MONTANA STATE UNIVERSITY
Western Transportation Institute

Student Employment Opportunity

POSITION TITLE:	GIS Analytical Assistant (undergraduate or graduate)
SALARY:	$15 - $20/hour depending on experience.
HOURS:	Between 5-15 hours per week, available starting immediately. Relatively flexible hours and remote work opportunities available. Employment Timeline: May – October 2022

JOB DESCRIPTION & TASKS:	The National Park Service has contracted MSU's Western Transportation Institute (WTI) to assess the condition of trails in National Parks using electric bikes outfitted with camera and sensor systems. The work will be focused in the Washington, DC area, and applicants living in the area are preferred. WTI is seeking an upper classman or other qualified student with proven skill in GIS and data management to assist the Project Team in organizing, analyzing and presenting geolocated data (including photo/video, audio, accelerometer and GPS data). The assistant will also have the opportunity to join the project team for data collection in the field. The analytical assistant will benefit from dynamic experience and connections with National Park Service and industry professionals and will be credited in the final report.

REQUIRED QUALIFICATIONS:	1. GIS and data management skills and experience. 2. Ability to clearly communicate information through maps and data visualizations. 3. Ability to work independently, but able to know when to ask for help and guidance. 4. Must be currently enrolled at a college or university

APPLICATION PROCEDURE:	Email your resume to: rebecca.gleason1@montana.edu
APPLICATION DEADLINE:	5/31/2022
CONTACT:	**Rebecca Gleason** Western Transportation Institute (WTI) Montana State University - Bozeman PO Box 174250 Bozeman, MT 59717-4250 Email (Preferred): rebecca.gleason1@montana.edu

Trailblazer Research Project

Trail Condition Assessment Study

Project Purpose

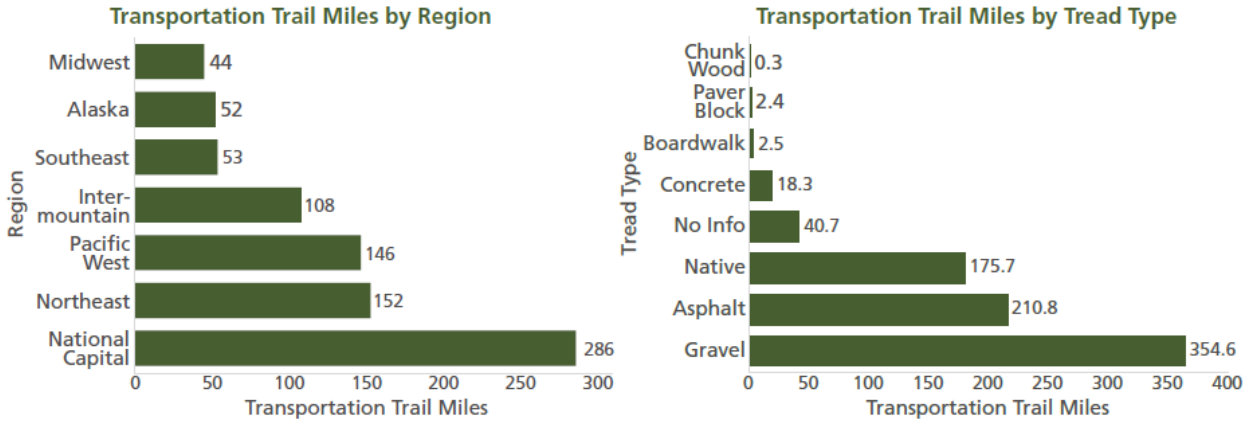
The purpose of this research is to utilize eBikes to efficiently and cost-effectively collect trail condition data for analysis, to produce a detailed and replicable trail condition assessments methodology for multi-use trails, and to inform National Park Service (NPS) asset-specific management decisions.

Project Background

Transportation Trails

The NPS recognizes the critical importance of transportation trails in the broader NPS transportation network, and indeed with connecting trails outside NPS boundaries. Transportation trails provide park access alternatives to driving, facilitate connectivity between parks and surrounding communities, and in some cases provide critical commuter services. The National Park Service's definition of a transportation trail is as follows: *Accommodates pedestrians and/or bicycles and connects to a larger transportation system including land and water-based transit and/or regional trail systems or direct connections to a community. A transportation trail provides functional access to a destination via non-motorized modes, AND provides an alternative to motorized transportation, enabling people to switch from motorized to non-motorized modes.*

As such, trails that meet the definition of a transportation trail need to be managed at a different standard for performance and maintenance than other recreational trails. In order to effectively manage and maintain these trails, the NPS and Volpe are completing a national inventory of NPS-managed transportation trails and preparing a document that outlines the wide array of trail condition assessment strategies employed by Federal Land Management Agencies (FLMAs) and other public entities. One of the main trail condition assessment methods outlined in the document is the 'parametric' system that the NPS currently employs.



The above chart details the transportation trail mileage by NPS region and the tread type of transportation trails.

Parametric Condition Assessments

A parametric condition assessment is a rapid survey for developing portfolio-level estimates of deferred maintenance costs. The basic premise of the parametric approach is to use mathematical models to predict cost estimates using a small number of simple inputs that are easy to obtain. This process is conducted using the Parametric Scoring Tool. The Parametric Scoring Tool asks the user to assign a separate score for the condition of each constituent system comprising the overall asset. Within the models, each of the systems comprises an assumed percentage of the total current replacement value (CRV) for the asset. Constituent systems for trails include:

• Plants, Vegetation and Trees –Any vegetation along a trail that must be cleared to maintain the trail corridor or construct the trail.

• Surface, Base and Subbase–Native or imported material that makes up the trail tread and supporting structure. Includes native material, gravel, pavement, and boardwalks.

• Structures–All constructed features of the trail used in the preservation of the prism or trail, associated facilities, including walls, water bars, steps, causeways, and other structures integral to the trail.

• Site Features –Features that are not integral to the trail but support its appearance and use, including signs, railings, fences, benches, tables, and other similar structures.

Parametric Condition Scoring Scale

Color Scale	Scoring Scale	Meaning	General Condition of the System
Green	9 – Very Good	Minimal normal routine maintenance is required. System functions as intended.	NPS manages routine maintenance, resulting in minimal negative impact on visitor experience.
	8 – Good		
	7 – Significantly Above Average		
Yellow	6 – Above Average	Minor and some infrequent larger repairs may be required. System functions as intended.	NPS manages recurring maintenance, resulting in moderate impact to visitor experience.
	5 – Average		
	4 – Below Average		
Red	3 – Significantly Below Average	Some significant repairs are required. System is often unable to function as intended. Wear and tear are visible.	May result in unsafe or uncomfortable conditions for visitors.
	2 – Poor		
	1 – Very Poor		
N/A	0 – Non-existent	System does not exist in facility.	N/A

Source: (NPS Park Planning, Parametric Scoring Inspection Guide 2020)

As of 2020, NPS will use this new method for all trails and many other asset types on a regular basis. The parametric approach will be the standard NPS method for estimating maintenance needs for many asset types, including trails. However, transportation trails (or a subset of transportation trails) may warrant a different type of assessment, in addition to parametric. **This research compliments the standard parametric approach with a more detailed, data-driven assessment and analysis of the condition of NPS Transportation Trails and other multi-use trials.**

Data Collection

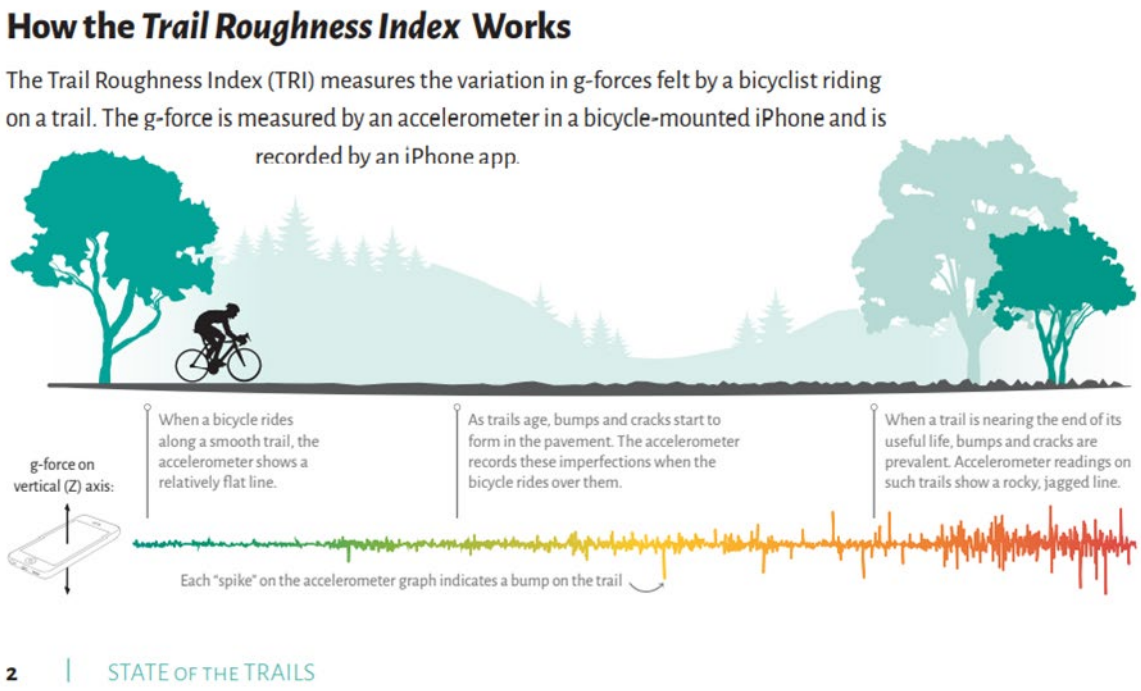
The project team will deploy two eBikes, each outfitted with a high-resolution 360 camera system, a GPS, and an accelerometer, that will collect data of the trail's condition and features as the bikes ride the length of the trail. The data collected by the sensor systems will be streamed in real time to a digital tablet interface mounted on the handlebars.

The riders will record geo-located annotations along the course of the trail using the digital tablet. These annotations will assist in the subsequent review and analysis of the data collected and inform the final GIS and analysis deliverables.

Data Analysis and Project Deliverables

This project will deliver objective condition data of the surveyed trail that will subsequently be reviewed using a roughness-index methodology driven by accelerometer data, as well as simplified versions of the FHWA Road Inventory Program's manual rating method and the NPS' Parametric scoring tool in some cases, depending on the specific Park or Partner.

An example of an accelerometer-based roughness-index, developed by the Parks and Trails Council of Minnesota is featured below:



The geolocated accelerometer and photo/video data collected will be synthesized into a GIS map that demonstrates the condition of the trail from a bike rider's perspective and reveal precise locations of disrepair, which can enable asset managers to consider the condition of the entire trail more wholistically, and prioritize areas most in need or attention.

Funding

This project was funded through the USDOT FHWA Innovation Research Council and awarded to the National Parks Service in fiscal year 2021. The National Park Service has contracted the Western Transportation Institute (WTI) out of Montana State University to facilitate the project in conjunction with the NPS.

Contact

Project Team

Pat McMahon – Project Lead – pmcmahon@nps.gov

Rebecca Gleason – Project Manager – rebecca.gleason1@montana.edu

Joni Gallegos – Project Supervisor – Joni_Gallegos@nps.gov