ACCESSIBILITY OBSERVATORY
UNIVERSITY OF MINNESOTA
Driven to Discover℠

Multi-modal applications of destination access

Research Highlights from the Accessibility Observatory

Kristin Carlson
Researcher
Accessibility Observatory
carl4498@umn.edu

Andrew Owen
Director
Accessibility Observatory
aowen@umn.edu

Brendan Murphy
Lead Researcher
Accessibility Observatory
murph677@umn.edu

Outline

- Definition of access to destinations
- Automobile access to jobs and the impacts of traffic congestion
- Transit access impacts of managed lanes and transitways
- Bicycle access to jobs using Level of Traffic Stress (LTS) framework
- Discussion/questions

Access to Destinations

Access to Destinations (Accessibility)

- Accessibility measures the ease of reaching destinations
- Reflects *possible* trips and interactions
- Accounts for the cost of travel (time, money, etc) AND the benefits
- Example: from a given location, can reach 100,000 jobs by transit within 30 minutes at 8 a.m.
- Mode-agnostic: can measure and compare across different transportation modes

National Accessibility Evaluation

- Pooled-fund project sponsored by state DOTs, MPOs, and FHWA
- Annual datasets and reports on multimodal accessibility across the U.S.
  - Phase I: 2015–2019
  - Phase II: 2020–2024
- Includes driving, transit, biking, and walking
- National-scale tools can be applied for detailed local analysis

Auto Access Impacts of Congestion and HOT Lanes

Measuring Access by Auto

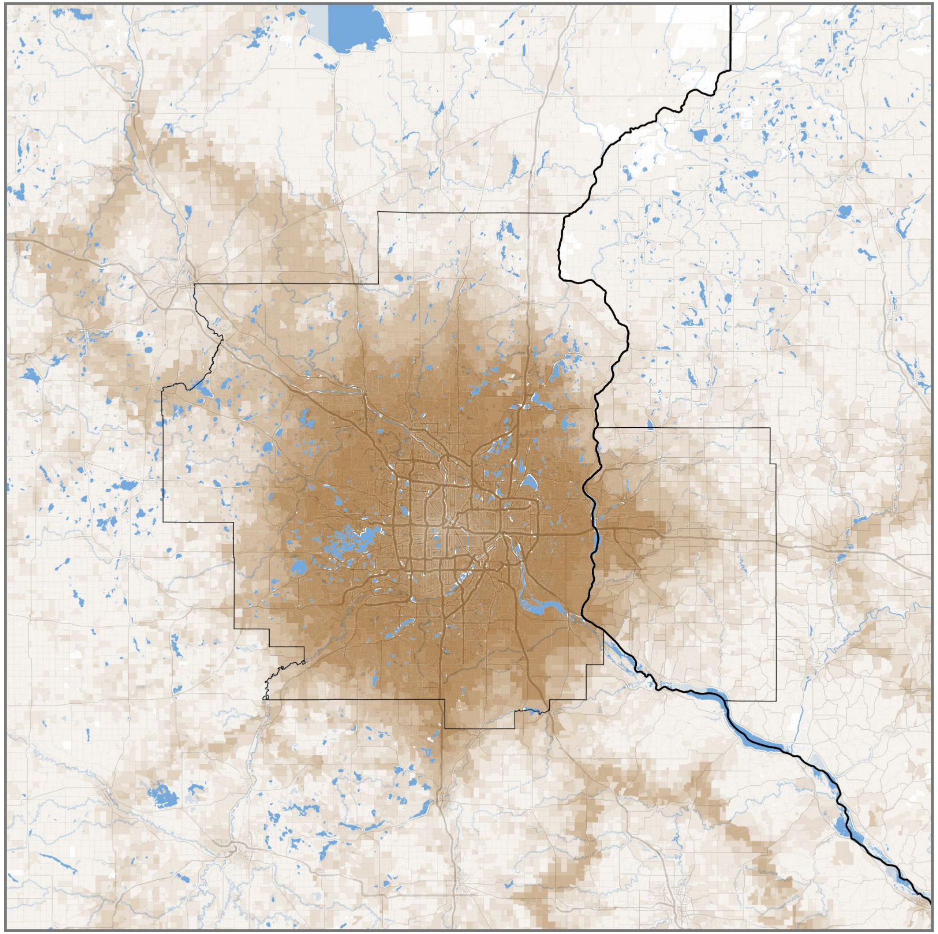
- Reflect congestion and varying road speeds
- Identify locations that benefit from investments
- Connect speed improvements with access impacts

Access Impact of Congestion

- National Accessibility Evaluation
  - Measure jobs accessible by auto from every Census block
  - TomTom road network & speed data
  - Repeat calculations for each hour
- Access impact of congestion
  - Free-flow access = access at fastest hour (typically overnight)
  - Congested access = access at specific time of interest (8 a.m.)
  - Difference indicates how much access is reduced during congested period

Minneapolis

Minneapolis-St. Paul-Bloomington, MN-WI



Change in jobs within 30 minutes

(Driving, congestion impact)

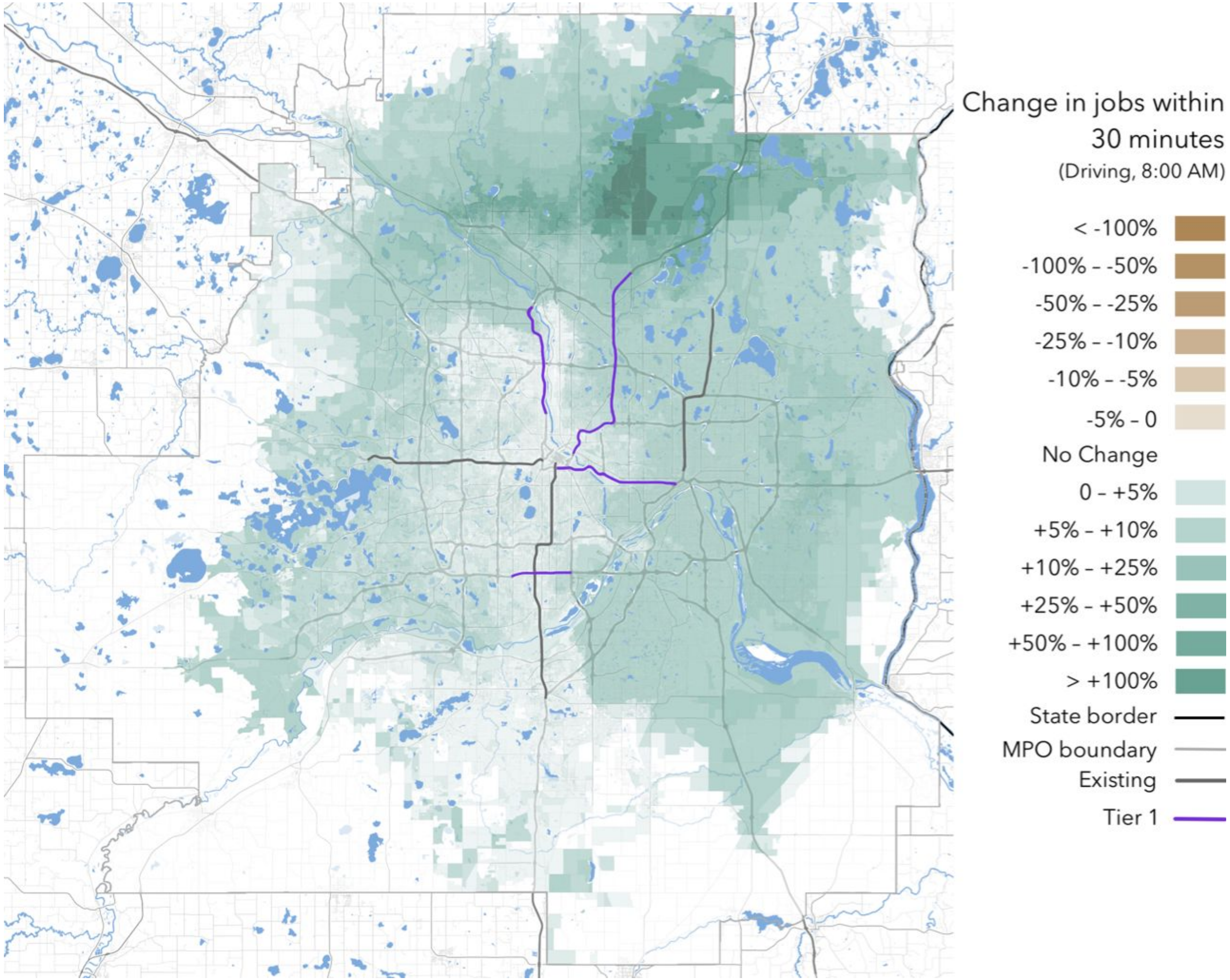
- < -250,000
- -250,000 – -100,000
- -100,000 – -50,000
- -50,000 – -10,000
- -10,000 – -5,000
- -5,000 – 0
- 0 – +5,000
- +5,000 – +10,000
- +10,000 – +50,000
- +50,000 – + 100,000
- +100,000 – +250,000
- > +250,000

State border

MPO boundary

Access Impacts of Managed Lanes

- Managed lanes provide faster/more reliable speeds compared to general-purpose lanes
- MnPASS
  - Subscription-based with in-vehicle transponders
  - Dynamic pricing, managed to maintain free-flow speeds
- Access with MnPASS lane use vs. access without MnPASS lane use shows access benefit of MnPASS lanes


Change in jobs within 30 minutes
(Driving, 8:00 AM)
< -100%
-100% - -50%
-50% - -25%
-25% - -10%
-10% - -5%
-5% - 0
No Change
0 - +5%
+5% - +10%
+10% - +25%
+25% - +50%
+50% - +100%
> +100%
State border
MPO boundary
Existing
Tier 1

Transit Access Impacts of Managed Lanes and Transitways

Measuring Access by Transit

- Include transit coverage, speeds, and transfers
- Reflect transit service frequency
- Include the pedestrian network to access and egress from transit stops

Project background

Title: Accessibility and behavior impacts of bus-highway system interactions

Completed: 2019

Project Goal: To improve accessibility calculation capabilities by integrating data about bus-highway facilities.

Project Outcome: A better understanding of how managed lanes can improve transit accessibility through speed and reliability improvements.

Data and scenarios

Parameters

- Census blocks
- Jobs data
- Transit schedule data
- Managed lane locations
- Pedestrian network

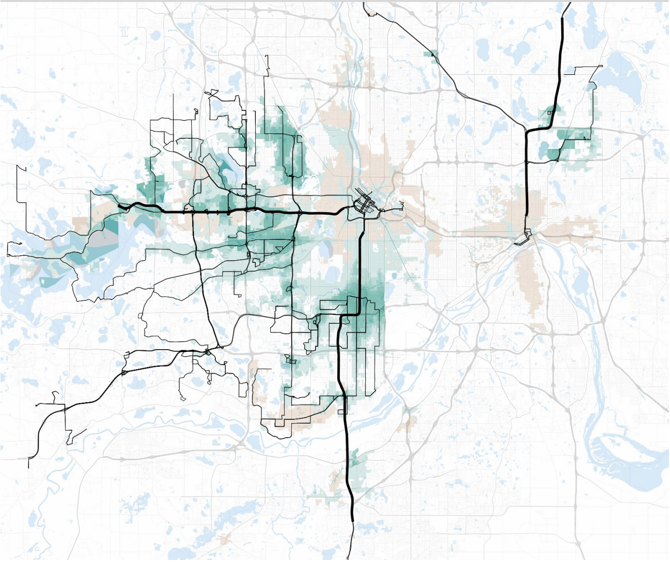
Scenarios

- Baseline—No speed update
- 2019 MnPASS network
- Future MnPASS network

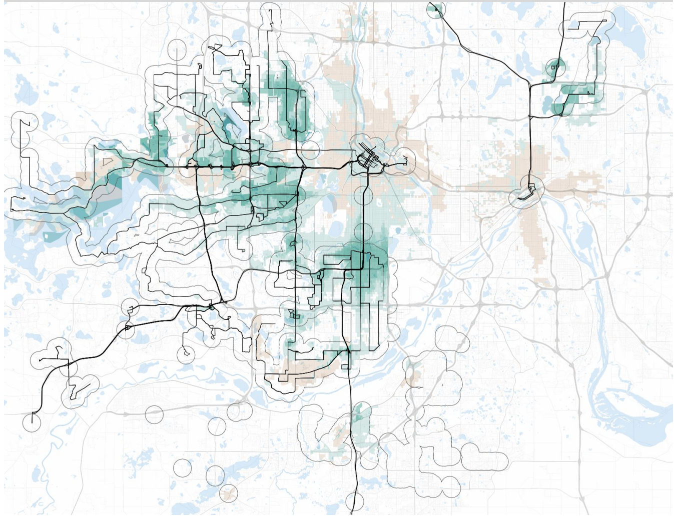
Express bus on existing managed lane network

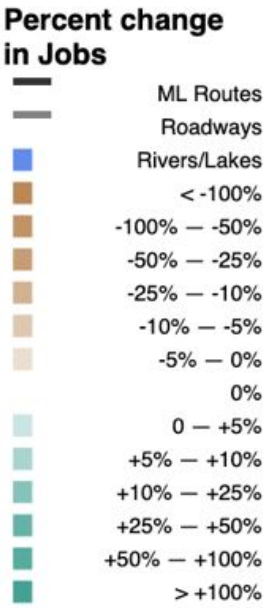
Worker-weighted average percent change in access to jobs—30 minutes

Worker-weighted average percent change—30 minutes travel: **1.4%**



Impact zone worker-weighted average percent change—30 minutes travel: **13.0%**

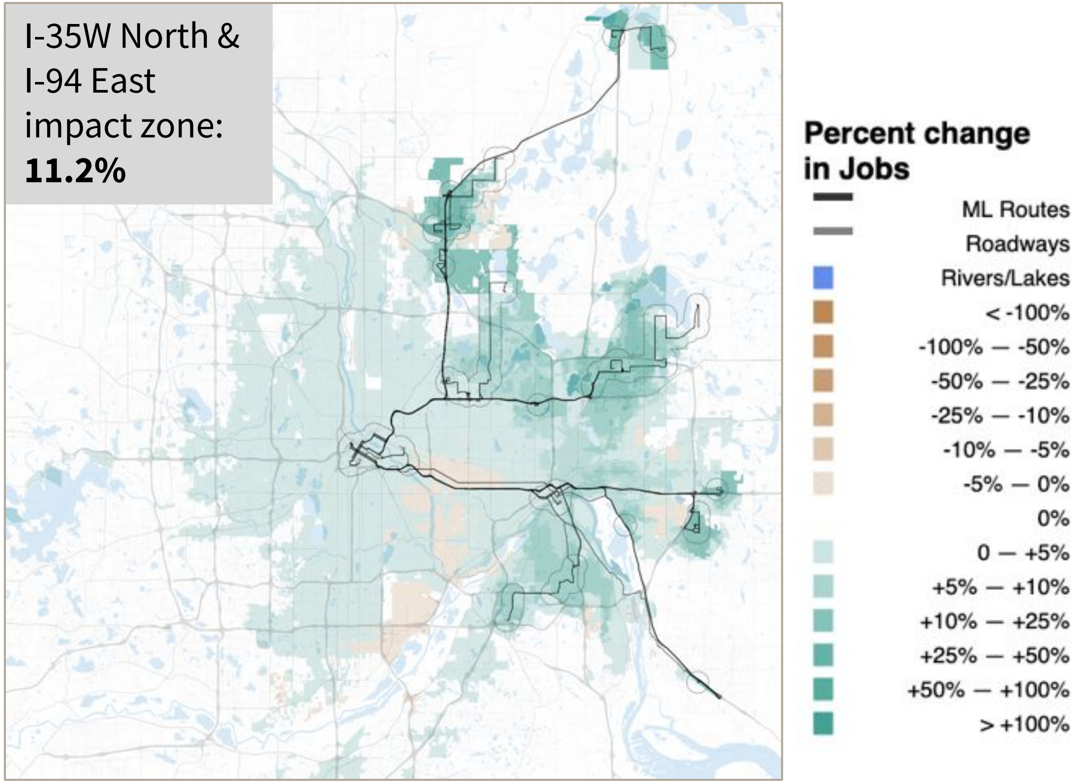




Express bus on future managed lane network

Worker-weighted average percent change in access to jobs—60 minutes

Managed lanes on I-35W and I-94 may increase transit accessibility by up to 11.2% for Twin Cities workers



Takeaways

- Managed lanes improve transit vehicle speeds thereby improving access to jobs.
- Workers within the transit service area experience the greatest improvement in job accessibility when transit vehicles utilize managed lanes.
- Despite fewer express bus routes experiencing impact on the future managed lane network, job accessibility improvements were substantial—suggesting better coordination between land use and transportation.

Project background

Title: Accessibility evaluation of planned transitways

Completed: 2019

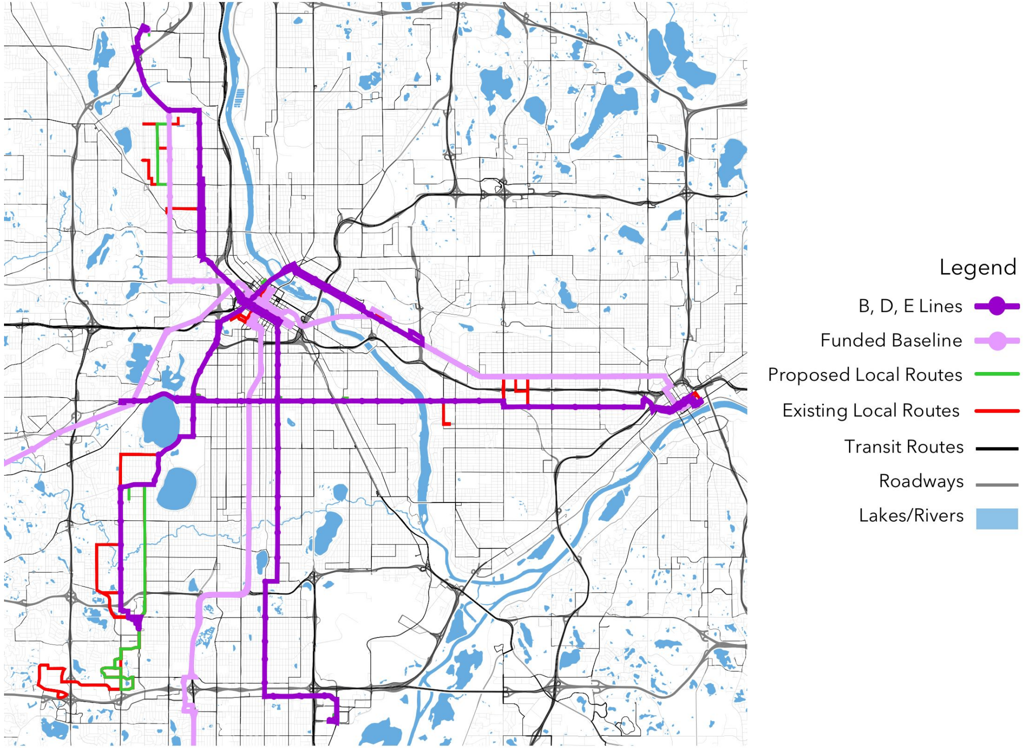
Project Goal: To measure the change in job accessibility when three transitways are added to the Minneapolis–Saint Paul transit network.

Project Outcome: A better understanding of the neighborhoods where access to jobs changed the most and least.

Planned transitways in Minneapolis–Saint Paul

Planned transitways: B Line, D Line, E Line

Local route changes: routes 5, 6, and 21

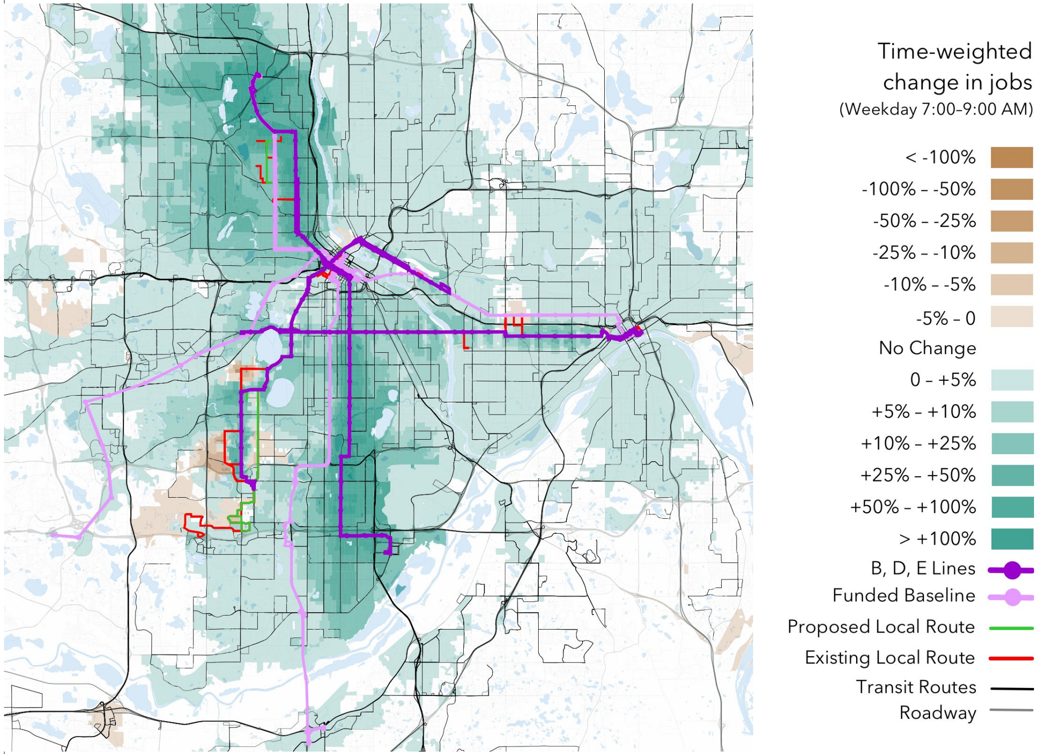


Accessibility changes

B Line: provides a backbone of service between job centers

D Line: connects numerous workers with numerous jobs in and around Minneapolis

E Line: both positive and negative accessibility changes occur along the corridor



Accessibility change by the numbers

	15 min	30 min	45 min	60 min	Time-weighted
Funded Baseline	1,999	20,919	76,649	167,896	6,407
Planned Network	2,245	24,452	85,496	181,291	7,191
Absolute Change—Metro	+245	+3,532	+8,847	+13,394	+784
Absolute Change—blocks within ½ mile of transit stops	+426	+6,129	+15,339	+23,055	+1,358
Percent Change—Metro	+5.9%	+7.8%	+5.7%	+4.2%	+5.5%
Percent Change—blocks within ½ mile of transit stops	+10.3%	+13.5%	+9.8%	+7.1%	+9.5%

Takeaways

- The transitway investments planned for Minneapolis–Saint Paul connect workers to more jobs in less travel time.
- Transit routes interact to spread accessibility benefit farther than the planned transitway corridors
- The E Line corridor shows how service cuts and improvements play out across neighborhoods in terms of access.

Bicycle access to jobs using level of traffic stress (LTS) framework

Measuring Access by Bike

- Include Level of Traffic Stress (LTS) to model where people would ride
- Measure access for different types of bicyclists
- Assess the performance of bicycle networks and propose improvements

Research project background

Title: Bicycle access to jobs using level of traffic stress (LTS) framework

Completed: ongoing, part of National Accessibility Evaluation

Project Goal: To accurately measure bicycle access to destinations by modeling bicycle travel on bike networks labeled and identified with LTS.

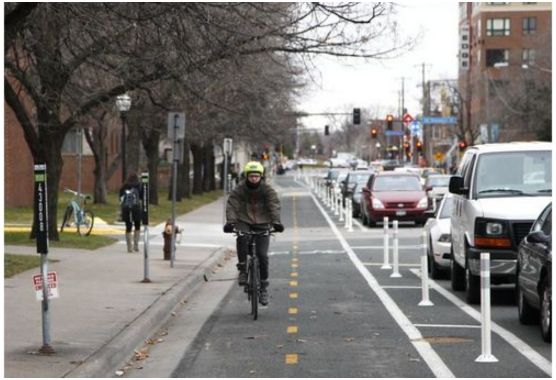
Project Outcome: Inclusion of LTS-informed bicycle access metrics in National Accessibility Evaluation.

Methodology

- Input dataset: OpenStreetMap
- Classify all roads and intersections in the US as LTS 1, 2, 3, or 4 (or not bikeable)
- Calculate bicycle access to destinations using LTS 1 roads, then LTS 1+2 roads, etc.
- Compare bicycle networks and access to destinations per maximum LTS level, for 50 largest cities nationwide

LTS Classifications

LTS 1 (lowest stress)



http://newdealprogressives.org/blog/wp-content/uploads/2016/01/bike-1.png

- Residential streets
- Off-street facilities
- Protected facilities

LTS 2 (low stress)

https://www.minnpost.com/sites/default/files/imagecache/article_detail/park-ave-bike-lane_main.jpg

- Tertiary roads
- Slow streets with mixed traffic
- Good bike lanes

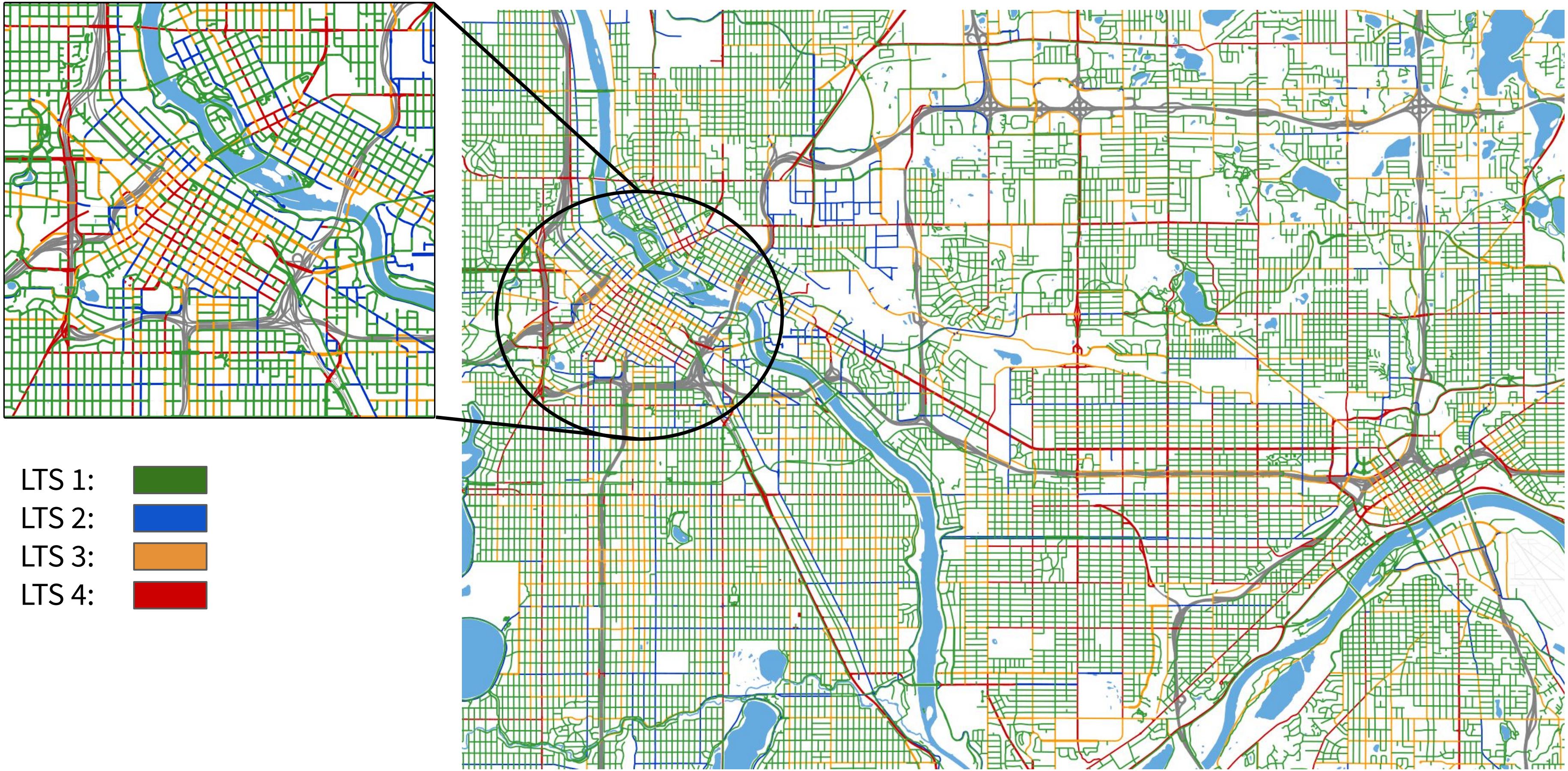
LTS 3 (medium stress)

- Faster streets
- Secondary roads
- May have bike lanes

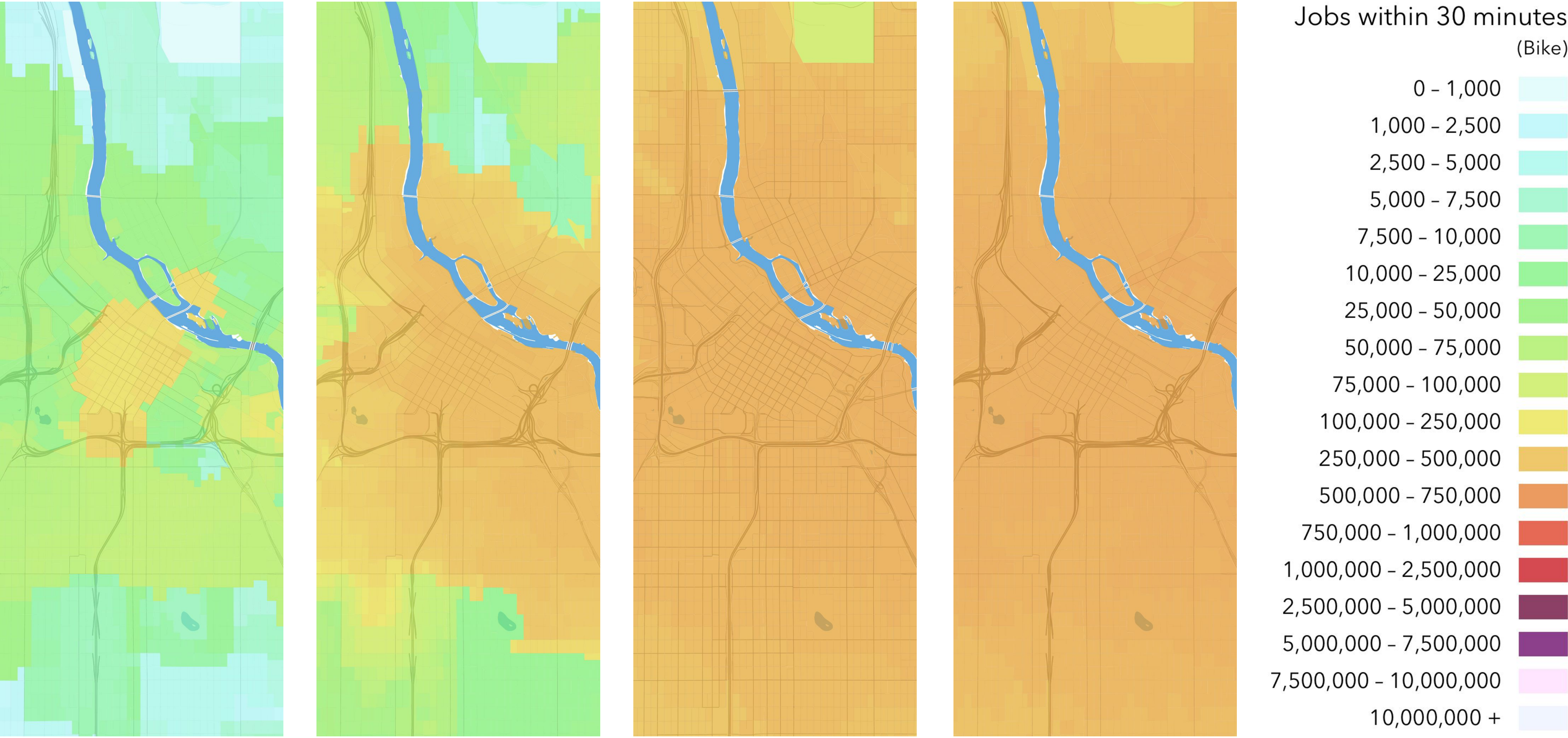
LTS 4 (high stress)

- Primary roads
- Arterials
- No bike facilities

LTS Classifications

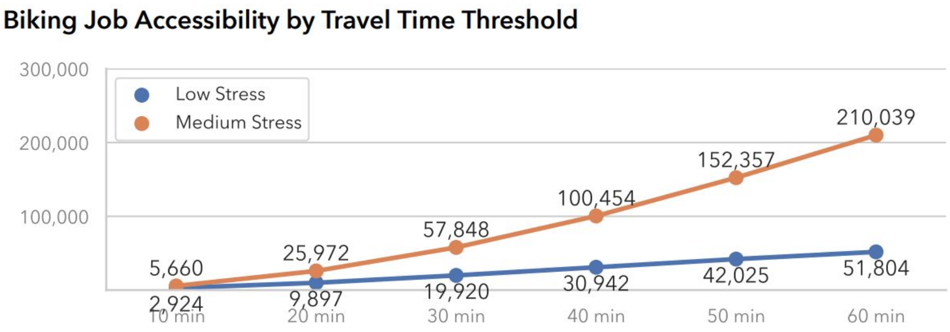


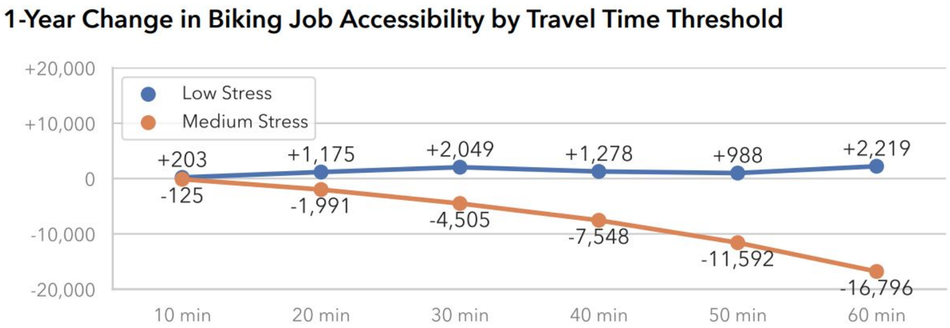
Accessibility across LTS levels



LTS 1 LTS 2 LTS 3 LTS 4

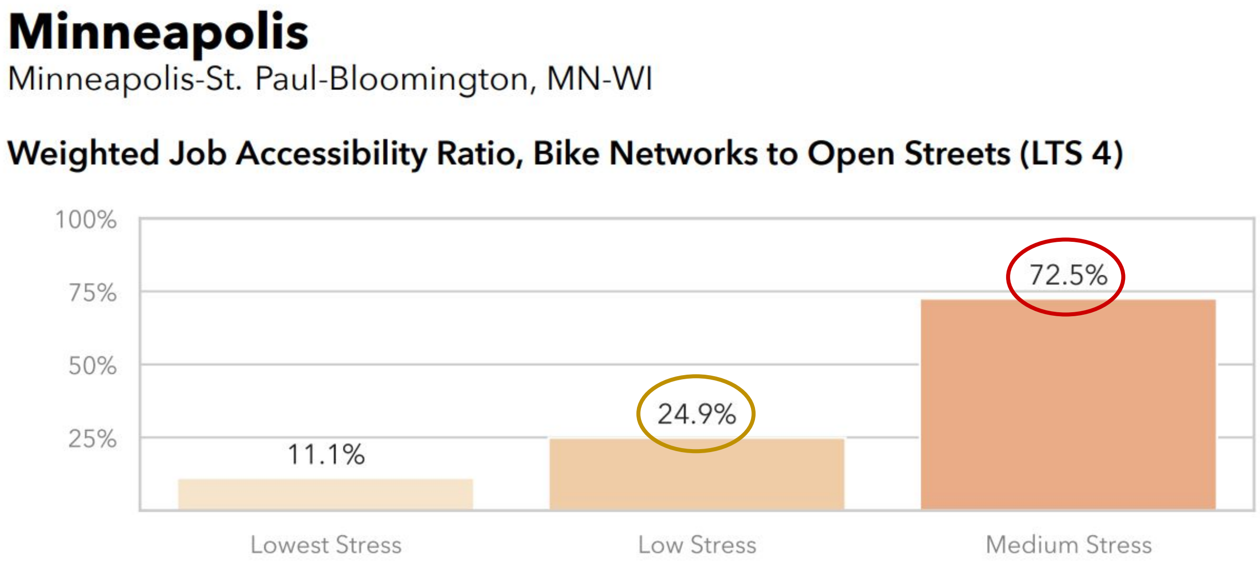
Metrics - Data and Rankings





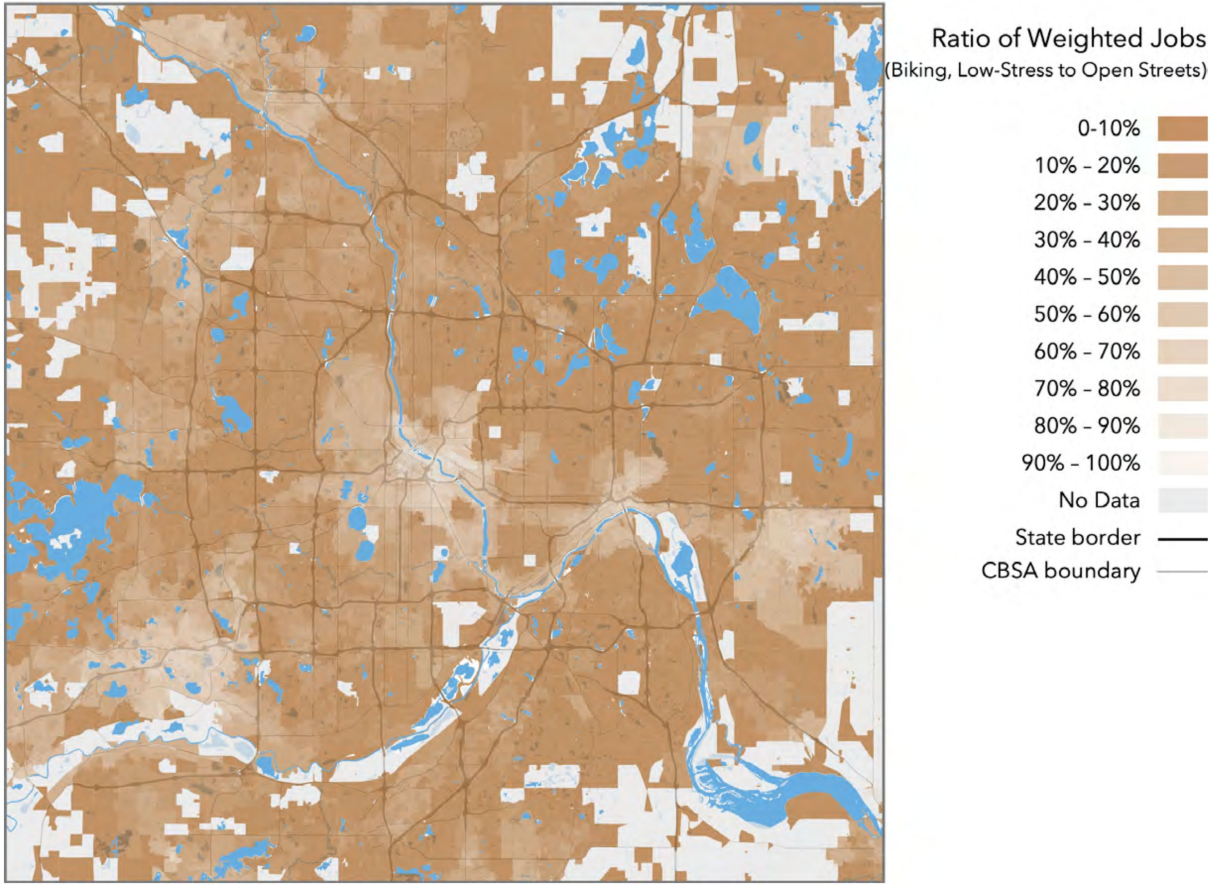
Metrics - Bike Network Performance

- Measures how well a given bike network provides access to the jobs that exist in a region.



- Cities where 70%+ of job opportunities reachable by “Open Streets” (LTS 4) are also reachable on Medium Stress bike networks:
    - San Francisco
    - Portland
    - New York
    - Minneapolis
    - Denver

Bike Network Performance in Minneapolis: Low Stress vs. Open Streets



Outcomes

- National LTS evaluation using OpenStreetMap implemented
- Two years of data produced
- Developed bicycle network performance metrics using accessibility data
- Successfully tracking bicycle access alongside auto and transit access, producing multimodal datasets and reporting

Comparisons Across Modes

Accessibility Rankings

Rank	Total Jobs	Auto	Transit	Bike (Low)	Bike (Med)
1	New York	New York	New York	New York	New York
2	Los Angeles	Los Angeles	San Francisco	San Francisco	San Francisco
3	Chicago	Dallas	Chicago	Chicago	Chicago
4	Dallas	San Jose	Washington	Denver	Denver
5	Houston	Chicago	Boston	Philadelphia	Washington
6	Philadelphia	Houston	Los Angeles	Washington	Portland
7	Washington	Twin Cities	Philadelphia	Los Angeles	Twin Cities
8	Atlanta	Phoenix	Seattle	Portland	Seattle
9	Miami	Detroit	San Jose	Seattle	Boston
10	Boston	San Francisco	Denver	San Jose	San Jose
11	San Francisco	Denver	Portland	Boston	Los Angeles
12	Detroit	Washington	Milwaukee	Twin Cities	Salt Lake City
13	Phoenix	Las Vegas	Twin Cities	Salt Lake City	Philadelphia
14	Twin Cities	Philadelphia	Salt Lake City	Phoenix	Columbus
15	Seattle	Salt Lake City	Baltimore	Detroit	Miami

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9	Miami	Detroit	San Jose	Seattle	Boston
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11	San Francisco	Denver	Portland	Bosto +2	Los Angeles
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4	Dallas	San Jose	Washington	Denver	Denver
5	Houston	Chicago	Boston	Philadelphia	Washington
6	Philadelphia	Houston	Los Angeles	Washington	Portland
7	Washington	Twin Cities	Philadelphia +7	Los Angeles	Twin Cities +7
8	Atlanta	Phoenix	Seattle	Portland +6	Seattle
9	Miami	Detroit	San Jose	Seattle	Boston
10	Boston	San Francisco	Denver	San Jose	San Jose
11	San Francisco	Denver	Portland	Boston	Los Angeles
12	Detroit	Washington	Milwaukee	Twin Cities	Salt Lake City
13	Phoenix	Las Vegas	Twin Cities	Salt Lake City	Philadelphia
14	Twin Cities	Philadelphia -8	Salt Lake City	Phoenix	Columbus
15	Seattle	(23) Seattle	Baltimore	Detroit	Miami

Conclusions

- Multimodal access is measurable with today's data and tools
  - Compare common performance metric across modes
  - Data requirements and technical parameters vary across modes
  - Detailed measurement can reveal large-scale patterns
- Access can be used for
  - Performance management
  - Planning
- Access enhances existing metrics
  - Congestion
  - Service Frequency
  - Level of Traffic Stress

Questions & Discussion

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