Making It Count:
Bike and Pedestrian
Data Collection and Analysis

Lisa Austin and Jasna Hadzic – MnDOT; Greg Lindsey – UMN
Video
Minnesota: Where Every Step Counts
Non-motorized Traffic Monitoring
Background

- National Bike and Ped Documentation Project
  - Manual Counts with volunteers
- MnDOT Research Project
- NCHRP 7-19 study: Methods and Technologies for Collecting Pedestrian and Bicycle Volume Data
- FHWA Traffic Monitoring Guide
2050 Vision – Minnesota Go:
  - Achieve a multimodal transportation system that benefits the health of people, the environment, and our economy.

Complete Streets:
  - Understand vehicle, bicycle, and pedestrian interactions
  - Achieve transportation goals listed in statute

Toward Zero Deaths:
  - Assess exposure and effectiveness of safety programs

Performance measures:
  - Increase bicycling, walking, and transit
MnDOT Bike & Ped Counting Initiative

- Research and implementation projects
  - Develop consistent methods for monitoring non-motorized traffic in Minnesota
  - Encourage communities to monitor bikes & pedestrians
  - Provide training, and technical support for local monitoring programs
    - Guidance for manual field counts
    - Support for automated counting programs
  - Create central repository for count data
Guiding principles

- Integrate with motor vehicle count program
- Build on experience (FHWA, TMG; NBPDP)
  - FHWA Traffic Monitoring Guide
- Produce practical products for practitioners
- Provide for institutional sustainability
Stakeholders and Partners

MnDOT
- Lisa Austin – TL – Bike/Ped
- Jasna Hadzic – TL – Bike/Ped
- Gene Hicks – TDA
- Jim Miles D-1 – Traffic Forecasting
- Bobbie Retzlaff – MnDOT Planning
- Melissa Barnes– Traffic Engineer
- Bruce Holdhusen – MnDOT Research
- Gina Mitteco – MnDOT Metro
- Greta Alquist – MnDOT Bike Plan
- Carson Gorecki – Equipment
- Mark Flinner – TRADAS
- Tim Mitchell – Bike/Ped Section Supervisor

PRINCIPAL INVESTIGATOR
- Greg Lindsey – U of M

PARTNERS
- Simon Blenski – City of Minneapolis
- James Gittimeier – Duluth Superior MIC
- Tim Kelly – DNR
- Muhammad Khan – Olmsted County
- Amber Dallman – MDH
- Heidi Schallberg – MetCouncil
- Thomas Mercier – Three Rivers Park District
- Reuben Collins – City of Saint Paul
- Hennepin County
- TLC

CONSULTANT
- Erik Minge – SRF
Why Count?

- Monitor trends in bicycle and pedestrian traffic
- Determine crash rates and assess safety
- Measure effects of road designs and traffic controls
- Project use of new facilities
- Measure effects of campaigns and promotions
- Assess economic impacts
- Inform investment decisions
Institutionalizing within MnDOT

- Pedestrian Plan
  Spring 2014 – Winter 2015
  - Data collection methodology
  - Measuring progress
    - Usage (frequency)
    - Safety (crash rates)

- Bicycle Plan
  Spring 2013 – Winter 2014/15
  - Prioritizing investments
  - Measuring progress
    - Usage (AADT, “BMT”)
    - Safety (crash rates)
Automated Counting Equipment
## Counters Purchased for Testing

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>TECHNOLOGY</th>
<th>VENDOR AND MODEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle Counter – Portable</td>
<td>Pneumatic Tubes</td>
<td>Metro Count MC 5600</td>
</tr>
<tr>
<td>Bicycle Counter – Permanent (on shoulder or bike lane)</td>
<td>Inductive Loops</td>
<td>Eco Counter ZELT Inductive loops</td>
</tr>
<tr>
<td>Bicycle Counter – Permanent (on trail)</td>
<td>Inductive Loops</td>
<td>Eco Counter ZELT Inductive loops</td>
</tr>
<tr>
<td>Pedestrian Counter – Portable</td>
<td>Microwave</td>
<td>Chambers Electronics RBBP7</td>
</tr>
<tr>
<td>Bicycle AND Pedestrian Counter – Permanent</td>
<td>passive Infrared and Inductive Loops</td>
<td>Eco Counter MULTI</td>
</tr>
</tbody>
</table>
Counters Purchased for Testing

Eco Counter ZELT
Inductive Loop – Bicycles: Shoulder or Bike Lane

Metro Count MC 5600
Pneumatic Tubes - Bicycles

Chambers Electronics
Microwave – Pedestrians
Permanent Counters - Equipment

- Eco-Counter Equipment:
  - Eco Counter ZELT Inductive Loops (Lane or Shoulder):
    - Duluth – Scenic 61
    - Minneapolis – Central Ave
    - Eagan – TH 13
  - Passive Infrared and Inductive Loop
    - Eco Multi – with tape loops:
      - Rochester
    - Eco Multi – with saw cut loops:
      - Duluth Lake Walk
      - Browns Creek - DNR
Permanent Counters – Metro

Eco Counter ZELT Inductive Loops:
Minneapolis – Central Avenue NE

Eco Counter ZELT Inductive Loops:
Eagan – TH 13 near Lone Oak Road
Eco Counter ZELT Inductive Loops:
Minneapolis – Central Avenue NE SB & NB

Eco Counter ZELT Inductive Loops:
Brick removal/heavy duty hand holes required
Permanent Counters - Eagan

Eco Counter ZELT Inductive Loops:
Eagan – TH13 near Lone Oak Road SB & NB
Permanent Counters – Duluth 1

Eco Multi with saw cut loops & microwave chambers for pedestrian count validation

Eco Multi & microwave chambers:
Duluth – Lake Walk
Permanent Counters – Duluth 2

Eco Counter ZELT Inductive Loops: Duluth – Scenic 61

North of Duluth to better capture commuter traffic
Semi Permanent & Portable Counters – Rochester

Location: Count Station “018”
Bike/Ped Bridge Over Highway 14 West
Semi Permanent Equipment

Location: Count Station “019”
Bike/Ped Bridge Over Silver Lake
Portable Equipment
Portable Counters – Locations

- **Pneumatic Tubes:**
  - Currently being tested in Hennepin County
  - Metro
  - Will be ready for statewide use early next summer:
    - Gateway Trail – DNR
    - I-35 Bong Bridge – MnDOT
    - Ped. Bridge Over I-35 – Duluth
    - Bemidji
    - Rosemount

- **Microwave:** currently being tested
  - Rochester
  - Metro – Trail segment along I-94
  - Hennepin County
  - Bong Bridge and Ped. Bridge – Duluth
  - And many more

Location: CSAH 066/Broadway St NE & TH 65/Central Ave for Hennepin County
HERE I WILL ADD DATA FROM HENNEPIN COUNTY, TEST DATA FROM METROCOUNT, AND RESULTS FROM CENTRAL AVE AND EAGAN.
## Test Deployment: Chambers RadioBeam Bicycle & People Counter (RBBP8)

**MnDOT I–94 Trail** (near Manning Road)  
(9/30/13 – 10/7/13)

<table>
<thead>
<tr>
<th>Traffic Mode</th>
<th>Weekday Mean</th>
<th>Weekend Mean</th>
<th>Daily Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle</td>
<td>11.5</td>
<td>5</td>
<td>9.9</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>2</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>13.5</strong></td>
<td><strong>6</strong></td>
<td><strong>11.6</strong></td>
</tr>
</tbody>
</table>
Hennepin County Collaboration in Portable Equipment Tests

- Identified 16 locations to test
  - Minneapolis, 1st & 2nd ring suburbs, rural
  - Streets with/without bike lanes, range of AADTs
  - Multiuse trails
- Deployed equipment at most locations
- Preliminary results for both Chambers and Metrocount devices
- Have video for validation and calibration of counters at six sites (not yet done)
## Hennepin County Test Sites

<table>
<thead>
<tr>
<th>Location</th>
<th>Bike Facility Type</th>
<th>County Location</th>
<th>Counter (v=video)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSAH 35 (Portland Ave S), S of 55th St E</td>
<td>On-road bikeway (bike lane)</td>
<td>Minneapolis</td>
<td>MetroCount (v)</td>
</tr>
<tr>
<td>CSAH 66 (Broadway St NE), E of TH65 (Central Ave NE)</td>
<td>No bikeway, ADT &gt;10,000</td>
<td>Minneapolis</td>
<td>MetroCount (v)</td>
</tr>
<tr>
<td>CSAH 53 (66th St W), W of CSAH 52 (Nicollet Ave), Richfield</td>
<td>No bikeway, ADT &gt;10,000</td>
<td>1st Ring Suburban</td>
<td>MetroCount</td>
</tr>
<tr>
<td>CSAH 27 (Stinson Blvd NE), N of CSAH 52 (Hennepin Ave NE)</td>
<td>Off-road Trail</td>
<td>Minneapolis</td>
<td>MetroCount (v) Chambers</td>
</tr>
<tr>
<td>CSAH 3 (Excelsior Blvd), W of CSAH 61 (Shady Oak Rd), Minnetonka</td>
<td>On-road bikeway (shoulder)</td>
<td>2nd Ring Suburban</td>
<td>MetroCount</td>
</tr>
<tr>
<td>Shingle Creek Parkway, W of CSAH 10 (Bass Lake Rd), Brooklyn Center</td>
<td>Off-road Trail</td>
<td>1st Ring Suburban</td>
<td>MetroCount (v) Chambers</td>
</tr>
<tr>
<td>CSAH 35 (Portland Ave S), S of 3rd St S</td>
<td>On-road bikeway (bike lane)</td>
<td>Minneapolis</td>
<td>MetroCount (v)</td>
</tr>
<tr>
<td>CSAH 33 (Park Ave S), S of 3rd St S</td>
<td>On-road bikeway (bike lane)</td>
<td>Minneapolis</td>
<td>MetroCount (v) Chambers</td>
</tr>
<tr>
<td>CSAH 5 (Minnetonka Blvd.), W of Honeywood Ln, Hopkins</td>
<td>Off-road Trail</td>
<td>2nd Ring Suburban</td>
<td>MetroCount Chambers</td>
</tr>
<tr>
<td>CSAH 19, S of Larsen Rd., Corcoran</td>
<td>Off-road Trail</td>
<td>Rural</td>
<td>MetroCount</td>
</tr>
</tbody>
</table>
Hennepin County Chambers Tests

- Tested on 3 multi-use trails, obtained useful data
- Daily volumes varied by an order of magnitude across sites
- Mode-mix varied by location
- Hourly volumes reflect both utilitarian and recreational traffic patterns (potential factor groups)
- Still need to validate and calibrate counters
Hennepin County Chambers Tests: Variation in daily trail volumes

Figure 1. Measured, non-validated mean daily volumes, Chambers.
Figure 2. Measured, non-validated mean daily volumes, Chambers (detail Shingle Creek and Minnetonka).
Figure 3. Weekday bicycle hourly distribution, Chambers.
Figure 5. Weekday pedestrian hourly distribution, Chambers.
Hennepin County Chambers Tests: Lessons Learned

- Installation
  - Limited to off-road trails
    - Maximum spacing of 10ft
  - More involved than Metrocount installation
    - May require driving steel posts into the ground
    - Difficult to vertically align
  - Long-term durability of plastic housings not yet demonstrated
- Distinguishes between pedestrians and cyclists
- Data stored in bins of adjustable duration
- Clean, modern data-logging software with simple data export
Hennepin County Metrocount Tests: Interpretation of Counts

- Metrocount devices
  - Provide time stamps, speed, wheel base, etc.
  - Classify vehicles in different schemes (e.g., FHWA)
  - Do not generate bicycle classifications
  - Require modification to yield bike counts
  - Experimenting with 2 approaches
    - Modified ARX (UMN: separate bikes from motorcycles based on wheel base and speed)
    - BOCO (Boulder County, CO: reclassification of all ARX categories to extract bicycles)
Hennepin County Metrocount Tests: Interpretation of Counts

Need to adjust axle base to differentiate bikes and motorcycles

Need to reclassify trucks to separate misclassified bicycles

Hennepin County Metrocount Tests: Preliminary Results

Complete Days of Counts

- Portland
- Broadway
- 66th St.
- Stinson (Tr)
- Excelsior
- Shingle Creek (Tr)
- Downtown
- Minnetonka (Tr)
- Corcoran (Tr)
Hennepin County Metrocount Tests: Preliminary Results – Mean Bikes / Day

Mean Daily Bicycles: ARX and BOCO

- Portland
- Broadway
- 66th St.
- Stinson (Tr)
- Excelsior
- Shingle Creek (Tr)
- Downtown (SB)
- Minnetonka (Tr)
- Corcoran (Tr)

ARX
BOCO
Hennepin County Metrocount Tests: Preliminary Results – Weekend/Weekday

MC Weekend /Weekday Index (WWI) = (Mean Weekend Vol) / (Mean Weekday Vol)
Hennepin County Metrocount Tests: Preliminary Results – On-Road Bike Share

MC Weekday Bike Mode Share, On-Road Facilities

- Portland: ARX 1.8%, BOCO 2.1%
- Broadway: ARX 0.3%, BOCO 1.0%
- 66th St.: ARX 0.1%, BOCO 0.4%
- Excelsior: ARX 0.2%, BOCO 0.3%
Hennepin County Metrocount Tests: Preliminary Results – On-Road Bike Share

MC Weekend Bike Mode Share, On-Road Facilities

Bike Mode Share (%)

- Portland
- Broadway
- 66th St.
- Excelsior

ARX
BOCO
Hennepin County Metrocount Tests: Portland Avenue (CSAH 35)

Bicycles per Day, Portland Ave.

Weekend


BOCO Bikes Total
ARX Bikes Total
Hennepin County Metrocount Tests: Portland Avenue (CSAH 35)

Weekday Bi-Directional Hourly Distribution

Percent Contribution

Hour Start

ARX  BOCO
Hennepin County Metrocount Tests: Portland Avenue (CSAH 35)

Weekend Bi-Directional Hourly Distribution

- **ARX**
- **BOCO**
BOCO: Weekday Northbound vs. Southbound Average Daily Volume by Hour

Hour Start

Average Daily Volume by Hour

Northbound

Southbound
BOCO: Weekend Northbound vs. Southbound Average Daily Volume by Hour

- Northbound
- Southbound
Hennepin County Metrocount Tests: Stinson Multiuse Trail (CSAH 27)

Daily Bicycle Volumes: Stinson Trail

- BOCO Bikes Total
- ARX Bikes Total

Weekend

Graph showing daily bicycle volumes from 9/21/2013 to 9/28/2013, with a peak on 9/24/2013 and a drop on 9/28/2013.
Hennepin County Metrocount Tests: Stinson Multiuse Trail (CSAH 27)

Weekday Bi-Directional Hourly Distribution

Percent Contribution

Hour Start

ARX  BOCO
Hennepin County Metrocount Tests: Stinson Multiuse Trail (CSAH 27)

Weekend Bi-Directional Hourly Distribution

Percent Contribution

Hour Start

0:00 2:00 4:00 6:00 8:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00

ARX  BOCO
Hennepin County Metrocount Tests: Stinson Multiuse Trail (CSAH 27)

BOCO: Weekday Northbound vs. Southbound Average Daily Volume by Hour

Average Daily Volume by Hour

Hour Start

0:00 2:00 4:00 6:00 8:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00

Northbound

Southbound
Hennepin County Metrocount Tests: Lessons Learned

- Installation
  - Faster and simpler than Chambers installation
    - Field staff are familiar with pneumatic tube installation
  - Durable steel housings
  - Safety hazard associated with median installation and driving nails into pavement
- Does not count pedestrians
- Can distinguish between bicycles and automobiles
  - Requires classification scheme and data post-processing
- Data stored by time stamp of axle hit
- Outdated, cumbersome software
Hennepin County Metrocount Tests: Preliminary Results

Stinson Trail: Chambers v. MC ARXm v. MC BOCO

- Chambers
- ARX (<=4', <=25mph)
- BOCO

Bicycle Volume vs. Date

- 9/23/2013
- 9/24/2013
- 9/25/2013
- 9/26/2013

Changes:
- +16 (4.1%)
- +19 (5.1%)
- +29 (8.5%)
- +9 (2.4%)
- +17 (5.6%)
- +9 (2.8%)
Data File to Be Uploaded
What’s Next?

- Testing new technologies in more locations
  - Duluth, Rochester, Bemidji, …
- Developing new factors for in-street traffic
  - E.g., bike lane counts)
- Working with local agencies to develop comprehensive plans
  - Three Rivers Park District, Hennepin County
- Integrating manual and continuous count programs
- New models of bicycle and pedestrian traffic volumes on city streets
So What?

“If you don’t count, you won’t count.”

- Planning and assessing investments
- New tools for counting and modeling
- Collaboration between governments and citizens

Jasna Hadzic – MnDOT

Jasna.hadzic@state.mn.us