies to improve roadside ecology in public lands.
3. Analyze relationships between clear zone width, extent of tree cover, and traffic speeds on rural highways in tourism areas.
4. Identify landscaping/vegetation species that contribute to the character of tourism routes but can safely be planted in clear zones.
5. Identify context sensitive design options for rural workhorse bridges in historic districts.
6. Assess transportation agency and SHPO practices for tribal knowledge incorporation in identification, recordation and evaluation of stone features.

### Environmental Impact Management

1. Develop guidance for improving natural hazards risk management and resiliency to climate change impacts for public lands and other tourism/recreational areas.
2. Develop an online database of best-practices for the management and mitigation of transportation impacts on endangered species.

### Geotechnical

1. Develop design guide for low-cost stormwater overflow management structures suitable for rural riparian areas.
2. Document strategies for geotechnical asset management, environmental sustainability and resilience (AFP00).
3. Identify economic analysis tools for management of rural geotechnical assets (AFP00).
4. Evaluate deterioration and unit costs for rural transportation geotechnical assets (AFP00).
5. Create an implementation manual for geotechnical asset management for transportation agencies (AFP10).
6. Identify structural and seismic risks to rural roads and bridges in petroleum and natural gas extraction areas (RNS10).

### Infrastructure Resilience

1. Create a bridge and culvert vulnerability assessment software suite (RNS1), including a low-cost tool to measure hydraulic capacity of structures, estimate future stormwater flows, identify vulnerable structures, and model stormwater management scenarios at roughly a countywide scale.

2. Evaluate impacts of climate change on road system at county level including long-term.
3. Identify the role of low volume roads to create network resilience/redundancy (AFB30).
4. Document best practices for the permanent relocation of rural communities threatened by climate-related problems. Evaluate infrastructure funding, social impacts, and the logistics of relocation. Develop case studies based on the experiences of Alaska Native villages.
5. Identify recommended practices for integrating resilience upgrades into routine transportation and economic development projects.
6. Identify the probability of large-scale population resettlements due to climate change and the resulting effects on rural transportation infrastructure and services. Examples could include resettlement of U.S. residents displaced by climate disasters, or future humanitarian programs to repopulate rural America with refugees from regions experiencing chronic crop failure, desertification, flooding, etc.

## Maintenance

1. Identify rural roadway winter maintenance techniques for climate change resilience.
2. Identify winter roadway maintenance techniques suitable for regions that experience occasional heavy snow/ice, such as the southern U.S.
3. Identify simplified analytical tools that incorporate weather and climate data to help rural decision makers optimize winter maintenance expenditure levels based on their safety and economic development goals.
4. Identify retrofit surface treatments to reduce asphalt pavement softening, prevent loss of skid resistance, and deter solar heat rutting.
5. Identify methods for predicting rural highway segments that are at risk of pavement heave under hotter summer conditions.

## Operations/Recovery

1. Identify rapid reconstruction techniques for bridges affected by natural disasters.
2. Analyze and document rural traffic management for particular populations for natural disasters.
3. Identify methods for providing alternative access to communities cut off by bridge failures caused by flooding or similar disasters, such as the temporary use of low water crossings.
4. Analyze and document methods for natural or man-made disaster recovery in rural areas.
5. Document best practices for the role of rural transit in disaster response/resilience.
6. Document methods for accelerating rural transportation recovery from climate disasters.
7. Document the use of drones for transportation infrastructure inspection and site reconnaissance following natural disasters.
8. Identify methods for reducing transportation costs and delays associated with disaster response/recovery in frontier and remote areas of the mainland United States and outlying areas such as Alaska, American Samoa, Guam, Hawaii, the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands.
9. Identify opportunities to expedite redesign and reconstruction of transportation facilities through flexible design standards and administrative processes.

10. Bouncing back from natural disasters in tourism-dependent rural communities (RNS 17).

### Planning

1. Identify the potential for planned abandonment/relocation of vulnerable rural highways (and adjacent land uses) in the event of a disaster, to build back better instead of replacing in-kind at disaster-prone sites.
2. Develop tools and guidance to optimize responses to climate hazards by helping local decision-makers identify climate-related risks and optimize expenditure decisions at the system-wide and program-wide levels.
3. Cross-jurisdictional stormwater and floodwater management strategies.
4. Identify holistic methods for coordinating roadside development and stormwater management at the watershed level, irrespective of state, county, and local jurisdictional boundaries, to assure that communities at lower elevations are not adversely impacted by runoff from communities far upstream.

### Prediction

1. Develop case studies for impacts of natural disasters and climate change on transportation, effects on local economies, and differences and similarities in practice from recent climate change events in various rural community types.
2. Create a climate change overlay for rural community types to establish a convergence of observations.
3. Evaluate climate change threats to transportation in rural areas, where to focus efforts, and examples of early-warning signs of climate change impacts on transportation systems.
4. Identify rural transportation adaptation strategies relevant to various regions.
5. Create a predictive model for where transportation jobs will be needed due to climate change.
6. Modeling, Identification of Risk Assessment and Categorization Impact of Climate Change on Low Volume Road Systems (AFB30).

### Transportation Health and Safety

1. Identify changes in rural roadway loss-of-control crash risks related to increased precipitation, freeze-thaw cycles, and cyclic thermal softening of asphalt pavements.
2. Quantify public health and public safety risks associated with rural highway washouts and structural failures caused by flash floods.
3. Quantify human health and safety impacts, livestock health, and cropland productivity from increased dust on unpaved rural roads due to more intense drought conditions.
4. Identify impacts of hot summers on rural transportation agency and contractor workforce health and safety; develop appropriate interventions and countermeasures.
5. Quantify health and safety trade-offs associated with moving rural roadwork to cooler nighttime hours.
6. Identify lessons learned and recommended practices for relocation of vulnerable transit users (e.g., frail elderly) during disasters.

## Tribal

1. Document best practices for transportation-related weather hazard mitigation and emergency management in tribal communities.