

How bike safety infrastructure opens the city

Access to opportunity by bicycle in low-stress versus
high-stress road networks

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15 Nov 2023



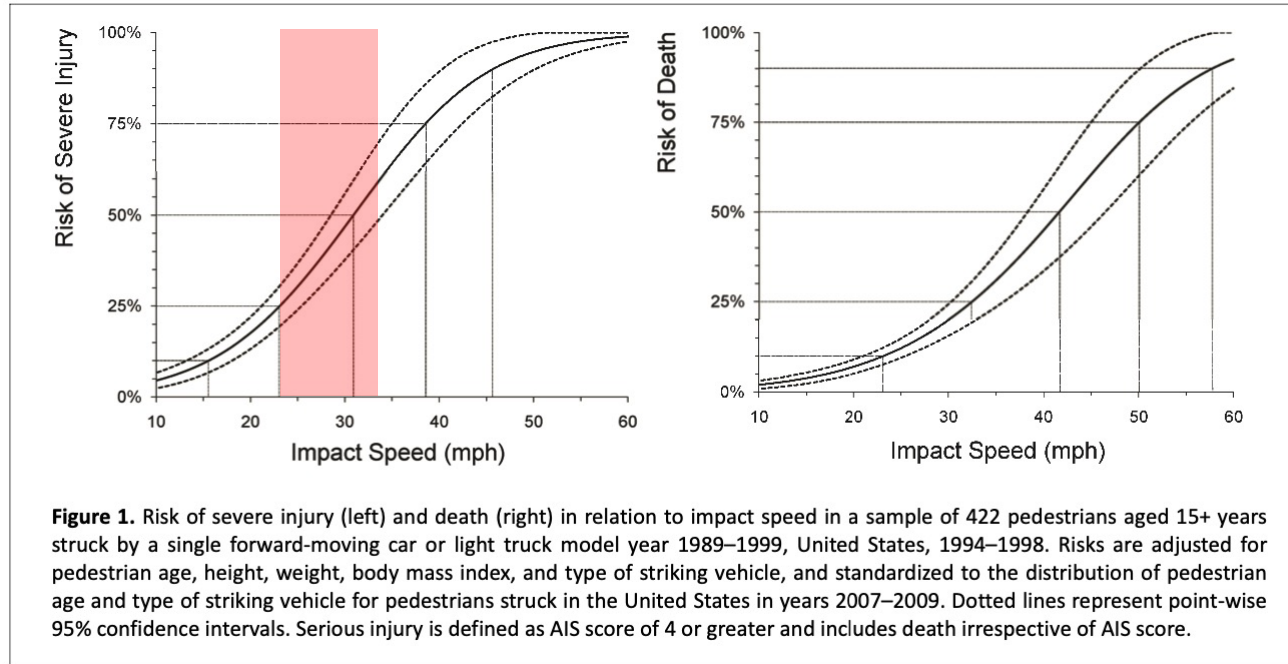
Talk Outline



- Safety motivation
- Levels of Traffic Stress (LTS)
- Access to Opportunity framework
- Example results
 - **Rochester, MN**
 - Duluth, MN
 - Minneapolis-St. Paul, MN
- Prioritizing safety infrastructure



Motivation: separation is safety



*AAA Foundation for
Traffic Safety 2011*

Motivation: separation is safety

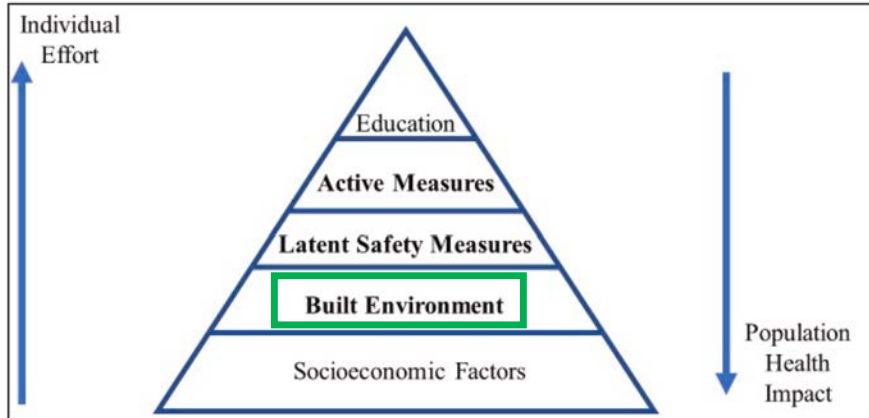


Fig. 3. The Safe Systems Pyramid.

Ederer et al. 2023. The Safe Systems Pyramid: A new framework for traffic safety

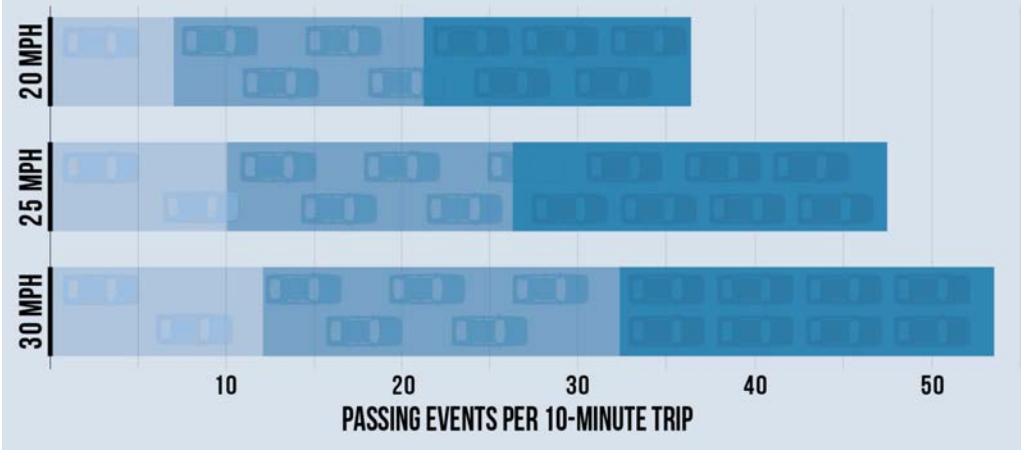
- **Engineering** impacts *all users*
- requires less individual effort
- has higher population impact
- requires infrastructure change

Motivation: separation is safety



Conflicts Increase with Speed & Volume

This chart illustrates the number of passing events (at increasing motor vehicle average speed and volume) experienced over a 10-minute period by a bicyclist riding 10 mph. As motor vehicle speed and volume increase, they magnify the frequency of stressful events for people bicycling.



“Motor vehicle speeds 30 mph or greater reduce safety for all street users and are generally not appropriate in places with human activity.”

- [NACTO Urban Bikeway Design Guide](#)

Level of traffic stress (LTS)



INCREASING LEVEL OF COMFORT, SAFETY, AND INTEREST IN BICYCLING FOR TRANSPORTATION

LTS 4

No bike lane on a busy street



LTS 3

Narrow bike lane or shoulder on a busy street



LTS 2

Buffered bike lane on a calm street



LTS 1

Separated bike lane



Graphics: Alta Planning and Design



Level of Traffic Stress (LTS) engineering



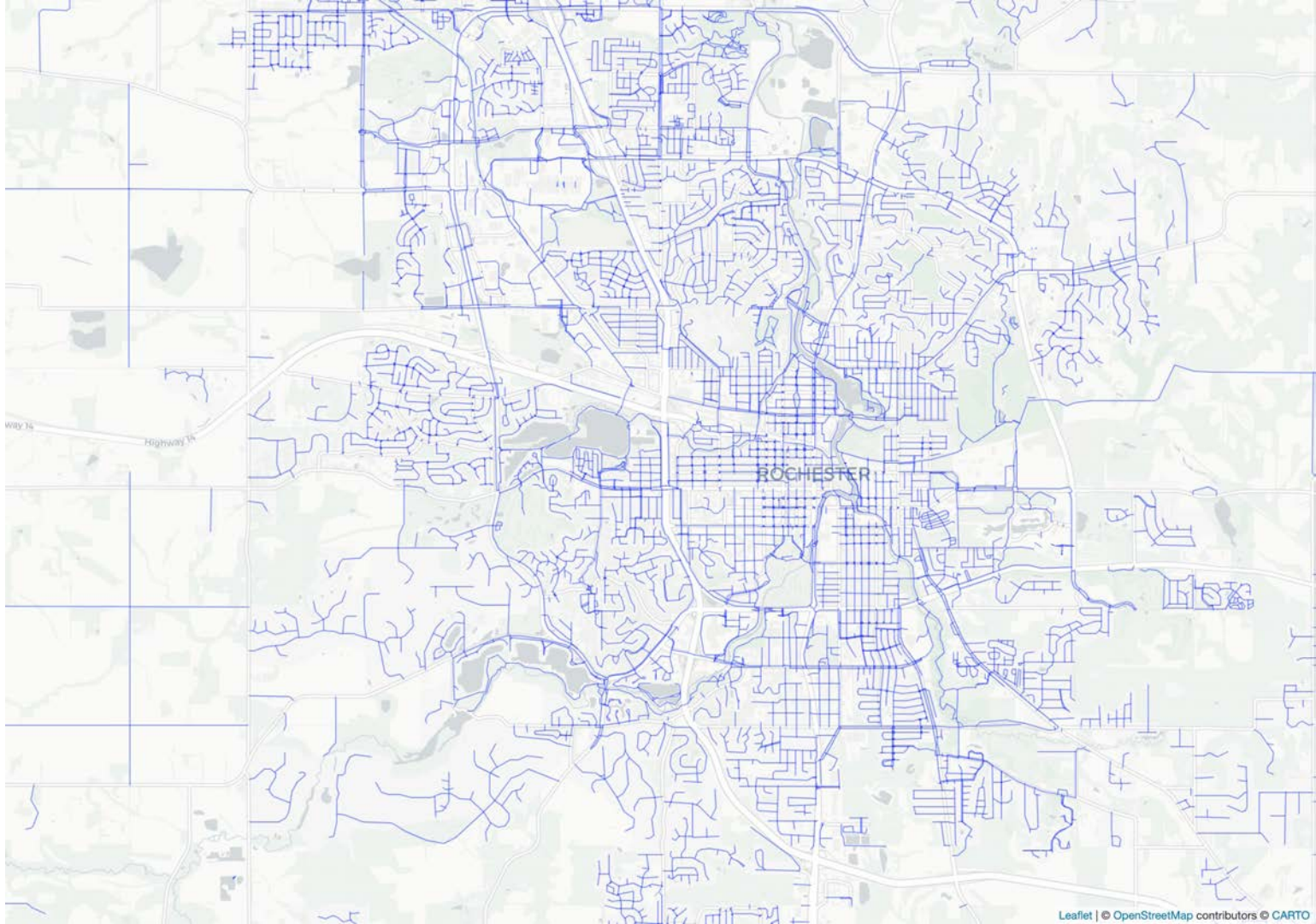
Contextual Guidance for Selecting All Ages & Abilities Bikeways

| Roadway Context | | | | All Ages & Abilities Bicycle Facility |
|---|-----------------------------------|--|---|--|
| Target Motor Vehicle Speed ¹ | Target Motor Vehicle Volume (ADT) | Motor Vehicle Lanes | Key Operational Considerations | |
| Any | | Any | Any of the following: high curbside activity, frequent buses, motor vehicle congestion, or turning conflicts ² | Protected Bicycle Lane |
| < 10 mph | Less relevant | No centerline, or single lane one-way | Pedestrians share the roadway | Shared Street |
| ≤ 20 mph | ≤ 1,000 – 2,000 | | < 50 motor vehicles per hour in the peak direction at peak hour | Bicycle Boulevard |
| ≤ 25 mph | ≤ 500 – 1,500 | Single lane each direction, or single lane one-way | Low curbside activity, or low congestion pressure | Conventional or Buffered Bicycle Lane, or Protected Bicycle Lane |
| | ≤ 1,500 – 3,000 | | | Buffered or Protected Bicycle Lane |
| | ≤ 3,000 – 6,000 | | | Protected Bicycle Lane |
| | Greater than 6,000 | | | Protected Bicycle Lane |
| Greater than 26 mph ¹ | ≤ 6,000 | Single lane each direction | Low curbside activity, or low congestion pressure | Protected Bicycle Lane, or Reduce Speed |
| | | Multiple lanes per direction | | Protected Bicycle Lane, or Reduce to Single Lane & Reduce Speed |
| | Greater than 6,000 | Any | Any | Protected Bicycle Lane |

- low LTS = all ages & abilities
- **avoiding auto speed and volume**
 - streets < 25 mph, 1 – 2 travel lanes
 - protected bicycle lane
- engineer segments & corridors, create **network**

NACTO Designing for all ages & abilities

Rochester:
low stress
bike
network





what opportunities can be reached?

Accessibility on the network

Accessibility definition



The *ease* with which
a traveler *could* reach
valued destinations

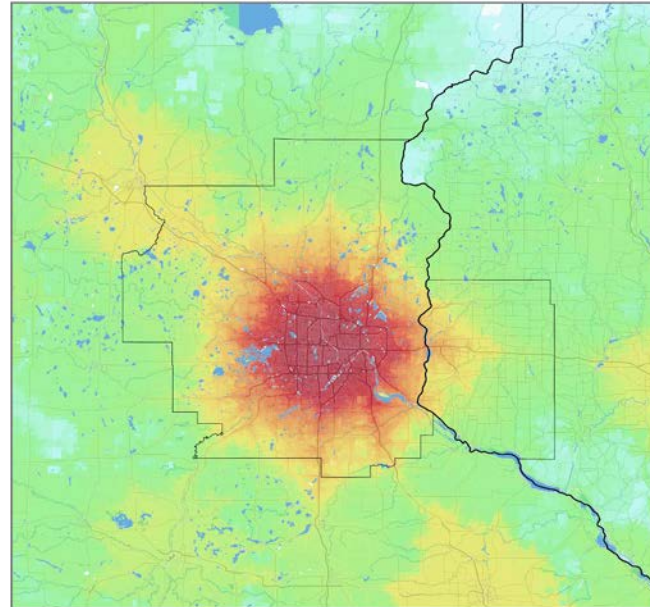


How many jobs can one reach from each point in 30 min driving at 8am?

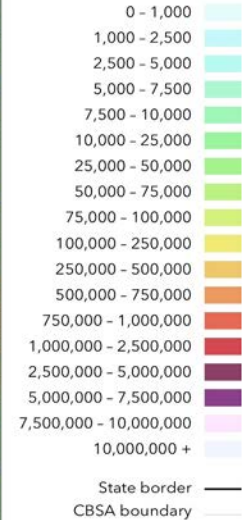


Minneapolis

Minneapolis-St. Paul-Bloomington, MN-WI



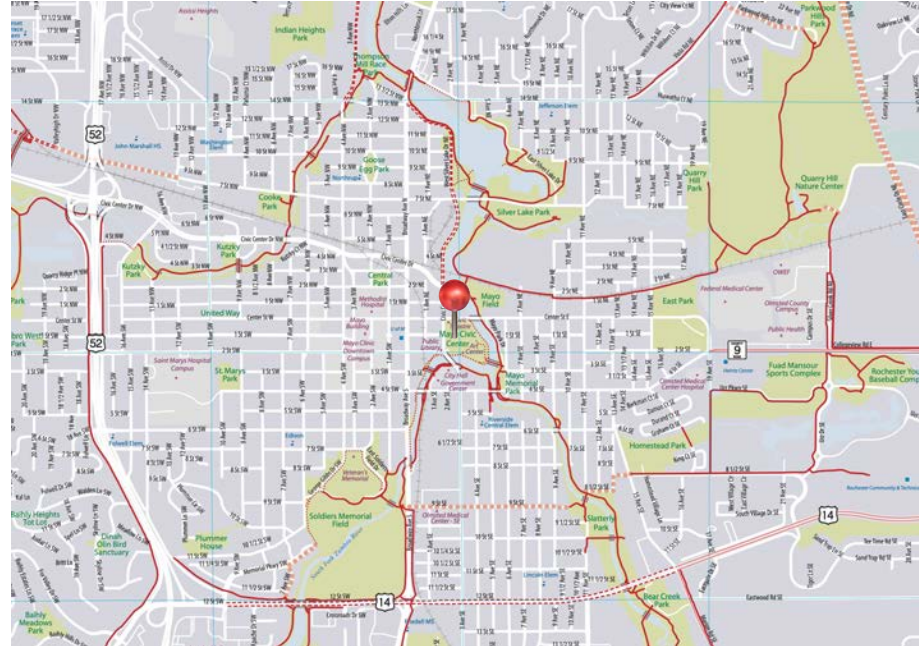
Jobs within 30 minutes
(Driving, AM peak)



Components of Accessibility metric



- Starting place
- Opportunity type
- Travel network
- ease = inverse of cost
 - usually: time



Rochester: all LTS networks

Freeway (no bike)



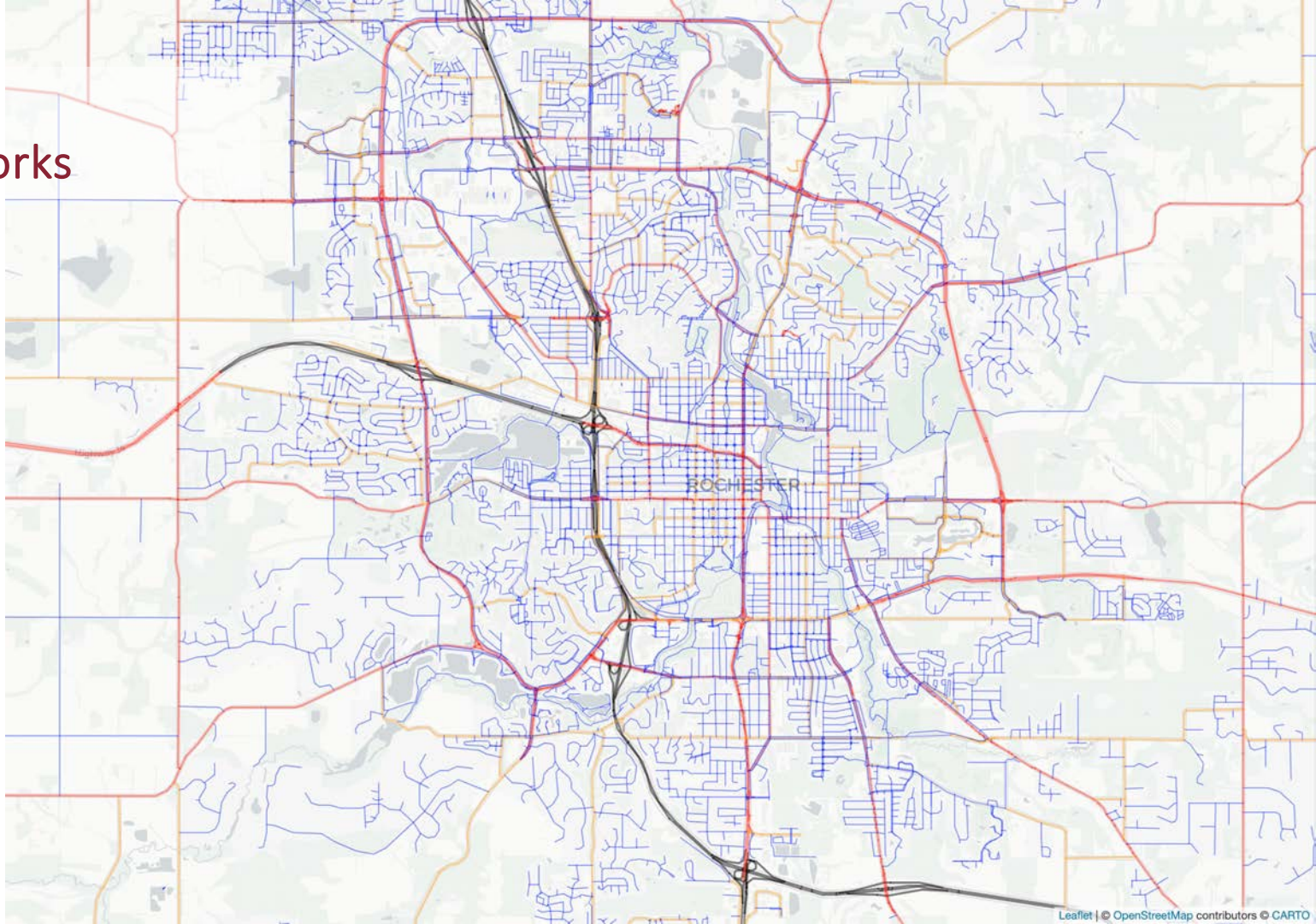
LTS 4



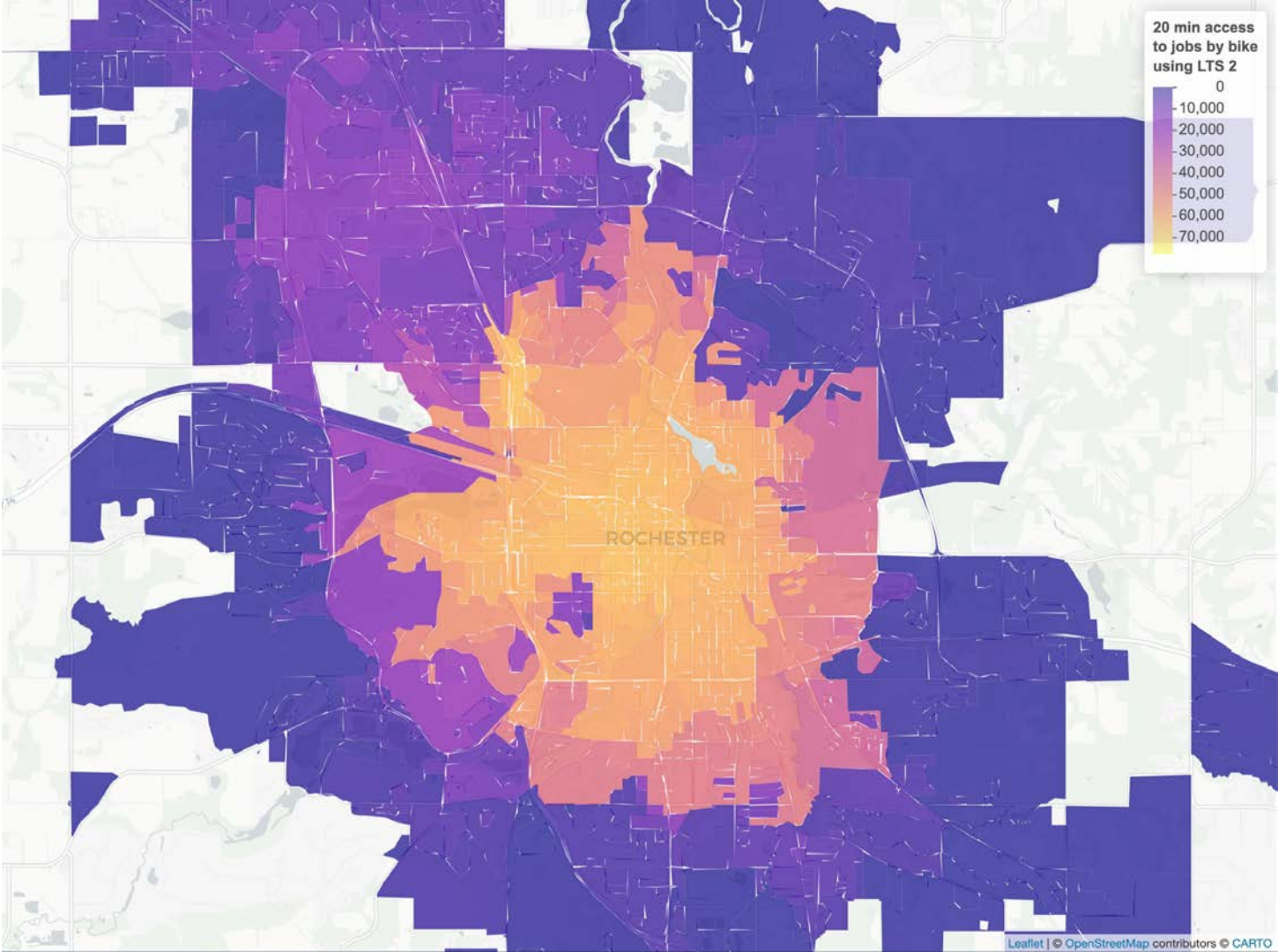
LTS 3



LTS 1 & 2 (all abilities)



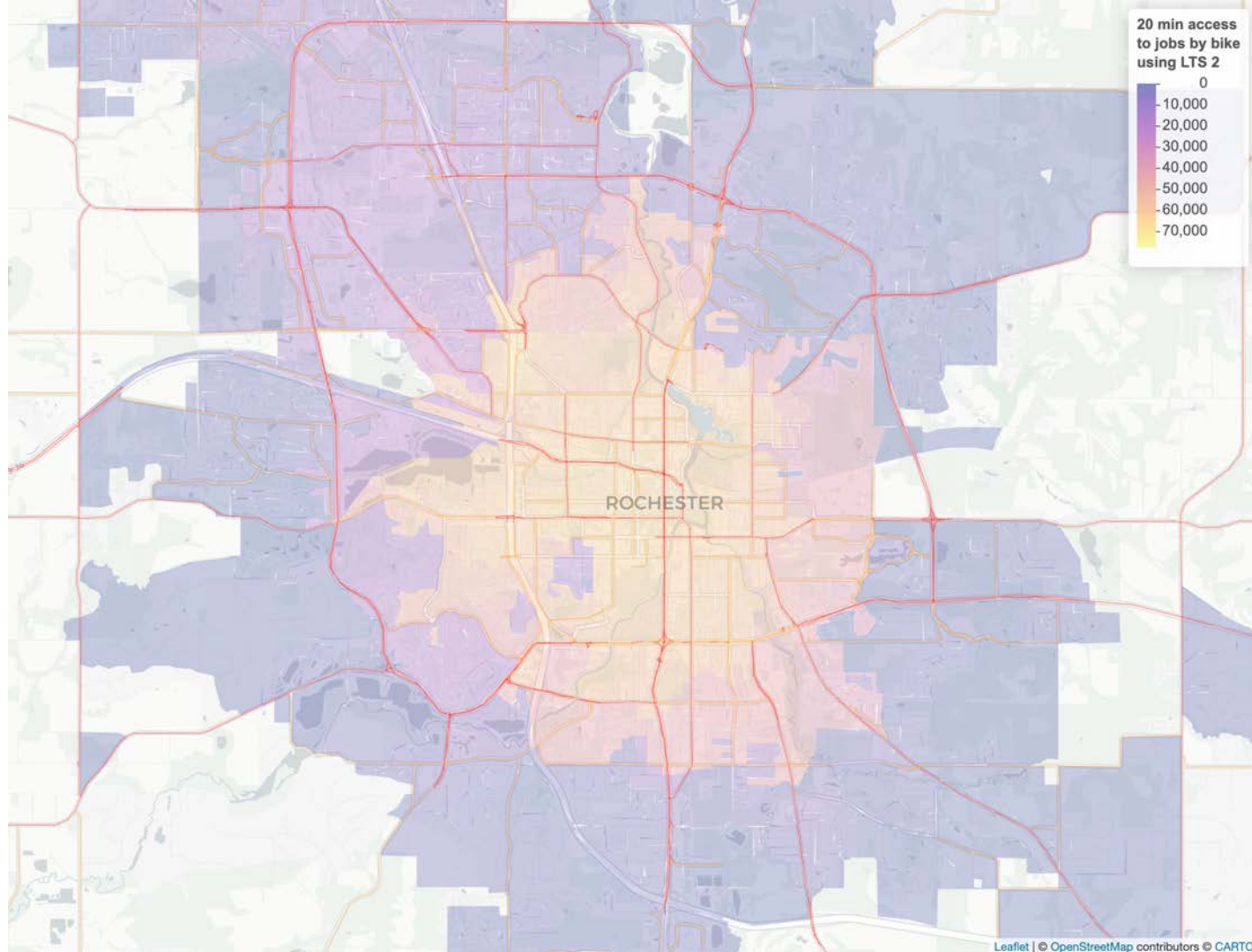
Rochester: access to jobs (all abilities)



Rochester:
access to jobs
(all abilities)

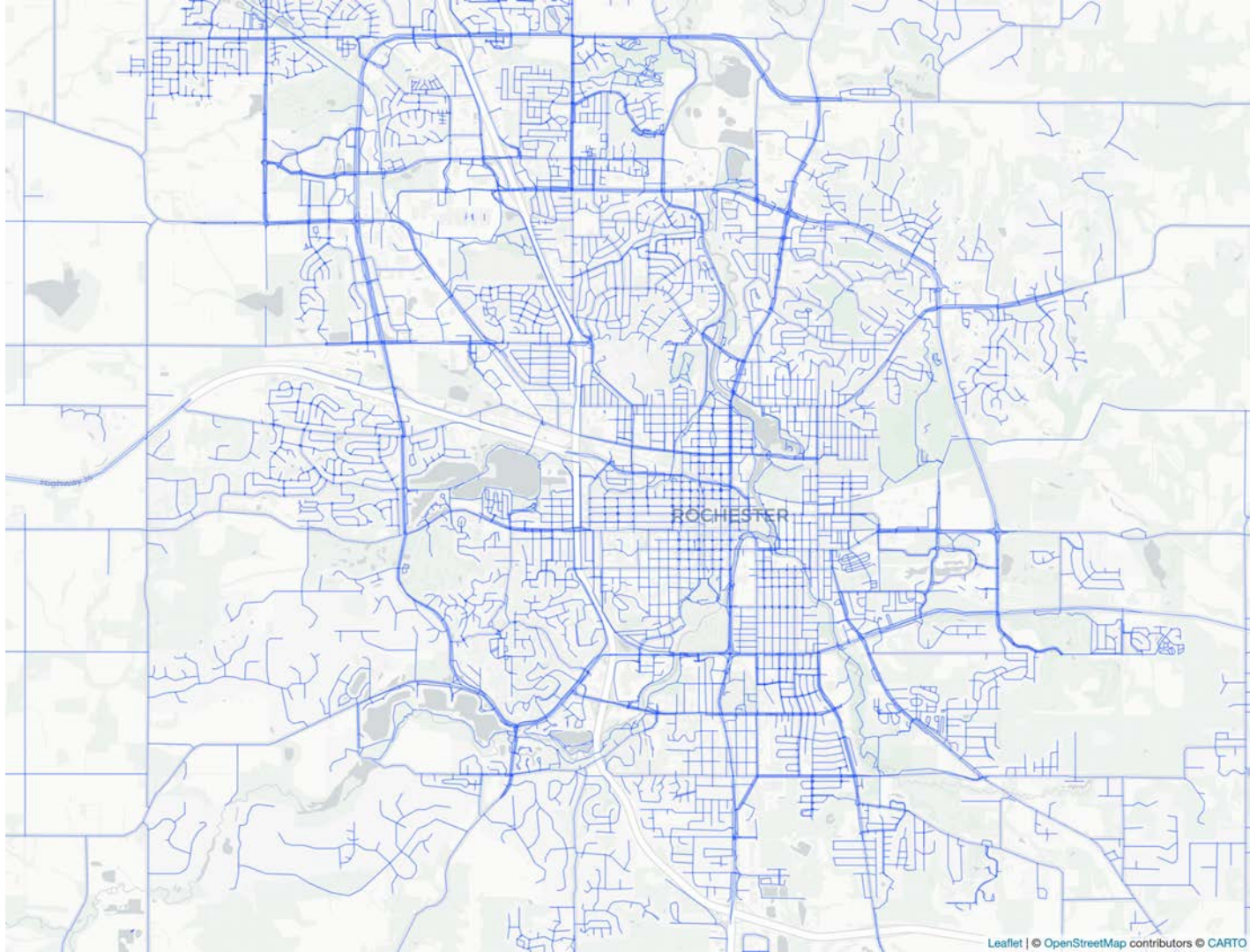
+

stress roads as
barriers

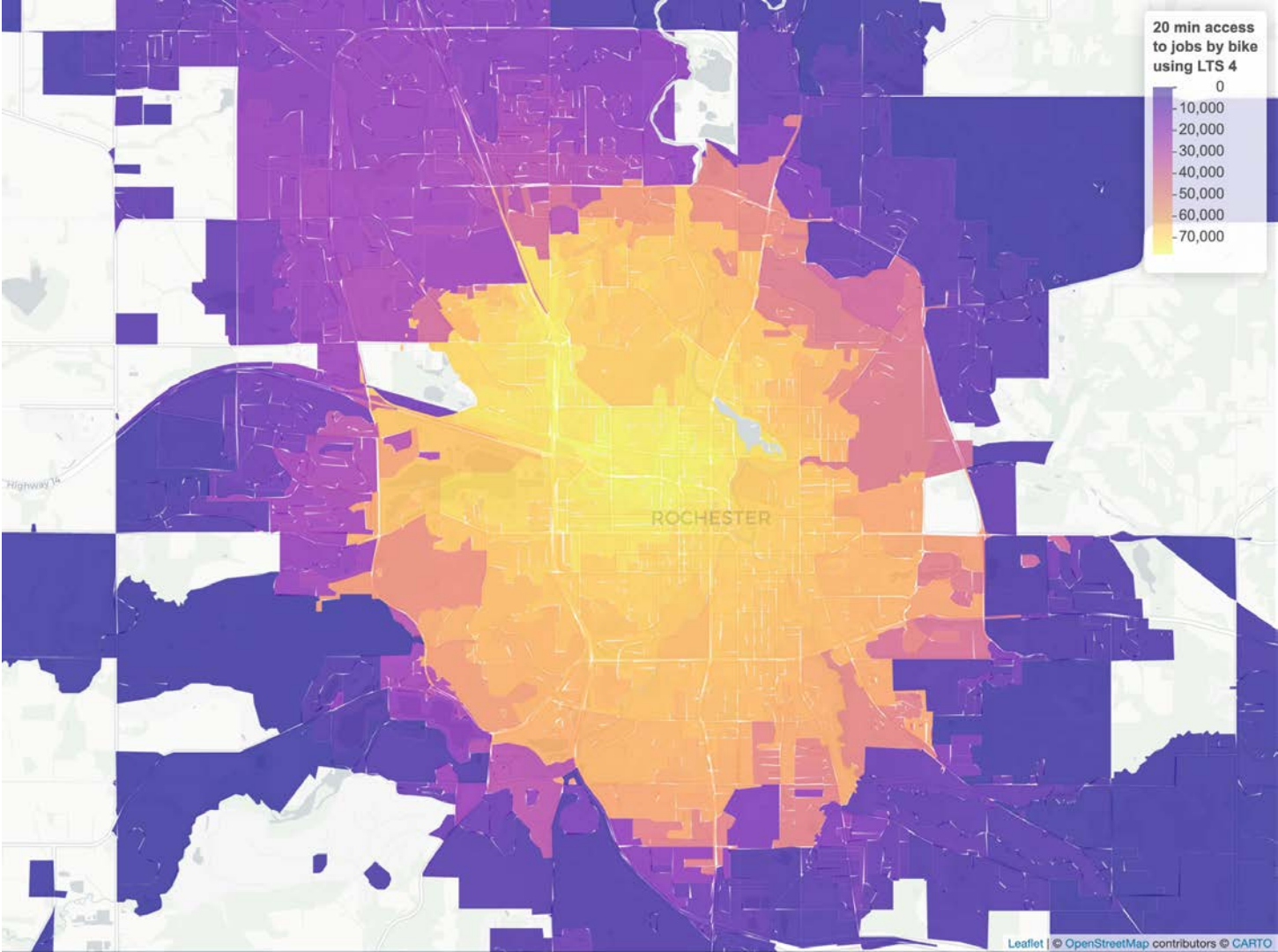


Rochester: “open streets” network

What if all roads
were made low
stress?



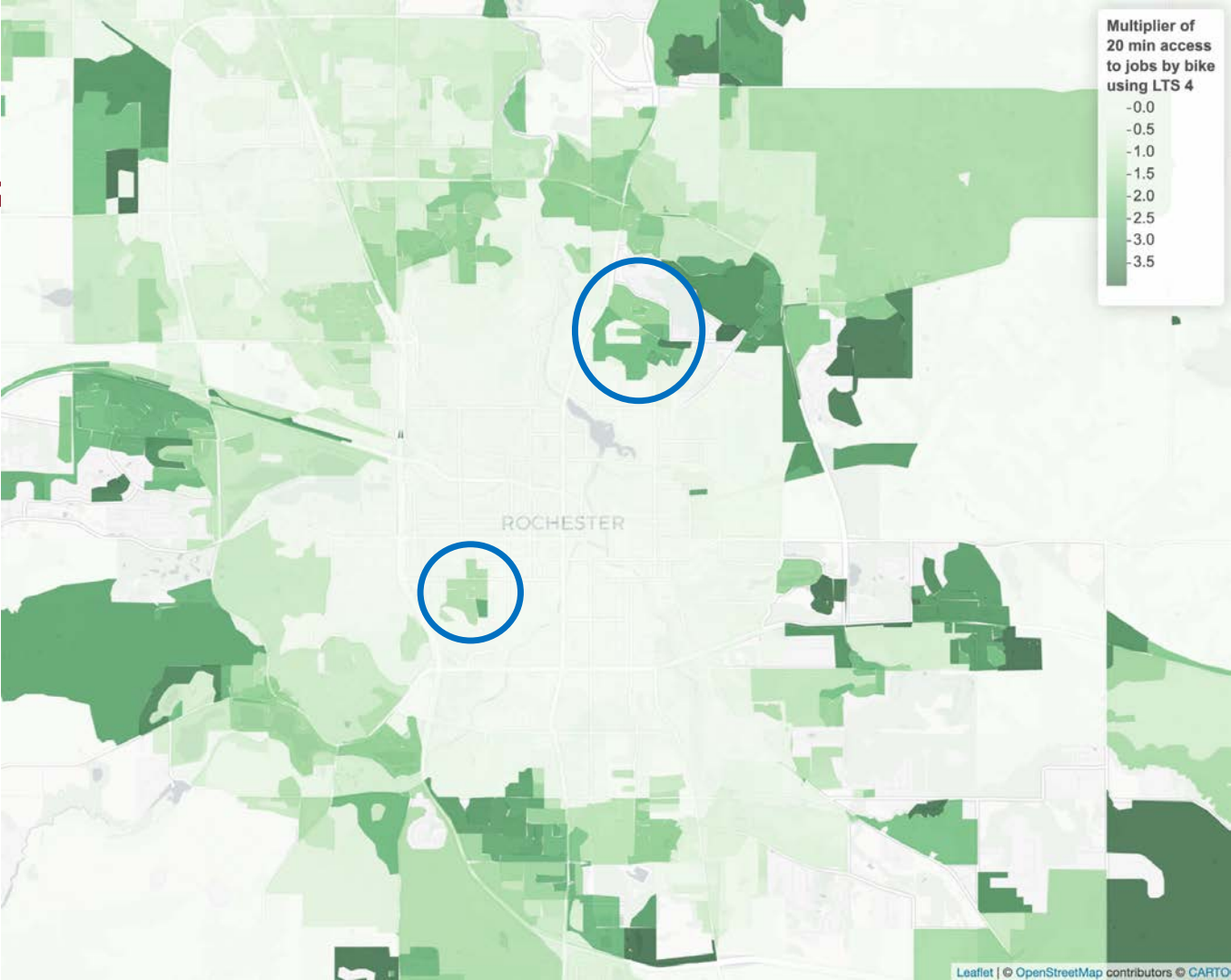
Rochester:
access to jobs
(open streets)



Rochester: change in acces (open streets)



Pockets of opportunity
created by connecting
to low stress network

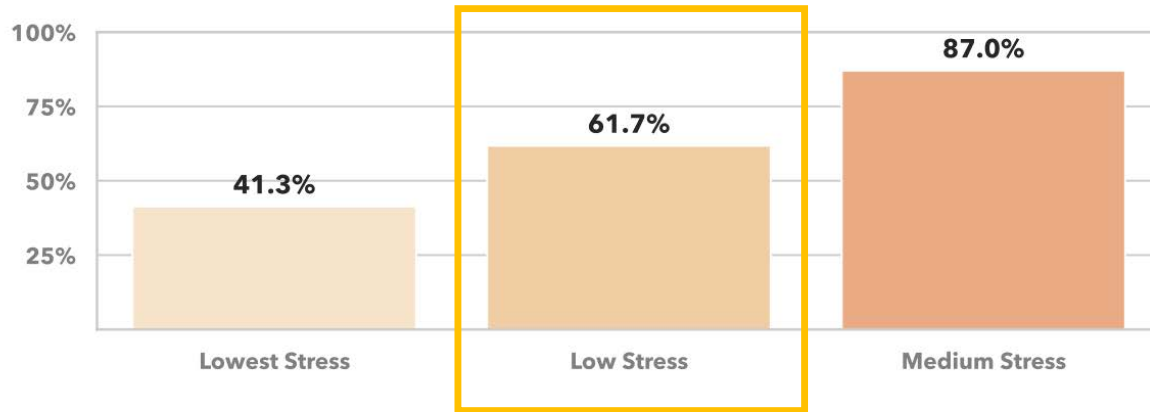




Bike safety “Accessibility gap”: 38%

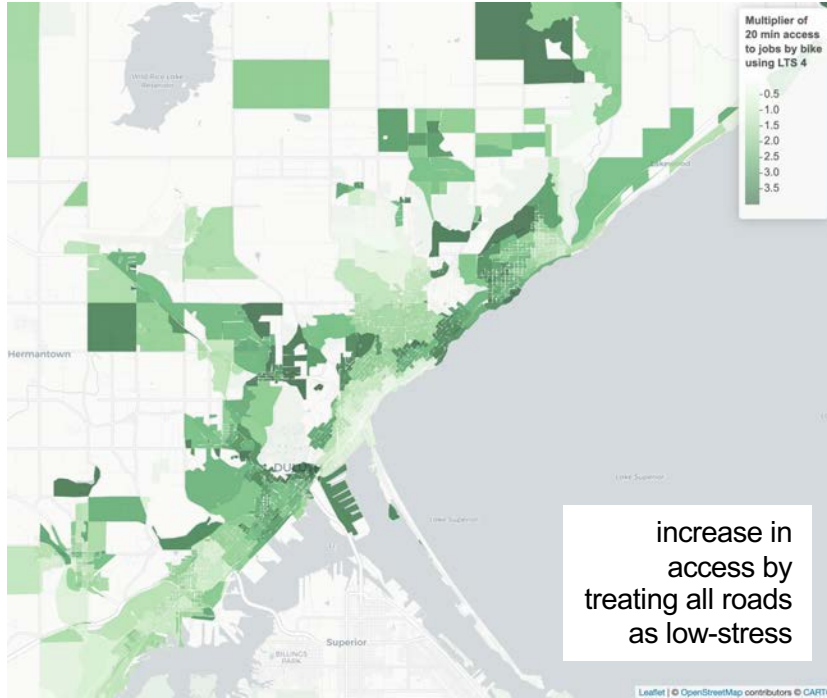
Rochester-Olmsted COG

Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)



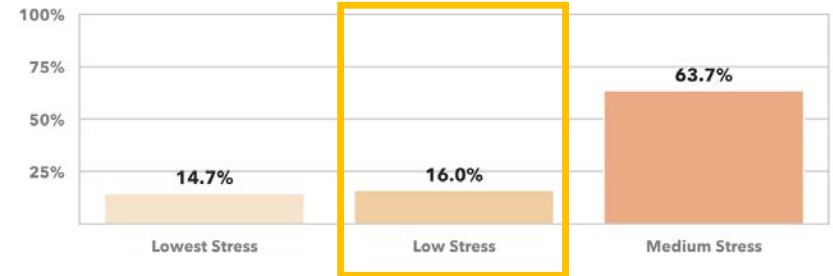
- all-abilities bikers can reach **38% fewer jobs** than if the entire network was low-stress

Duluth bike safety accessibility gap: 84%



Duluth-Superior Metropolitan Interstate Council

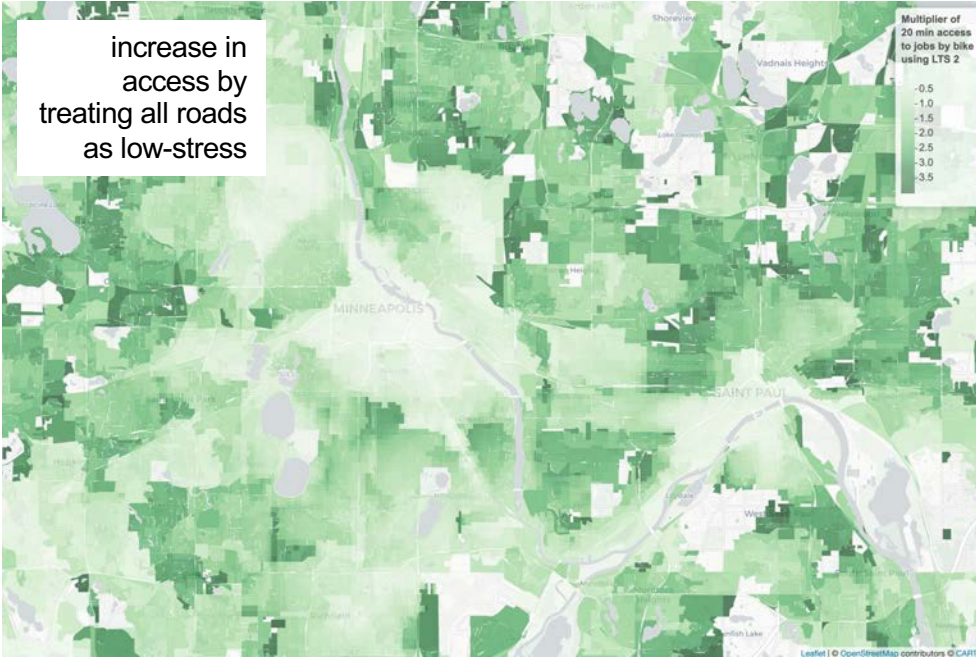
Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)



MSP bike safety accessibility gap: 72%

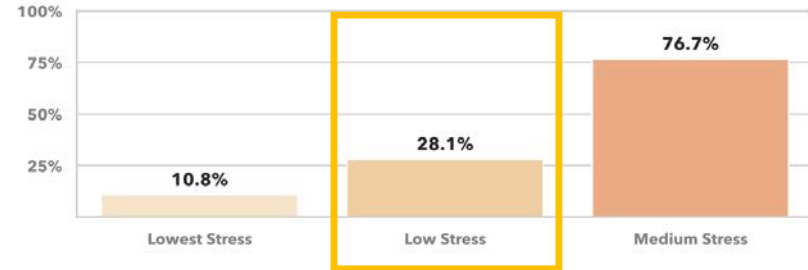


increase in
access by
treating all roads
as low-stress



Metropolitan Council

Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)

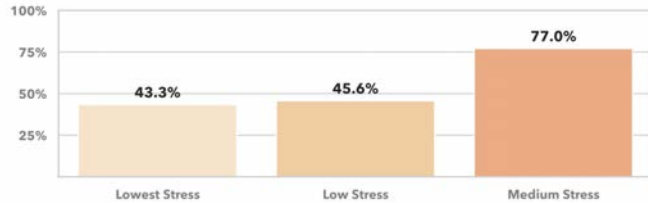


Minnesota bike safety accessibility gaps



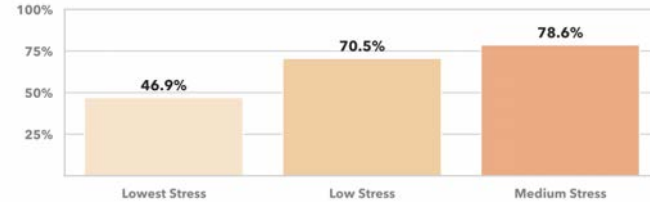
Fargo-Moorhead Metropolitan COG 54%

Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)



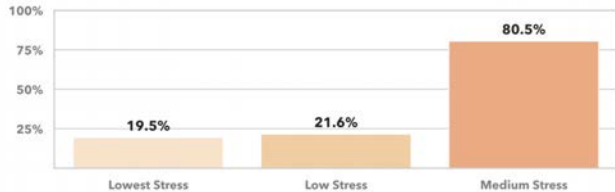
Grand Forks-East Grand Forks MPO 29%

Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)



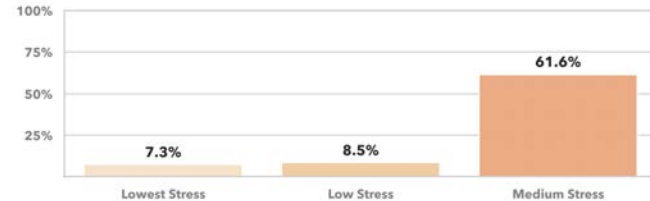
Mankato / North Mankato Area Planning Organization 78%

Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)

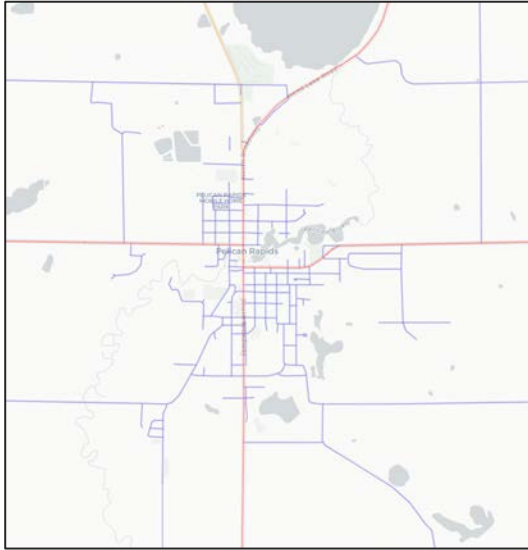


St. Cloud Area Planning Organization 91%

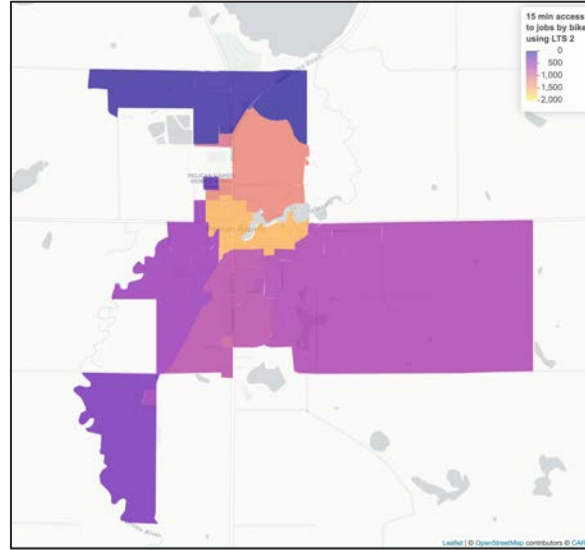
Weighted Job Accessibility Ratio, Bike Networks to Open Streets (LTS 4)



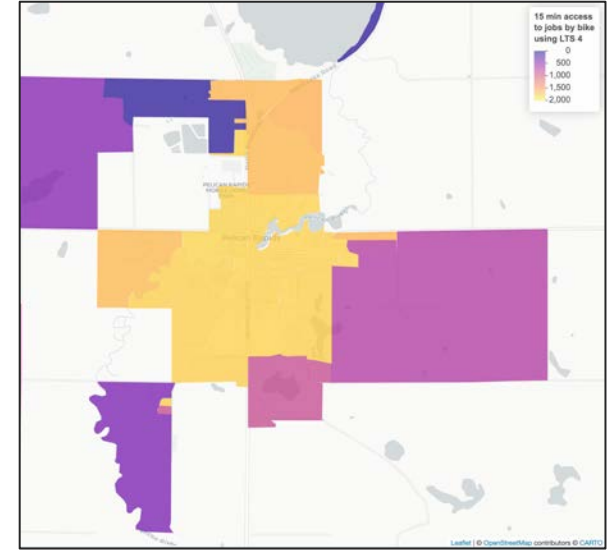
Accessibility gaps: a rural phenomenon



Pelican Rapids, MN



existing low stress access



with all open streets

Hwy 59, 108 - Pelican Rapids Complete Streets Project

Pelican Rapids

- Project Home
- Roundabouts
- Demonstration Projects
- ADA
- Contacts
- Thrive During Construction Business Guidance

We want your feedback before construction starts in 2024! Tell us how we've done up to this stage. [Take our online survey!](#)

Project details

The Minnesota Department of Transportation is partnering with the City of Pelican Rapids for the 2024 resurfacing and reconstruction project on Highways 59 and 108 in Pelican Rapids.

The project will address pavement concerns, pedestrian accessibility (ADA) requirements and storm sewer needs. As part of this project, the City of Pelican Rapids will be replacing up to 25 blocks of city utilities.

In 2019, the City of Pelican Rapids worked with MnDOT and PartnerSHIP 4 Health to conduct a planning study ahead of MnDOT's design phase. The planning study helped aid the City of Pelican



Language

Select Language

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Schedule

Letting: January 26, 2024

Construct: 2024-2025

Location

- Hwy 59 from 5th Ave SW to just north of County Road 9
- Hwy 108 west from Hwy 59 to 9th Street NW
- Hwy 108 east from Hwy 59 to Ann Lane

Preliminary cost estimate

\$15 million (*estimated*)

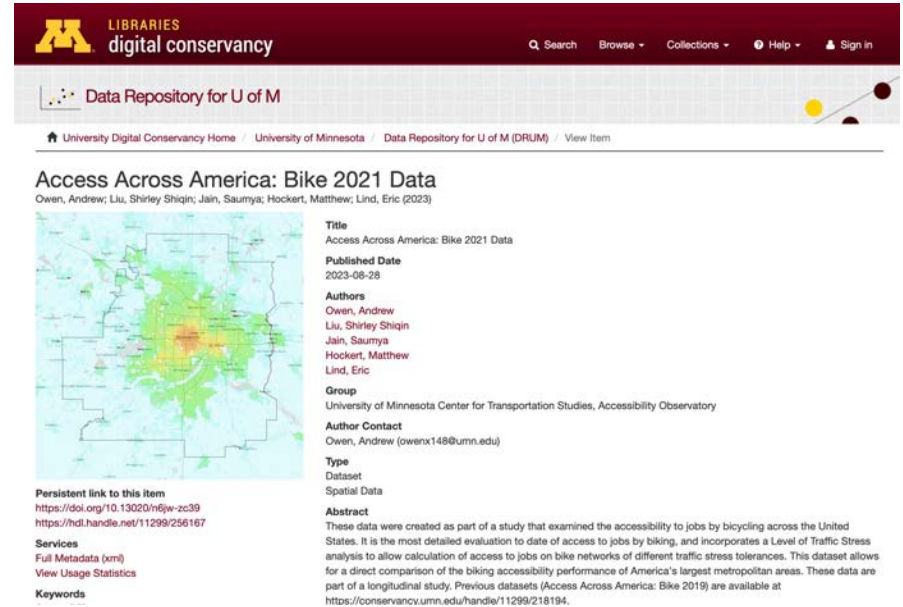
Accessibility Observatory data



2021 Bike Accessibility Report: Minnesota

Prepared for the state of Minnesota by the
Accessibility Observatory at the University of Minnesota

July 7, 2023



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Access Across America: Bike 2021 Data

Owen, Andrew; Liu, Shirley Shiqin; Jain, Saumya; Hockert, Matthew; Lind, Eric (2023)



Title
Access Across America: Bike 2021 Data

Published Date
2023-08-28

Authors
Owen, Andrew
Liu, Shirley Shiqin
Jain, Saumya
Hockert, Matthew
Lind, Eric

Group
University of Minnesota Center for Transportation Studies, Accessibility Observatory

Author Contact
Owen, Andrew (owenx148@umn.edu)

Type
Dataset
Spatial Data

Abstract
These data were created as part of a study that examined the accessibility to jobs by bicycling across the United States. It is the most detailed evaluation to date of access to jobs by biking, and incorporates a Level of Traffic Stress analysis to allow calculation of access to jobs on bike networks of different traffic stress tolerances. This dataset allows for a direct comparison of the biking accessibility performance of America's largest metropolitan areas. These data are part of a longitudinal study. Previous datasets (Access Across America: Bike 2019) are available at <https://conservancy.umn.edu/handle/11299/218194>.

Persistent link to this item
<https://doi.org/10.13020/n6jw-zc39>
<https://hdl.handle.net/11299/256167>

Services
[Full Metadata \(xml\)](#)
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Keywords

Engineering gives Access to Opportunity



- separation is safety, comfort
- low-stress **network** defines bike accessibility for all
- auto speed & volume block bike accessibility
- **increasing opportunities** can be done with engineering





thank you!

Eric Lind

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