Data Management Plan for Tier 1 UTC
Environmentally Responsible Transportation Center for Communities of Concern (ERTC^3)

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Background:
The Environmentally Responsible Transportation Center for Communities of Concern (ERTC^3) is a tier-one University Transportation Center (UTC) led by the University of Missouri-Kansas City. Sponsored by the Bipartisan Infrastructure Law, ERTC^3 is one of five UTCs that focus on preserving the environment and is the only UTC to be analyzing the environmental impact of transportation infrastructure on minorities and marginalized identities in the United States.

The consortium consists of the following universities:

- University of Missouri-Kansas City (Lead)
- Washington State University
- University of Louisville
- Tennessee State University (Minority institution)
- Texas State University (Minority Institution)

Overview:
ERTC^3 will perform research to develop innovative approaches that will improve the sustainability, resilience, and equity of transportation infrastructure. This goal will be achieved through research in three main thrust areas. The first thrust area, Environmental Analysis, will focus on measurement and monitoring of transportation related pollution in air, water, and soil. This effort will develop tools and models that will support evidence-based decision-making at transportation agencies regarding the environmental impacts of projects. The second thrust area, Environmental Justice, will focus on the assessment of environmental and health impacts of transportation activities on minority (communities of color, elderly, people with disabilities) and low-income populations, which are called “communities of concern.” The third thrust area, Environmental Mitigation, will focus on the reduction of exposure to transportation related pollution through sustainable and resilient construction materials and practices and innovative technologies. In addition to research activities, through education, workforce development, and technology transfer activities, ERTC^3 will help deployment of the developed mitigation technologies to reduce the disproportionate environmental impact of transportation activities on communities of concern.

This Data Management Plan (DMP) aims to facilitate the best practices of data documentation and promote the sharing of research results and experimental data across the broad spectrum of stakeholders of our center. This DMP additionally serves as the basis for specific Data Management Plans of the projects that ERTC^3 is sponsoring. When those DMPs are being developed or reviewed, language can be borrowed from this DMP for time efficiency and uniformity with this DMP. The individual project DMP’s also must declare the unique and specific aspects of the project under the same headings as this DMP. Principal Investigators (PIs) of projects, in communication with the Center Director

or other Site Directors, will ensure adherence to this DMP and will suggest changes to it if deemed necessary.

All Data Management Plans associated with ERTC^3 are living management tools for information relating to each project, ERTC^3 in general, project partners, and information related to the communities and issues that we are researching. These tools should be updated regularly, particularly when there is a change in key personnel, data, project processes, or research methods.

Projects and Data Description

ERTC^3 is sponsoring multiple different projects using several different data collection methods under the three different thrusts listed in the overview. Many of these projects will either be using existing data collection methods or newly developed patented technologies. Some of the projects will require direct experimentation and data collection from selected physical sites, such as multiple areas in Austin, Texas and Salmon Creek in Washington, and even retrofitting humans with data-gathering technology. In addition to research data, center-wide data will be collected on the center performance indicators, such as number of journal publications, organized webinars, attendance in workforce development activities, and others. Data related to performance indicators will be reported to the USDOT through semi-annual and annual reports and will be available on the ERTC^3 website.

Environmental and transportation engineers, as well as the public, will have access to the project final reports and collected data. Data files will be accompanied with separate files including the related Metadata. Data and metadata are important to modify and build off of this program and to be able to do complementary future research projects. Tests and experiments utilized in these projects should be repeatable, modifiable, and verifiable. Access to collected data and related metadata will also allow more comprehensive analysis to be performed in the future by researchers of ERTC^3 or other researchers.

Current Projects sponsored by ERTC^3 in three trust areas are listed below.

Environmental Analysis Projects:

- Sorption, Leachability, and Transport of AFFF Impacted Concrete Materials.
- Long-term water quality monitoring network to assess downstream efficacy of green Infrastructure.
- Subsurface Contamination Modeling and Remediation Techniques.
- An AI Powered Remote Sensing Framework for Monitoring and Predicting Roadside Water Quality.
- Transport and Mitigation of Tire and Road Wear Microparticles in Stormwater Runoff from Highways.

Environmental Justice Projects:

- Evaluation of Green Infrastructure as a Means to Mitigate Increased Stormwater Volumes in Disadvantaged Communities.
- Biomechanics-Informed Pavement Guidelines for Safe Walking Surfaces.
- Develop an Agent-based Modeling Tool to Promote Electrical Vehicle Deployment and Reduce Lung Cancer Risks.
- Neighborhood Walkability and Cardiometabolic Disease in Central TX.
- Traffic Congestion and Asthma-related Hospital Visits in Central TX.

Environmental Mitigation Projects:

- Remediation of oil products spillage during Transportation.
- Retrofit, Self-Contained, and Smart Solar Ice Control System for Resilient Infrastructure.
- A Sustainable Snow-Free Pavement to Mitigate Negative Effect of Road Salts on Soil and Water Environment.
- In-pavement Charging for Electric Vehicles to Reduce Air Pollution.
- Nanotechnology-enabled sustainable and cement-free pervious concrete pavement.
- Developing Sustainable Waste Plastics Asphalt Roadway Construction.
- Evaluation of Bio-Inspired Water Treatment Plant Sludge Materials Through Mycelium.

Data Standards and Formats

ERTC^3 requires PIs to use open access file formats, such as PDF, whenever possible instead of proprietary formats. PIs will be responsible for converting all data collected during the performance of research projects to a digital format and for its storage. At least two copies of digital data will be stored on local and network storage platforms, such as box, one drive, google drive, and others. ERTC^3 site directors will ensure compliance with the DMP requirements at each site and will share the requested data with UMKC center director and program manager to be made publicly available on the center website and other public access data repositories. During the submission of their data files, PIs will generate the metadata required to retrieve, use, or manage the stored data files in public access data repositories such as information on the author, date of submission, description, format, and others. As further detailed in the Data Preservation and Archiving section of this DMP, this center will utilize a public data repository that uses DSpace software. The Dublin Core Metadata Registry (DC) schema will be used for Metadata which is the default schema used by DSpace software.

Reports will be archived in PDF form while data is expected to be mostly archived in CSV format. Additionally, raw data may be collected and archived in any of the commonly used formats including but not limited to;

- Microsoft Office, including Word, Excel, Access, etc.
- MATLAB
- ARCGis
- SPSS
- SQLDatabase
- ASCII
- TIFF
- OIB
- Mathematica
- C and C++
- PDF
- ANSYS
- ORIGIN

Data Access and Protecting Sensitive Data

Data collected during the research activities will be stored at the end of the research projects at publicly accessible repositories and summary analysis of data will be available through the ERTC^3 public website

for research projects in progress. The project investigators are responsible for collecting the data and ensuring the validity of the data through their own means depending on the utilized data collection methods. Project Investigators will also be responsible for deidentification of any unusable information, such as personal data, following their institutional research board (IRB) guidelines before making the data publicly available.

All Intellectual Property developed including inventions, patents, mask works, software, processes, methods, or all other legally protectable information, will be owned by the consortium members of ERTC^3 that created it.
Further, researchers are reminded:

1. That by accepting US DOT funding through this grant, researchers have granted to US DOT a comprehensive non-exclusive, paid-up, royalty-free copyright license for all research outputs (publications, datasets, software, code, etc.). This includes all rights under copyright, including, but not limited to the rights to copy, distribute, prepare derivative works, and the right to display and/or perform a work in public; and,
2. In accordance with Chapter 18 of Title 35 of the United States Code, also known as the Bayh-Dole Act, where ERTC^3 elects to retain title to any invention developed under this UTC grant, US DOT retains a statutory nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any such invention throughout the world.

The performance metrics data of the UTC, as well as the website, will primarily be managed by UMKC's ERTC^3 Project Manager Tate Berry. He will analyze the data and its validity using the guidelines outlined in the Grant Deliverables and Reporting Requirements document. The data that is not to be publicly accessed will fall under any of the following categories:

- The data could reveal private information about any of the project participants or members of the communities we are analyzing.
- The data is overly disputable.
- The data can compromise educational opportunities for Universities or Communities.
- The data was requested to be kept confidential by the US Department of Transportation.

Data Sharing, Reuse, and Redistribution
The rights to manage and transfer the data are solely at the discretion of ERTC^3 personnel, and will be reused, redistributed, and shared as necessary. Center staff will make good-faith efforts to provide requested data after careful review but do not guarantee that they are without any errors. ERTC^3 shall not be liable for any damage that may result from errors in the data. The researchers and digital file authors retain copyright to the data and will extend creative commons licenses as seen fit. However, all information on the website is free to the public to use, source, and cite. *The USDOT also reserves a royalty-free, nonexclusive, and irrevocable license to reproduce, publish, or otherwise use and to authorize others to use the work for government purposes.*

Data Preservation and Archiving
In addition to summary analysis and data published on the ERTC^3 website, all research data and related metadata will be made available on the publicly accessible repository, MOSpace (https://mospace.umsystem.edu/xmlui/handle/10355/96721) . The MOSpace Institutional Repository is an online repository for creative and scholarly works and other resources created by faculty, students, and staff at the University of Missouri--Columbia and the University of Missouri--Kansas City. MOspace

makes these resources freely available on the web and assures their preservation for the future. Submissions to MOSpace are permanent and MOSpace items have persistent URLs. These URLs are considered persistent, because they are registered with the Handle System, a comprehensive system for assigning, managing, and resolving persistent identifiers. The use of handles means that, unlike most URLs, this identifier will not have to be changed when the system migrates to new hardware, or when changes are made to the system. Public will be able to access all research data and metadata through a specially created ERTC^3 collection under this repository. Information on awarded and continuing research projects will be uploaded to the Transportation Research Board's Research in Progress (TRB RiP) database with a link to the project information on the ERTC^3 website. Once the projects are over, final reports and data sets will be uploaded to MOSpace and linked to other repositories for access, such as

- Transportation Research International Documentation (TRID).
- National Transportation Library Digital Repository (ROSAP).
- US Department of Transportation Research Hub.

ERTC^3 researchers may request their final reports and data sets not to be made publicly available for a period of time if they are the subject of ongoing analysis for publication or patent applications. This period is limited to 2 years maximum after the completion of the projects. Additionally, any research inventions and patents will be submitted to iEdison by the respective sponsored research offices of the consortium member universities. The project investigators are responsible for managing the data of their assigned projects and for submitting them to the program manager at UMKC. The UMKC Program Manager and the Center Director will manage the content of the ERTC^3 website, and the program manager will be responsible for submission of all the necessary information to the listed repositories.

The UMKC Program Manager can encrypt files onto UMKC Box for disaster recovery and will protect the data along the guidelines required of employees by UMKC's IT department. Should the data be attacked, corrupted, or deleted; having multiple copies of the project data already being developed will allow for an efficient recovery.

Changelog
2023-10-17: Original draft
2023-11-17: Second draft revised based on OST comments