



Exhibit D

Research Project Requirement Template

Assessing Transportation Infrastructure and Community Vulnerability to Increased Flooding Risk in Tribal Lands

Recipient/Grant (Contract) Number: 69A3552348306 (CY1-OU-01)

Center Name: Southern Plains Transportation Center (SPTC)

Research Priority: Improving the Durability and Extending the Life of Transportation

Principal Investigator(s): Yang Hong, Farina King, and Theresa Tsoodle, University of Oklahoma; James LeClair, Otoe Missouri Oklahoma Tribe

Project Partners: University of Oklahoma and Otoe Missouri Oklahoma Tribe

Research Project Funding: University of Oklahoma: 75,000 (Federal), \$75,000 (Match)

Proposed Start and End Date: 10/1/2023 to 10/1/2024

Project Description: The resilience and vulnerability of the nation's transportation and infrastructure to extreme weather under changing climate is in critical need of further research. In particular, the South-Central US (Region 6 including Arkansas, Louisiana, New Mexico, Oklahoma, and Texas) has new challenges each year to combat extreme weather events. Previous building standards, codes, and practices of transportation that were established based on the FEMA 100-year floodplain, without considering the new climatic trends, are outdated and not prepared to meet the emerging natural challenges predicted in the future. Therefore, there is an urgent research need for updating civil infrastructure design criteria for better adaptation and finding sustainable solutions for the future. Flooding, which is a major risk, is projected to increase in frequency and severity. Assessing transportation vulnerability to flooding will enable targeted adaptation efforts. A resilient floodplain map can serve as a basis for city planning. In this study, the research team will develop a future floodplain map that considers climate impact and is forced by the RCP (Representative Concentration Pathway) 8.5 scenario, known as the business-as-usual scenario.

This research will analyze current and future flood risks to transportation infrastructure serving the Otoe-Missouria Oklahoma Tribe (OMT). Specific objectives include the following: (1) Map the current 10/50/100 floodplain within the tribal jurisdiction using hydrologic-hydraulic models; (2) Project future 10/50/100 floodplains under RCP 8.5 scenario, incorporating climate change impacts on precipitation; (3) Identify roadways, bridges, transit routes, and rail lines within current and future floodplains; (4) Assess vulnerability of this transportation infrastructure and map community risks in 10/50/100 flood events; (5) Propose flood mitigation measures including nature-based solutions. This project will lay the groundwork for expanded efforts to detailed climate mitigation and adaptation plans with nature-based solutions. This project also provides opportunities to expand to other Tribal Nations in Region 6. Specifically, the research team will engage the Choctaw Nation and Citizen Potawatomi Nation to showcase the results of this study and propose expansion of the study to these tribal regions.

The proposed study region will include two creek basins located in the OMT. The Greasy Creek basin contains a significant traffic intersection and makes for an ideal candidate to study potential impacts of climate change. The Red Rock Creek basin contains a significant road crossing of US 177 near the OMT community center.



The proposed research will consist of the following five tasks. Task 1: This task involves gathering research data from OMT including socioeconomic profiles, geospatial attributes such as road networks, and preparing hydrologic forcing data for the model setup. Task 2: This task involves floodplain mapping under the current conditions using the state-of-the-science two-dimensional hydrologic-hydraulic model – CREST-iMAP, developed at the HyDROS group, University of Oklahoma. Task 3: This task involves floodplain mapping in a warmer climate utilizing the results of Task 2 and future climate scenarios. Task 4: This task involves vulnerability mapping of transportation infrastructure utilizing the updated floodplain maps developed during the research. Task 5: This task includes impact-based assessments on local OMT communities and engagement of the Choctaw Nation and Citizen Potawatomi Nation for future studies. Workshops and focus groups will be used to validate infrastructure maps and flooding risks.

US DOT Priorities: A future climate-impacted floodplain map that is forced by the RCP (Representative Concentration Pathway) 8.5 scenario, known as the business-as-usual scenario, addresses the primary SPTC goal to address “Climate and Sustainability” and “Safety” from the USDOT Strategic Plan. Reducing the risk of under-designed transportation systems in a warmer climate addresses the secondary goal of “Economic Strength and Global Competitiveness.” Since Indigenous people are often on the front lines of climate change, this project will address environmental/climate injustice and inequality.

Outputs: This research will develop an approach that can be expanded to other regions, and two products that can be used operationally to update design methods for transportation systems. Specific outputs include: (1) Update the current 10/50/100-year floodplain map using the latest high-resolution terrain data and high-quality rainfall data; (2) Generate the future 10/50/100-year floodplain map with consideration of climate change and land use/land cover change impacts; (3) Vulnerability map of critical transportation infrastructure; (4) Integrated risk map of tribal communities by combining hazards, vulnerability, and exposure; and (6) Co-produce an assessment report with stakeholders and communities through workshop and focus group meeting.

Outcomes/Impacts: These maps and actionable data can (1) directly inform tribal adaptation planning and investments; (2) protect access to emergency services, healthcare, education, and jobs during disasters; (3) improve the reliability and safety of transportation networks serving tribal communities; and (4) enable hardening/relocation of highest risk assets. The innovative methodology of updating the 10/50/100-year floodplain map from this work will allow research communities to extend the proposed approach to other regions in the future. This work tangibly demonstrates how research can support environmental justice and build capacity for community-engaged research with Indigenous peoples. Collaborating with the research team’s established partnership with the Otoe-Missouria Oklahoma Tribe (OMT), the project aims to improve the safety and wellness of local and Indigenous communities and their environment while amplifying the voices of those most impacted by flooding. Results (successes/lessons) of this pilot study can be further expanded to other tribes such as the Choctaw Nation of Oklahoma and Citizen Potawatomi Nation in Region 6. The results from this study will be shared with these nations to engage them in future efforts.

Final Research Report: