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Introduction

Central Iowa is home to more than 600 miles of shared use trails connecting urban centers with natural rural landscapes that showcase the beauty of the heart of Iowa. Trails in central Iowa continue to be an important quality of life aspect for thousands of residents every year by providing recreational opportunities accessible to all ages. More recently, the trails have been leveraged as a tool to generate additional tourism through events like the BaCoon Ride along the Racoon River Valley Trail.

This extensive trail system continues to grow and evolve as missing links in the trail system are constructed by local communities, county conservation boards, or collaborations between local partners. Each year the Des Moines Area MPO (MPO) provides trail projects with funding through state and federal programs to fill gaps within the trail system. As more Iowans embrace bicycling for both recreation and daily transportation, the trail system will continue to see use throughout the year.

While the network of trails expands, the existing trail network is starting to mature and soon spending priorities will require a greater focus on the maintenance of existing trails. Currently, when trail maintenance is required, local governments utilize field investigations to determine the condition of trail segments they plan to maintain. The field investigation process can be time-consuming and sometimes difficult as not all trail segments are readily accessible by road. Communities need a systematic approach of tracking the pavement condition of their trails so they can plan and program funds for future maintenance accordingly.

Connection to Mobilizing Tomorrow

The MPO’s long range transportation plan for the Greater Des Moines Area called Mobilizing Tomorrow, provides the goals for the transportation network to the year 2050. Goal 1 of Mobilizing Tomorrow is to “manage and optimize the transportation infrastructure and services” within the region. As the region’s infrastructure continues to age, priority should shift towards managing the existing before investment in new.
Currently, the MPO utilizes pavement condition data collected for the entire street network to provide a regional review of the investment necessary to maintain the current condition of the roadway network. However, no such comprehensive database exists for the extensive trail network within the region. The MPO similarly seeks to support long-range planning of trail maintenance by providing data to make performance-based decisions on prioritizing trail maintenance.

The Central Iowa Trail Condition project was created in 2017 to fill this information gap within the central Iowa trail system. It intends to:

- Develop a bike-based data collection vehicle to improve the efficiency of collecting data on the extensive trail network.
- Create an inventory of condition data for all paved trails within central Iowa, with a focus on trail roughness and geo-located photos of trail surfaces.
- Provide data to local agencies, consultants, and the public to inform a long-term maintenance strategy for the central Iowa trail network.
- Make the project replicable and promote the project to expand knowledge regarding approaches to collect trail condition data.
- Make high quality imagery available to trail users and tourists.

Central Iowa Trails

The beginning of the central Iowa trails network started with the Bill Riley Trail, now known as the Neal Smith Trail. Since the late 1970’s, local community leaders and organizations have pushed for trails within and connecting their communities. This leadership is still seen today as a majority of trails are managed by local agencies rather than state agencies.

In 2004, the Central Iowa Bicycle-Pedestrian Roundtable was formed to further develop bicycle and pedestrian facilities in central Iowa. The Roundtable encompasses the planning areas of the MPO, the Ames Area MPO, and the Central Iowa Regional Transportation Planning Alliance (CIRTPA). The mission of the Roundtable is “to facilitate the development, maintenance, and promotion of a world-class commuter and recreational trail system in central Iowa.”
The Roundtable assisted MPO staff in creating the plan, *CONNECT: Central Iowa Bicycle and Pedestrian Transportation Action Plan 2020*. This plan includes projects, programs, and policies on bicycle and pedestrian transportation in upcoming years. Additionally, it includes the breakdown of four Trail Level of Significance classifications. In 2019, only Level 1 and 2 trail data was collected, in addition to a few Downtown Des Moines on street facilities. With the upcoming update of the *CONNECT Plan*, future Data Bike reports should become consistent with the new State classification system. The current four Trail Level of Significance classifications are as follows:

**Level 1: State Significance**

Must first meet all of the criteria described in Level 2. Must span two or more counties and be recognized by the State of Iowa/Iowa Department of Transportation as a Level 1 Trail. A decisive knowledge of the trail boundaries must exist. Alternatively, must receive approval by the Central Iowa Bicycle-Pedestrian Roundtable.

**Level 2: Regional Significance**

Must first meet all of the criteria described in Level 3. Must exist in two or more city or county jurisdictions. Must connect places, streets or trails of significance to the central Iowa region. Alternatively, must receive approval by the Central Iowa Bicycle-Pedestrian Roundtable.

**Level 3: Jurisdiction Significance**

Must first meet all of the criteria described in Level 4. Must be a minimum of 8 feet in width. Must connect places, streets, or trails of jurisdictional significance. Alternatively, must receive approval by the Central Iowa Bicycle-Pedestrian Roundtable.

**Level 4: Local/Neighborhood Significance**

Must meet the minimum criteria to be designated as a Shared-Use Path, Bicycle Lane, or Bicycle Route, as specified in the Manual on Unified Traffic Control Devices.

Today, Iowans and visitors continue to enjoy trails and what they provide for communities. The demand for trails and better connectivity between individual trails persists. As the Central Iowa trail system continues to grow, it will be important to create a reliable procedure to conduct condition assessments in order to maintain a high quality network and locate gaps in the network.
Iowa Data Bike

A primary objective of this project has been to develop a bike-based data collection vehicle to improve the efficiency of collecting data on the extensive trail network.

Using an electric-assist bicycle, an iPhone, an app designed to detect pavement roughness, and a pair of cameras, the MPO created a tool to efficiently collect data to evaluate trail condition. The Data Bike is able to provide a consistent speed for data collection regardless of terrain as the electric-assist bicycle provided the rider additional power while pedaling.

The Data Bike uses three main components to collect data:

1. The rRuf app on the iPhone collected accelerometer data to measure the roughness of trail pavement.
2. A GoPro camera mounted on the rear of the bike provided geo-located photos of the trails.
3. A Samsung Gear 360 mounted above the riders head provided imagery used for Google Street View.
Data Collection Process
The Data Bike is ridden on Des Moines Area trails to collect roughness and pavement data. In the past, MPO staff has been responsible to collection and processing of all data.

The MPO incorporated a public component into the data collection process this year by utilizing community volunteers. The intent was twofold; to educate and engage the public into this important project and to also understand how to improve the process and methodology in the future. In order to solicit a group of volunteers, the MPO utilized the Greater Des Moines’s Street Collective’s volunteer network. MPO Staff worked closely with the selected volunteers according to their skill levels to help them understand the Data Bike components as well as the data collection process. The volunteers rode over 80 miles of trails on the databike assisting the MPO with collecting trail condition information.

State of the Trails
During the summer and fall of 2019, the Data Bike collected approximately 112 miles of roughness data, including Downtown Des Moines on-street bike facilities. Most trails are either level 1 or 2 facilities. Additionally, over 31,400 photos of the trail surface, and more than 1,400 photos for Google Street View were also collected.

The data collected to date provides evidence that the regional trail network in Central Iowa is in good condition with 95 percent of trail miles in smooth or very smooth condition. While these trails may have intermittent cracking, maintenance has been completed to keep trail users on a smooth surface.

The photos collected on the trails provide a snapshot of the experience available to users. As previously stated, the trails provide a link between the urban cityscapes and the rolling rural landscapes. Trailheads in towns throughout the region highlight the investment in amenities that make central Iowa a cycling destination.

It should be noted that trail segments traverse through multiple jurisdictions and the responsibility of maintenance may lie with a separate entity.

Trail Roughness
The accelerometer data collected by the Data Bike indicated significant changes in the smoothness of the trail segment. Using the accelerometer data, the trails can be categorized into five roughness categories. The photos on the following page illustrate roughness conditions for each of the five levels. Some pavement materials, such as, brick, gravel, or wood, are recorded as rough due to the nature of the material and their method of placement on the trail.

For Example, Bridges with wooden planks, laid brick paths, or gravel trail heads may be recorded as rough.

The rRuf app scores the condition of trails by using the iPhone’s accelerometers and gyros to produce a segmented Class 3 response based roughness condition rating. It includes an automated intelligent map matching algorithm that connects collected data to the appropriate trail segment. Through the RUBIX dashboard, the trail network can be monitored to ensure coverage and filling of gaps as needed. This specialized app is also able to produce averages and other statistics if data on sections of trails are collected multiple times.
Very Smooth
Very smooth trails have nearly no cracking or vegetation growing on the trail. Variations in smoothness can be caused at seams between concrete or other material spread across trail.

Smooth
Smooth trails are typically in good condition, but are beginning to show signs of cracking. Cracking on smooth trails generally does not create discomfort for the rider.

Fair
Fair trails are beginning to show increased wear and typically have more cracking. Cracking on trails in fair condition can cause minor discomfort for riders.

Rough
Trails in rough condition are showing advanced cracking with vegetation growing through the surface. These cracks are typically wider and deeper than cracks along fair conditioned trails and can cause discomfort for riders.

Very Rough
Very rough condition trails have cracking similar to trails in rough condition, but also have vertical displacement of the trail surface. Very rough conditions on trails may be avoided by riders, but if traversed can cause discomfort.
2019 Trail Condition

- Bill Riley Trail (2.2 miles)
- Chichaqua Valley Trail (13.0 miles)
- Clive Greenbelt Trail (5.2 miles)
- Des Moines Downtown Bike Lanes (5.2 miles)
- Gay Lea Wilson Trail (14.4 miles)
- Great Western Trail (9.2 miles)
- High Trestle Trail (12.4 miles)
- John Pat Dorian Trail (1.5 miles)
- Jordan Creek Trail (10.7 miles)
- Meredith Trail (2.8 miles)
- Neal Smith Trail (5.6 miles)
- Principal River Walk (2.0 miles)
- Raccoon River Valley Trail (11.1 miles)
- Summerset Trail (11.0 miles)
- Walnut Creek Trail (7.1 miles)

Legend:
- Very Smooth
- Smooth
- Fair
- Rough
- Very Rough

Note: Based on percent of mileage collected in 2019
Key Findings

• Of the Level 1 and 2 trail segments collected in 2019, 95% are in good condition with smooth or very smooth surface conditions.

• Of the trail segments collected in 2019, only 2% are in rough or very rough conditions.

• Of the Des Moines Downtown trails and bike lanes, only 3% are in rough condition or very rough conditions.
BILL RILLEY TRAIL

Miles: 2.20
Location: Des Moines
Primary Surface Type: Asphalt

1. Smooth
2. Very Smooth
3. Very Smooth
4. Fair
5. Very Rough
6. Smooth

61% Very Smooth, 23% Smooth, 5% Fair, 0% Rough, 11% Very Rough
CHICHAQUA VALLEY TRAIL

Miles: 13.00
Location: Bondurant, Polk County and Jasper County
Primary Surface Type: Asphalt, Concrete

54% Very Smooth
44% Smooth
0% Fair
1% Rough
1% Very Rough

1. Very Smooth
2. Very Smooth
3. Smooth
4. Very Smooth
5. Very Rough
6. Rough
CLIVE GREENBELT TRAIL

Miles: 5.20
Location: Clive
Primary Surface Type: Asphalt, Concrete

1. Rough
2. Very smooth
3. Fair
4. Fair
5. Smooth
6. Fair

45% Very Smooth
47% Smooth
6% Fair
2% Rough
0% Very Rough
DES MOINES DOWNTOWN BIKE LANES

Miles: 5.20
Location: Des Moines
Primary Surface Type: Asphalt, Concrete

1. Very Smooth
2. Fair
3. Fair
4. Fair
5. Smooth
6. Very Smooth
Miles: 14.40
Location: Altoona, Pleasant Hill, Des Moines, Polk County
Primary Surface Type: Asphalt

Gay Lea Wilson Trail

46% Very Smooth
53% Smooth
2% Fair
0% Rough
0% Very Rough

1. Smooth
2. Very Rough
3. Fair
4. Very Smooth
GREAT WESTERN TRAIL

Miles: 9.20
Location: Des Moines, Cumming, Polk County and Warren County
Primary Surface Type: Asphalt

1. Very Smooth
2. Fair
3. Fair
4. Smooth

48% Very Smooth
49% Smooth
3% Fair
0% Rough
0% Very Rough
HIGH TRESTLE TRAIL

Miles: 12.40
Location: Ankeny, Polk County and Story County
Primary Surface Type: Asphalt, Concrete

89% Very Smooth
10% Smooth
0% Fair
1% Rough
0% Very Rough
JOHN PAT DORIAN TRAIL

Miles: 1.50
Location: Des Moines
Primary Surface Type: Asphalt

1. Smooth
2. Fair
3. Smooth
4. Very Smooth
JORDAN CREEK TRAIL

Miles: 10.70
Location: Des Moines, West Des Moines
Primary Surface Type: Asphalt, Concrete

28% Very Smooth
67% Smooth
5% Fair
0% Rough
0% Very Rough

1. Very Smooth
2. Fair
3. Fair
4. Fair
5. Fair
6. Smooth
MEREDITH TRAIL

Miles: 2.80
Location: Des Moines
Primary Surface Type: Asphalt

1. Smooth
2. Smooth
3. Very Smooth

4. Very Smooth
5. Fair
6. Smooth

83% Very Smooth 14% Smooth 3% Fair 0% Rough 0% Very Rough
NEAL SMITH TRAIL

Miles: 5.60
Location: Des Moines, Polk County
Primary Surface Type: Asphalt, Concrete

32% Very Smooth
49% Smooth
16% Fair
2% Rough
2% Very Rough
Principal River Walk

Miles: 2.00
Location: Des Moines
Primary Surface Type: Asphalt, Concrete, Brick

1. Very Rough
2. Fair
3. Very Rough
4. Fair

23% Very Smooth 61% Smooth 4% Fair 5% Rough 6% Very Rough
RACCOON RIVER VALLEY TRAIL

Miles: 11.10
Location: Waukee, Clive, Polk County and Dallas County
Primary Surface Type: Asphalt, Concrete

1. Smooth
2. Very Smooth
3. Fair
4. Very Rough
5. Smooth
6. Smooth

68% Very Smooth  29% Smooth  1% Fair  1% Rough  1% Very Rough
SUMMERSET TRAIL

Miles: 11.00
Location: Carlisle, Indianola, Warren County
Primary Surface Type: Asphalt

25% Very Smooth
73% Smooth
1% Fair
1% Rough
0% Very Rough

1. Very Smooth
2. Smooth
3. Rough
4. Fair
WALNUT CREEK TRAIL

Miles: 7.10
Location: Windsor heights, Urbandale, Des Moines, Polk County
Primary Surface Type: Asphalt, Concrete

1. Fair
2. Fair
3. Smooth
4. Very Smooth
Meet the 2019 Databike Volunteer

According to the MPO’s Public Participation Plan, there is "...a process that provides citizens, stakeholder groups, and other interested parties to be involved in the transportation planning process." This participation typically comes in the form of public review and comment on the MPO’s publications. However, the MPO recognized that the Data Bike initiative provided a more engaging public participation opportunity: riding the Data Bike! The MPO worked with the Greater Des Moines Street Collective to gather a team of Data Bike volunteers through social media outreach. Many Iowans utilize the trails network for recreation and commuting, so there was no shortage of enthusiastic volunteers to help with the Data Bike this year.

Five volunteers participated, collecting 86 of the 112 total miles of trails included in this report. An overview of the project and equipment setup demonstration took place at the MPO office to prepare each Data Bike volunteer before they rode their respective trails. Many volunteers were somewhat familiar with e-bikes, but the Data Bike warranted specific instruction because it is nearly 7.0’ long and required the management of the rRuf app, GoPro camera, and Samsung Gear 360 camera while riding. No volunteer had used an app to collect georeferenced photos or pavement conditions data prior to this experience. Photos captured during the trail rides are available on Google Street View, and the pavement roughness is included in this report to better inform local governments, communities, and individuals of the existing conditions and necessary maintenance of the Central Iowa trails network.

Distributing the time-consuming work of collecting trails data between MPO staff and volunteers served an educational purpose for both parties: the Data Bike volunteers gained planning knowledge from the perspective of a data collector rather than a public commenter, and the MPO gained useful feedback about how to improve the initiative for future trials. Because this experience was so successful and rewarding for both the MPO and the volunteers, it is likely that the next run of the Data Bike will request volunteer riders again.

"I was inspired to be a Data Bike volunteer because of my love of cycling, Central Iowa, and our trail system. It was an easy and fun way for me to help with future planning of our region’s infrastructure to make it a more bike-friendly area."
- Sonya Staudt, volunteer
Volunteer Statements

“I came across a post on Facebook looking for data bike volunteers, and knew right away I’d want to give it a try. I'm interested in random technology, and hadn’t ridden an eBike up to that point. My favorite part of riding the data bike was the interest shown from other riders. I met a group of people who were riding back north on the Great Western Trail, returning from a weekend spent at Hinterland music festival. The camera’s monopod latch wasn’t working, so it was difficult to keep the camera extended fully. My favorite trail to ride is the Chichaqua Valley Trail.”
- Ben Bjork, Great Western Trail volunteer

“My favorite part of being a Data Bike volunteer was getting to try the electric bike and also explore a new trail that I had not had the chance to ride on prior to that day. I also enjoyed learning more from the MPO employees about the process and data retrieval and analysis. The only challenge I had when riding the Data Bike was one of the applications kept shutting down ...”. I have two favorite trails that I like to ride on in Iowa. If I want a quick ride, or more social ride, I head to the High Trestle Trail. If I want a beautiful, scenic, peaceful, reflective ride, I head out on the Chichaqua Valley Trail.”
- Sonya Staudt, Summerset Trail and Chichaqua Valley Trail volunteer

“A year prior I weighed 300 pounds. Many small changes and a growing circle of friends led me to successfully lose weight and gain a life worth living. I began to enjoy being active, especially biking. I rode over 500 miles on a local trail and rode RAGBRAI for the first time, completing the century loop and pedaling a bike and gear that weighed 80lbs. That experience sparked my joy to bike more. Doors opened and friends ushered unique opportunities my way. I was able to jockey a pedicab, take local nursing home residents on rides and participate in the data bike. I love my SWAG and wear it proudly. It was enjoyable to experience unfamiliar trails, riding a motorized bike was NEW to me. The data bike data brings value to the trail system. The technology is fascinating! The hardest part is maintaining a slow enough speed to gather data. Finishing the route early did provide some time for joy riding. I rode two trails, on both I enjoyed exploring unknown territory to me. I look forward to getting to go back on these trails again in the spring.”
- Kristine Jimenez, High Trestle Trail and Clive Greenbelt Trail volunteer
Google Street View Trails Photos

A series of 360° photos along all Central Iowa trails in the MPO region are available on Google Street View. These panoramas are useful for assessing various characteristics along the trails, such as the frequency of intersections, restrooms, signage, drinking fountains, bike racks, seating (benches, picnic tables), trash bins, bike repair stations, canopy cover and vegetation.

Volunteers collected data for seven out of the fourteen total trails updated in this report. Their photos add to the existing collection of trails photos from the Data Bike’s first run in 2017, all of which are available to view online. Drop the Street View icon onto any Central Iowa trail on Google Maps to explore these photos and see how much the trails conditions have changed.