ACCESSIBILITY AND BEHAVIOR IMPACTS OF BUS-HIGHWAY SYSTEM INTERACTIONS

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TRANSPORTATION ADVISORY BOARD, OCTOBER 16TH, 2019
PROJECT BACKGROUND

• **Project Goal:** To improve accessibility calculation capabilities by integrating data about highway bus operations, park-and-ride facilities, and travel + parking costs for automobile and transit modes.

• **Project Outcome:** A deeper understanding of auxiliary transportation facilities and how they affect time-based and cost-based accessibility for the Twin Cities region.
ACCESSIBILITY AS A PERFORMANCE MEASURE

• Accessibility is a measure of the ease of reaching destinations and activities.

• Accessibility accounts for the cost of travel (time, money, lost opportunity) AND the benefits (reaching valuable destinations).

• **For example:** Workers at the MnDOT central office have access to >100,000 jobs by transit within 30 minutes during the morning peak hours.
EXPRESS BUS ON EXISTING MANAGED LANE NETWORK

Worker-weighted average percent change—30 minutes travel: 1.44%

Impact zone worker-weighted average percent change—30 minutes travel: 12.96%
EXPRESS BUS ON FUTURE MANAGED LANE NETWORK

Worker-weighted average percent change – 60 minutes

I-35W North Impact Zone 12.1%
I-94 East Impact Zone 3.92%
I-35W North & I-94 East Impact zone 11.2%
PARK-AND-RIDE ACCESSIBILITY RESULTS

- Worker-weighted average access: 51,900 jobs
- 3x the access of walk-up transit for the average commuter.
- Worker-weighted PNR accessibility as a percent of auto accessibility – 30 minutes travel: 4.47%
CONCLUSIONS FROM TIME-BASED ACCESSIBILITY ANALYSES

• The Park-and-Ride accessibility profile is a blend of auto and transit profiles. See 30 minute examples below.
CONCLUSIONS FROM TIME-BASED ACCESSIBILITY ANALYSES

- Suburbs near dense park-and-ride zones have greater job accessibility by park-and-ride mode compared to transit.
CONCLUSIONS FROM TIME-BASED ACCESSIBILITY ANALYSES

- Park-and-ride is more competitive than transit at every travel time threshold due to increased suburban and exurban access to transit.
  - Access to a vehicle improves access to transit.

<table>
<thead>
<tr>
<th></th>
<th>15min</th>
<th>30min</th>
<th>45min</th>
<th>60min</th>
<th>75min</th>
<th>90min</th>
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</thead>
<tbody>
<tr>
<td>Transit</td>
<td>0.58%</td>
<td>1.15%</td>
<td>3.65%</td>
<td>7.76%</td>
<td>8.06%</td>
<td>7.98%</td>
</tr>
<tr>
<td>Park-and-ride</td>
<td>0.71%</td>
<td>4.47%</td>
<td>16.15%</td>
<td>26.01%</td>
<td>30.67%</td>
<td>32.78%</td>
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*Table 1. Transit and park-and-ride accessibility as a percent of automobile accessibility.*
COMPREHENSIVE ACCESSIBILITY IMPACTS OF BUS-HIGHWAY FACILITIES
COMBINED ML AND PNR SCENARIOS

- Scenario shows how bus-highway facilities impact the transit accessibility profile as a whole

<table>
<thead>
<tr>
<th>Scenario</th>
<th>10min</th>
<th>20min</th>
<th>30min</th>
<th>40min</th>
<th>50min</th>
<th>60min</th>
<th>Time-weighted Avg</th>
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<tbody>
<tr>
<td>Walk-up Transit</td>
<td>469</td>
<td>3,856</td>
<td>15,868</td>
<td>42,628</td>
<td>84,894</td>
<td>140,086</td>
<td>5,123</td>
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<tr>
<td>Walk-up Transit + ML</td>
<td>469</td>
<td>3,873</td>
<td>16,297</td>
<td>44,431</td>
<td>88,504</td>
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<tr>
<td>PNR</td>
<td>162</td>
<td>6,581</td>
<td>51,902</td>
<td>180,053</td>
<td>340,666</td>
<td>459,408</td>
<td>17,948</td>
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<tr>
<td>PNR + ML</td>
<td>196</td>
<td>7,609</td>
<td>57,987</td>
<td>197,553</td>
<td>359,499</td>
<td>473,474</td>
<td>19,277</td>
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</table>

Table 1. Worker weighted average job accessibility for bus-highway facilities during the morning peak hours 6 – 9 AM.

Example interpretation
The average worker can reach 57,987 jobs in 30 minutes of travel by park-and-ride and use of managed lanes.
ACCESSIBILITY AT 30 MINUTES TRAVEL TIME

1. Baseline walk-up transit
2. Walk-up transit + managed lanes
3. Park-and-ride
4. Park-and-ride + managed lanes
MEASURING ACCESSIBILITY COMPETITIVENESS

Competitiveness ratio =
\[
\frac{\text{Mode } X \text{ Accessibility}}{\text{Auto Accessibility}}
\]

<table>
<thead>
<tr>
<th>Mode</th>
<th>10min</th>
<th>20min</th>
<th>30min</th>
<th>40min</th>
<th>50min</th>
<th>60min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk-up Transit</td>
<td>0.58%</td>
<td>0.62%</td>
<td><strong>1.15%</strong></td>
<td>2.59%</td>
<td>4.87%</td>
<td>7.76%</td>
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<tr>
<td>Walk-up Transit + ML</td>
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<td>0.62%</td>
<td>1.18%</td>
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<tr>
<td>PNR</td>
<td>0.28%</td>
<td>1.38%</td>
<td>4.47%</td>
<td>11.69%</td>
<td>20.19%</td>
<td>26.01%</td>
</tr>
<tr>
<td>PNR + ML</td>
<td>0.33%</td>
<td>1.54%</td>
<td>4.97%</td>
<td>12.84%</td>
<td>21.35%</td>
<td>26.85%</td>
</tr>
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**Figure 2.** The minimum worker weighted average job accessibility of bus-highway facilities as a percent of automobile accessibility during the morning peak hours of 6 – 9 AM.

Example interpretation
The average worker traveling by walk-up transit can reach 1.15% of the jobs that automobile can reach in 30 minutes.
ACCESSIBILITY COMPETITIVENESS RATIO AT 30 MINUTES OF TRAVEL TIME

1. Baseline walk-up transit

2. Walk-up transit + managed lanes

3. Park-and-ride

4. Park-and-ride + managed lanes
MANAGED LANE IMPACT ZONES

Impacts of MLs on walk-up transit accessibility – 30 minutes

1. Zones that gained at least 15,000 jobs
2. Zones that increased accessibility by 25%

Impacts of MLs on park-and-ride accessibility – 30 minutes

3. Zones that gained at least 15,000 jobs
4. Zones that increased accessibility by 25%
TAKEAWAYS
TAKEAWAYS

- Managed lane use by transit vehicles improves accessibility for those living within a half-mile of a transit stop.
- The regional park-and-ride system improves transit accessibility for those with access to a vehicle.
- Park-and-ride clusters that are easily accessed from the freeway and give riders multiple transit route options have greater transit accessibility compared to surrounding areas.
- Park-and-ride facilities make public transit more competitive with automobile commuting in the suburbs when considering access to jobs.
- The park-and-ride accessibility profile is a blend of automobile and transit accessibility patterns across the Twin Cities metropolitan region.
- Coupling park-and-rides with express bus on managed lanes offers a substantial accessibility improvement for Twin Cities workers compared with walk-up transit alone.
- Monetary accessibility reveals areas where transit is more competitive with auto when money and time are considered independently and together.
CONTACT

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