Today’s Presentation

• MN Bicycle and Pedestrian Counting Initiative
  – Research objectives and guiding principles
  – Trends in non-motorized traffic monitoring
  – Bicycle and pedestrian monitoring in Minnesota
  – Guidance for short duration manual field counts
  – Short duration counts: pilot project results
  – Analyses of continuous counts
  – Conclusions and recommendations
Thanks and Acknowledgements

Project Champion and Leader
- Lisa Austin, MnDOT

Technical Advisory Committee
- Lisa Bingham, MnDOT District 7
- Simon Blenski, City of Minneapolis
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- Rob Ege, MnDOT District 1 - State Aid
- Brad Estochen, MnDOT Traffic Safety
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- Matt Johnson, RDC Mid-Minnesota Development Center

- Tim Kelly, DNR Research
- Muhammad Khan, Olmsted County
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- Gina Mitteco, MnDOT Metro District Bike/Ped Coordinator
- Gordy Pherson, Dept. of Public Safety
- Bobbi Retzlaff, MnDOT Multimodal Planning
- Dan Warzala, MnDOT Research Services
- Jan Youngquist, Met Council

Additional Project Advisers
- Greta Alquist, MnDOT
- Mitzi Baker, Olmsted County
- Matthew Dyrdahl, MDH
- Alan Rindels, MnDOT Research
- Fay Simer, MnDOT
- Chu Wei, MnDOT
MN Bike and Ped Counting Initiative

- Research objective
  - Develop consistent methods for monitoring bicycle and pedestrian traffic in Minnesota

- Guiding principles
  - Integrate with motor vehicle count program
  - Build on experience
  - Produce practical products for practitioners
  - Provide for institutional sustainability
Trends in Non-motorized Traffic Monitoring

- Rapidly growing interest across nation
- Local leadership in initiating monitoring
- New commercially available technologies
- National Bike and Ped Documentation Project
- FHWA Traffic Monitoring Guide
- TRB Bike and Ped Data Subcommittee
- NCHRP 7-19 research study: Methods and Technologies for Collecting Pedestrian and Bicycle Volume Data
National Bike & Ped Documentation Project

(http://bikepeddocumentation.org/)

• Voluntary initiative
• Sponsors
  – Institute of Traffic Engineers & Alta Planning + Design
• Purpose
  – “provide consistent model of data collection and ongoing data for use by planners, governments, and bicycle and pedestrian professionals”
• Focus
  – Manual, semi-annual field counts, evening peak hours
    (September, May: 4 – 6:00 p.m.; Tu., W. & Th.)
FHWA Traffic Monitoring Guide

- TMG is authoritative guidebook used by all state DOTs to guide vehicular traffic monitoring
- Chapter 4 Non-motorized Traffic (DRAFT)
  - Based on vehicular traffic monitoring principles
  - Describes unique aspects of non-motorized traffic
  - Reviews technologies for automated counting
  - Describes complementary roles of continuous and short-duration monitoring
- Represents new initiative to institutionalize non-motorized traffic monitoring
FHWA Traffic Monitoring Guide

- **Continuous monitoring**
  1. Review existing continuous count program
  2. Develop inventory of count locations and equipment
  3. Determine traffic patterns to monitor
  4. Establish pattern/factor groups
  5. Determine number of continuous monitoring locations
  6. Select specific count locations
  7. Compute monthly, day-of-week, and hourly adjustment factors

- **Short-duration monitoring**
  1. Select count locations
  2. Choose whether screen-line or intersection counts
  3. Determine duration of counts
    a. Determine whether manual or automated
    b. Consider count magnitude, variability
    c. Consider weather
  4. Determine months for counting
  5. Determine factoring methods
<table>
<thead>
<tr>
<th>Monitoring Organization / Type of Monitoring</th>
<th>Vehicular Monitoring Sites</th>
<th>Bike &amp; Ped Monitoring Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MnDOT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automated, continuous reference monitors</td>
<td>± 1,000</td>
<td>0</td>
</tr>
<tr>
<td>Short-duration (48 hour)</td>
<td>± 31,000</td>
<td>0</td>
</tr>
<tr>
<td>Total sites</td>
<td>± 32,000</td>
<td>0</td>
</tr>
<tr>
<td><strong>Local Governments &amp; Nonprofits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automated, continuous reference monitors</td>
<td>NA / MnDOT</td>
<td>± 10</td>
</tr>
<tr>
<td>Short-duration locations (2 – 12 hour, misc.)</td>
<td>NA / MnDOT</td>
<td>± 500</td>
</tr>
<tr>
<td>Total sites</td>
<td>NA / MnDOT</td>
<td>± 500*</td>
</tr>
</tbody>
</table>

*Excludes monitoring by recreational agencies
# Bike & Ped Monitoring in Minnesota

<table>
<thead>
<tr>
<th>MN Agency</th>
<th>Bikes</th>
<th>Peds</th>
<th>Mixed-mode (bikes &amp; peds)</th>
<th>Manual (locations)</th>
<th>Automated Technology (locations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met Council &amp; local park districts – user visits</td>
<td>X</td>
<td>X</td>
<td></td>
<td>± 500 trail segments</td>
<td></td>
</tr>
<tr>
<td>Minneapolis Dept. of Public Works</td>
<td>X</td>
<td>X</td>
<td></td>
<td>± 250 streets, sidewalks</td>
<td>3 inductive loops on trails</td>
</tr>
<tr>
<td>Minnesota Dept. of Natural Resources</td>
<td>X</td>
<td>X</td>
<td></td>
<td>12 state-owned trails</td>
<td></td>
</tr>
<tr>
<td>Transit for Livable Communities</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>± 400 streets, sidewalks</td>
<td>1 passive infrared on sidewalk</td>
</tr>
<tr>
<td>Three Rivers Park District</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>District trail segments</td>
<td>Passive infrared on trails</td>
</tr>
<tr>
<td>UMN, Minneapolis Park and Recreation Board, and MDPW</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>6 active infrared on trails</td>
</tr>
</tbody>
</table>
MnDOT Guidance for Short Duration Manual Field Counts

- Based on MDPW, TLC, NBPDP protocols
- MnDOT guidance (http://www.dot.state.mn.us/bike/)
  - Count Manager Training (PowerPoint, 11 MB)
  - Volunteer Training (PowerPoint, 3 MB)
  - Count Form
  - Public Information Sheet
  - Check Lists
  - Site Location Coordinates
  - Reporting Spreadsheet
Short Duration Counts: Pilot Project Results

- 6 training workshops
  - 75 participants
- Counts in 43 communities*
  - 5% of MN municipalities
  - 25% municipalities > 10,000
  - 30 MDH SHIP grantees required to participate
- Counts in 133 locations
- Counts for 848 hours
  - p.m. peak hour, mid-week days

*Excluding Minneapolis, which has well-established monitoring program.
More than 25% of Minnesota Municipalities over 10,000 Population Participated

<table>
<thead>
<tr>
<th>City Population Class</th>
<th>Cities in Class</th>
<th>Communities in Pilot Counts</th>
<th>Cities % of Population Class in Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. &gt; 100,000</td>
<td>4</td>
<td>3*</td>
<td>75%</td>
</tr>
<tr>
<td>II. 20,001 – 100,000</td>
<td>51</td>
<td>12</td>
<td>25%</td>
</tr>
<tr>
<td>III. 10,001 – 20,000</td>
<td>40</td>
<td>10</td>
<td>24%</td>
</tr>
<tr>
<td>IV. ≤ 10,000</td>
<td>758</td>
<td>18</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>853</strong></td>
<td><strong>43</strong></td>
<td><strong>5%</strong></td>
</tr>
</tbody>
</table>
• Most counts taken on Tues, Wed, or Thurs at 4:00 or 5:00 p.m.
### Hourly Bikes & Peds: All Cities, All Times

<table>
<thead>
<tr>
<th>Mode</th>
<th>Mean Hourly Count</th>
<th>Median Hourly Count</th>
<th>Maximum Hourly Count</th>
<th>Percent Hours = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycles</td>
<td>7.5</td>
<td>4</td>
<td>104</td>
<td>14.0%</td>
</tr>
<tr>
<td>Pedestrians</td>
<td>19.3</td>
<td>8</td>
<td>322</td>
<td>6.7%</td>
</tr>
</tbody>
</table>

**Mean Hourly Bicycle and Pedestrian Traffic, by City Class**

- Little difference in hourly bike and ped volumes in Class II – Class IV municipalities.
Class I Cities: Mean Hourly Bicycle and Pedestrian Traffic by Road Type

Class II Cities: Mean Hourly Bicycle and Pedestrian Traffic by Road Type

Class III Cities: Mean Hourly Bicycle and Pedestrian Traffic by Road Type

Class IV Cities: Mean Hourly Bicycle and Pedestrian Traffic by Road Type
MnDOT Survey of Count Managers

• Communities counted to
  – Fulfill MDH requirements (30 of 43 participants)
  – To assess infrastructure improvements
  – To monitor Safe Routes to Schools
  – To increase understanding of bicycle and pedestrian traffic

• Participants included diverse organizations

• Counting done by mix of employees and volunteers

• Volumes of bikes and peds about as expected.

• The MnDOT training materials useful
  – Reporting worksheet needs improvement

• Data collected being used in grant applications
Analyses of Automated Continuous Counts

• Analyze continuous counts of mixed-mode traffic on multiuse trails in Minneapolis (2011)
• Measure variability in bike & ped traffic
• Calculate adjustment factors for extrapolating short duration counts
• Estimate average daily bicyclists, pedestrians, or mixed-mode traffic
• Estimate annual trail miles traveled
Automated Traffic Counters on Multiuse Trails in Minneapolis

Typical Monitoring Site: Midtown Greenway
## Average Annual Daily Bicycle & Pedestrian Traffic

<table>
<thead>
<tr>
<th>Location / Mode</th>
<th>Location</th>
<th>Estimated Total Annual Traffic</th>
<th>Estimated AADT</th>
<th>Percent of Traffic at Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Hennepin Ave. &amp; Midtown Greenway (MGW)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bicycle</td>
<td>629,262</td>
<td>1,724</td>
<td>87%</td>
<td></td>
</tr>
<tr>
<td>b. Pedestrian</td>
<td>91,451</td>
<td>251</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>c. Total – mixed-mode</td>
<td>720,714</td>
<td>1,975</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>(2) West River Pkwy &amp; MGW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bicycle</td>
<td>320,198</td>
<td>877</td>
<td>96%</td>
<td></td>
</tr>
<tr>
<td>b. Pedestrian</td>
<td>13,196</td>
<td>36</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>c. Total – mixed-mode</td>
<td>333,395</td>
<td>913</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>(3) Cedar Ave. &amp; MGW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Total – mixed-mode</td>
<td>738,336</td>
<td>2,023</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>(4) Lake Calhoun Parkway*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bicycle (outer)</td>
<td>494,209</td>
<td>1,354</td>
<td>38%</td>
<td></td>
</tr>
<tr>
<td>b. Pedestrian (inner)</td>
<td>814,434</td>
<td>2,231</td>
<td>62%</td>
<td></td>
</tr>
<tr>
<td>c. Total – mixed-mode</td>
<td>1,308,643</td>
<td>3,613</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>(5) Lake Nokomis Parkway*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bicycle (outer)</td>
<td>193,843</td>
<td>531</td>
<td>36%</td>
<td></td>
</tr>
<tr>
<td>b. Pedestrian (inner)</td>
<td>344,604</td>
<td>944</td>
<td>64%</td>
<td></td>
</tr>
<tr>
<td>c. Total – mixed-mode</td>
<td>538,448</td>
<td>1,475</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>(6) Wirth Parkway – mixed-mode</td>
<td>116,765</td>
<td>320</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td><strong>Six Location Mixed-Mode Total</strong></td>
<td><strong>3,756,301</strong></td>
<td><strong>10,291</strong></td>
<td><strong>100%</strong></td>
<td></td>
</tr>
</tbody>
</table>
Monthly Mixed Mode Traffic Patterns

Monthly mean daily traffic

Monthly/annual mean daily traffic

Monthly/annual mean daily traffic by mode

- Mixed mode traffic varied by an order of magnitude across sites.
- Monthly to annual mean daily traffic ratios generally were consistent across sites.
- Bicycle traffic is characterized by greater seasonality than pedestrian traffic.
Mixed mode: six monitoring sites

- Mixed-mode day of week scaling factors generally are consistent across locations with higher traffic on weekend days.

- Bicycle day of week factors vary by location, with greater weekend traffic ratios at recreational sites around lakes.

- Pedestrian do not appear to vary as much as bicycle factors but reflect greater day-of-week variability.

Bikes: recreational and greenway trail sites

Peds: recreational and greenway trail sites
Weekday and Weekend Hourly Traffic (%)

Midtown Greenway Hennepin

Lake Calhoun Trail

Weekdays

Weekends
<table>
<thead>
<tr>
<th>Step in Process</th>
<th>Example Value or Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Obtain February 2012 sample short duration count (48 hours)</td>
<td>• Fri: 175</td>
</tr>
<tr>
<td></td>
<td>• Sat: 250</td>
</tr>
<tr>
<td>2. Look up 2011 February day of week factors</td>
<td>• Fri: 1.04</td>
</tr>
<tr>
<td></td>
<td>• Sat: 1.27</td>
</tr>
<tr>
<td>3. Calculate 48-hour adjustment factor</td>
<td>Sample 48-hour factor = (1.04+1.27) / 2 = 1.16</td>
</tr>
<tr>
<td>4. Calculate 2012 February monthly average daily traffic from 48-hour adjustment factor</td>
<td>(175 + 250) = 183 / 1.16</td>
</tr>
<tr>
<td>5. Look up 2011 February factor</td>
<td>0.18</td>
</tr>
<tr>
<td>(Feb average daily traffic / annual average daily traffic)</td>
<td></td>
</tr>
<tr>
<td>6. Calculate the 2012 annual average daily traffic</td>
<td>(183 / 0.18) = 1,023</td>
</tr>
<tr>
<td>7. Use 2012 annual average daily traffic to calculate annual traffic volume.</td>
<td>1,023*365 = 373,422</td>
</tr>
</tbody>
</table>
Observations and Conclusions

- Increasing interest in monitoring
- New guidance for monitoring
- New research on monitoring protocols and development of adjustment factors
- Important to following established principles of traffic monitoring (e.g., FHWA TMG)
  - Determine purposes of monitoring
  - Establish reference sites using continuous, automated monitoring technologies
  - Determine locations for short-duration counts
  - Determine mix of automated and manual field counts
  - Use factors from continuous sites
Observations and Conclusions

- Minnesota communities engaged in continuous and short duration counting
- MnDOT pilot field counts successful in engaging more communities
- Analyses of continuous counts demonstrates potential for factoring and estimation of annual non-motorized traffic
- Many newer counting technologies not yet deployed in Minnesota
TAP Recommendations

1. Continue coordination of statewide bike & ped field counts
2. Improve methods for reporting results
3. Demonstrate the feasibility of automated technologies
   - Inductive loop detectors for counting bikes on streets
   - Pneumatic tubes for short duration counts of bikes on streets
   - Infrared counters for counting peds on sidewalks
   - Integrated loop detectors and infrared monitors for counts on trails
4. Begin integration of non-motorized and vehicular count databases
5. Work with local governments to
   - Establish network of permanent, automated continuous monitoring sites
   - Develop data for factoring and extrapolating short duration counts
   - Share and deploy new technologies for short duration monitoring
MnDOT Bike and Ped Counting Initiative: Implementation Phase

• Continue support of manual field counts
  – May, Sept. 2013
  – Partners include MDH and many local communities

• Demonstrate the feasibility of automated technologies
  – Local partners include Bemidji, Duluth, Minneapolis, Rochester, Rosemount
  – State partners include MDNR, MDH
  – National partners include NCHRP study (Minneapolis test sites)

• Begin integration of non-motorized and vehicular count databases

• Final results expected in January 2015
### Automated Technologies to Be Tested

<table>
<thead>
<tr>
<th>Technology</th>
<th>Manufacturer</th>
<th>Mode: Infrastructure</th>
<th>Collaborators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Permanent Equipment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inductive loop</td>
<td>Eco Counter Zelt</td>
<td>Bikes: streets, roads</td>
<td>MnDOT, Duluth, Minneapolis</td>
</tr>
<tr>
<td>Inductive loop</td>
<td>Eco Counter Zelp (bidirectional)</td>
<td>Bikes: multiuse trails</td>
<td>Rochester</td>
</tr>
<tr>
<td>Integrated passive infrared and inductive loop</td>
<td>Eco Multi</td>
<td>Bikes &amp; peds: multiuse trails</td>
<td>Rochester, Duluth, DNR</td>
</tr>
<tr>
<td><strong>Portable Equipment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumatic tubes</td>
<td>Metro Count MC 5600</td>
<td>Bikes: varies</td>
<td>MnDOT, DNR, Bemidji, Rosemount</td>
</tr>
<tr>
<td>Microwave</td>
<td>Chambers Electronics RBBP7</td>
<td>Bike &amp; Ped: mixed mode</td>
<td>Duluth, Rochester</td>
</tr>
</tbody>
</table>
Questions?

Thank you for attending!

For more information contact:

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