Multi-modal applications of destination access

Research Highlights from the Accessibility Observatory

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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
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
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

I-35W North & I-94 East impact zone: 11.2%
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

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<tr>
<th></th>
<th>15 min</th>
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<th>45 min</th>
<th>60 min</th>
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<td>+245</td>
<td>+3,532</td>
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<td>Absolute Change—blocks within ½ mile of transit stops</td>
<td>+426</td>
<td>+6,129</td>
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<td>Percent Change—Metro</td>
<td>+5.9%</td>
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<td>Percent Change—blocks within ½ mile of transit stops</td>
<td>+10.3%</td>
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<td>+9.8%</td>
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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)
- Residential streets
- Off-street facilities
- Protected facilities

LTS 2 (low stress)
- 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

LTS 1: Green
LTS 2: Blue
LTS 3: Orange
LTS 4: Red
Accessibility across LTS levels

- LTS 1
- LTS 2
- LTS 3
- LTS 4

Jobs within 30 minutes (Bike):
- 0 - 1,000
- 1,000 - 2,500
- 2,500 - 5,000
- 5,000 - 7,500
- 7,500 - 10,000
- 10,000 - 25,000
- 25,000 - 50,000
- 50,000 - 75,000
- 75,000 - 100,000
- 100,000 - 250,000
- 250,000 - 500,000
- 500,000 - 750,000
- 750,000 - 1,000,000
- 1,000,000 - 2,500,000
- 2,500,000 - 5,000,000
- 5,000,000 - 7,500,000
- 7,500,000 - 10,000,000
- 10,000,000 +
Metrics - Data and Rankings

Biking Job Accessibility by Travel Time Threshold

1-Year Change in Biking Job Accessibility by Travel Time Threshold
Metrics - Bike Network Performance

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

**Minneapolis**
Minneapolis-St. Paul-Bloomington, MN-WI

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

- 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

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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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