Non-Motorized Traffic Counts: Operations and Methodology

Updated December 31, 2013[1]

Background

Since 2007, the Minneapolis Public Works Department has partnered with Transit for Livable Communities (TLC) to conduct annual non-motorized traffic counts. TLC is the local manager of the Federally-funded Non-Motorized Transportation Pilot Program (NTP) grant and conducts counts as part of its ongoing evaluation of NTP projects in Minneapolis. While TLC's count efforts primarily focus on NTP evaluation, the counting methods are similar and data is shared with Public Works.

Purpose

Non-motorized traffic counts are conducted to measure annual changes in bicycling and walking and to gain an understanding of non-motorized traffic in Minneapolis. Data collected is currently used in the following ways:

- To understand the significance of streets and trails for non-motorized traffic.
- To measure the effects of improvements made to streets.
- To develop bicyclist and pedestrian crash rates.
- To understand bicyclist riding position across different riding environments.
- To determine if Minneapolis is meeting its target of increasing bicycling, as outlined by the City's sustainability indicators.

Count Methodology

Public Works conducts non-motorized counts during the second full week of September. Make-up counts are conducted in the third or fourth week of September. This observation period captures warm-weather traffic in addition to trips generated by school activities. The count days also align with dates selected by the National Bicycle and Pedestrian Documentation Project, a nationwide effort to collect consistent and accurate non-motorized traffic data. Year-round trail counts show that a typical September count in Minneapolis yields about 80 percent of annual peak traffic observed in July-August.

Non-motorized counts are conducted on Tuesday, Wednesday or Thursday to capture routine weekday traffic. Weekend trips, while a significant period for non-motorized traffic, are more difficult to count due to inconsistent travel patterns.

Counts are currently conducted during the following time periods:

- **2-hour** – All of TLC's counts and the majority of Public Works' counts are two-hour counts conducted from 4:00-6:00 p.m. Models are used to estimate daily traffic over a 24-hour period.
- **12-hour** – At some locations 12-hour counts are conducted from 6:30 a.m. - 6:30 p.m. Models are used to estimate daily traffic over a 24-hour period.
- **24-hour** – Public Works currently has inductive loop-detectors at three locations along the Midtown Greenway. The counters only detect bicycles and do not count pedestrians or other trail users.

Manual Counts

To conduct counts, Public Works and TLC use in-field observations in which trained volunteers manually tabulate the number of bicyclists and pedestrians at an assigned location. At each count location, an imaginary screen line is drawn across a street and includes any sidewalks or paths. All bicyclists and pedestrians crossing that line are counted. Individuals using other means of non-motorized transportation such as a skateboard or scooter, are also tabulated and categorized. Standardized Public Works and TLC count forms can be found at the end of this report.

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[1] This report provides an overview of the City of Minneapolis' non-motorized traffic counting operations and serves as a companion document to the City's Annual Bicyclist and Pedestrian Count Report. This report is published by Traffic & Parking Services within the Minneapolis Public Works Department. For questions about this report please contact Simon Blenski at 612-333-1274 or simon.blenski@minneapolismn.gov.

The counts focus on recording individuals, not conveyances. For example two individuals riding a tandem bicycle are counted as two bicyclists, rather than one bicycle. If an individual crosses the line multiple times, he or she is counted each time.

Automated Counts

At three locations on the Midtown Greenway, inductive loop detectors are used to count bicycles 24 hours a day, year-round. The loop detectors register the presence of metal passing over the loops. Overcounting has been observed at two counters, although precise error rates have not been determined. Public Works will continue to monitor for discrepancies and adjustment factors may be incorporated once the issues are fully understood.

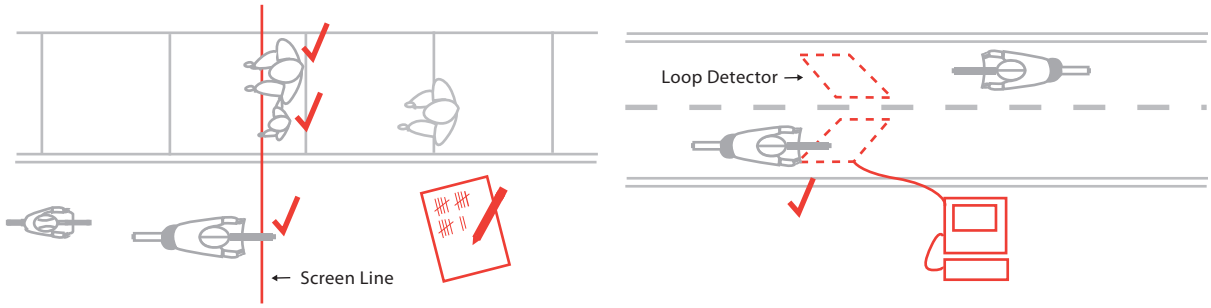

Figure 1 - To conduct manual counts, a screen line is established and all non-motorized traffic crossing the screen line is tabulated and categorized. Loop detectors are currently used to conduct automated counts on the Midtown Greenway.

Locations

Each year, non-motorized traffic counts are conducted at a variety of locations including bicycle paths, pedestrian shortcuts, busy streets, local streets, downtown streets, on bridges, in residential neighborhoods, in parks, near schools, college campuses, transit stations and along commercial corridors. The selected locations attempt to capture a variety of riding and walking environments that attract an array of recreational and utilitarian users. In addition, counts are often conducted near new or planned bicycle and pedestrian projects as a way to measure the impact of new facilities on non-motorized traffic. Many of these locations are in corridors and priority areas outlined in the Minneapolis Bicycle Mater Plan[1] and Pedestrian Master Plan[2] .

Count Frequency

To determine annual changes in non-motorized traffic, Public Works counts 30 benchmark locations for bicyclists and 23 benchmark locations for pedestrians. Public Works has over 300 additional non-motorized locations that are counted once every three years. Data are also available for over 100 historical locations where there is no regular count cycle.

The count cycles are as follows.

- **Annual Count Cycle:** Counted once a year
- **3-Year Count Cycle:** Counted once every three years
- **Historical Location:** No regular count cycle

Weather

The effect of various weather conditions on non-motorized levels is complex. Counts have been conducted on days with rain, although make up counts are usually conducted. The following graph suggests there is a relationship between bicycle traffic, temperature and rain, although daily variations in traffic are likely influenced by other weather factors and non-weather factors.

[1] www.minneapolismn.gov/bicycles
[2] www.minneapolismn.gov/pedestrian

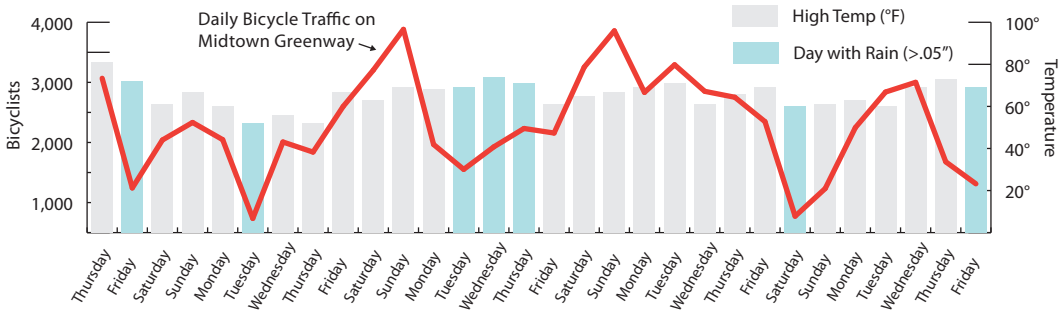

Figure 2 - Daily bicycle traffic on the Midtown Greenway compared with daily temperature and perception data over a 30-day period.

Estimating Daily Traffic

Manual counts are currently the most cost-effective method to conduct non-motorized traffic counts on a large-scale basis. However, due to the limited availability of staff and volunteers, collecting 24 hours of data is not feasible across all the locations counted by Public Works and TLC. Automated counters are available to count bicycles and pedestrians, but each technology requires careful calibration and frequent monitoring. For these reasons, automated counters are not yet used on a large-scale basis and models are used to estimate daily traffic from two and 12-hour counts.

In order to calculate estimated daily traffic (EDT), two assumptions are used:

- **Assumption 1:** 75 percent of daily bicycle and pedestrian traffic occurs between 6:30 a.m. - 6:30 p.m.
- **Assumption 2:** 20 percent of daily bicycle traffic and 18 percent of daily pedestrian traffic occurs between 4:00-6:00 p.m.

Assumption 1: 75 percent of daily bicycle and pedestrian traffic occurs between 6:30 a.m. - 6:30 p.m.

This assumption originates from Robert Seyfried[1], and is based on motor vehicle traffic counts between 7:00 a.m. - 7:00 p.m. The applicability of this figure to bicyclist and pedestrian counts is under continued investigation for two reasons.

First, the differences between motorized and non-motorized traffic patterns over the course of the day are unknown. For example, it is likely that bicycle or pedestrian traffic at night is lower than motor vehicle traffic because of concerns of visibility and personal security.

Second, the assumption is inherently flawed because the 7:00 a.m. - 7:00 p.m. period does not align with the 6:30 a.m. - 6:30 p.m. period. Since downtown cordon counts began in the 1960's, the 6:30 a.m. - 6:30 p.m. period has been the traditional period to conduct manual counts in Minneapolis. Traffic volumes are greater between 6:30-7:00 p.m. when compared to 6:30-7:00 a.m. As a result, it is likely that the 75 percent figure would be lower if it encompassed 6:30-7:00 p.m. rather than 6:30-7:00 a.m.

Assumption 2: 20 percent of daily bicycle traffic and 18 percent of daily pedestrian traffic occurs between 4:00-6:00 p.m.

This assumption originates from 75, 12-hour count locations in Minneapolis counted between 2007-2013. The graph below illustrates the temporal distribution of bicyclist and pedestrian traffic over a 12-hour period. Using the assumption that 75 percent of non-motorized traffic occurs between 6:30 a.m. - 6:30 p.m., the percentage of 4:00 p.m.-6:00 p.m. traffic can be calculated. It is assumed that all locations follow these traffic patterns, although surrounding land uses may generate different trip patterns throughout the day.

[1] Seyfried, Robert. *The Fundamentals of Traffic Engineering*. University of California. 2007.

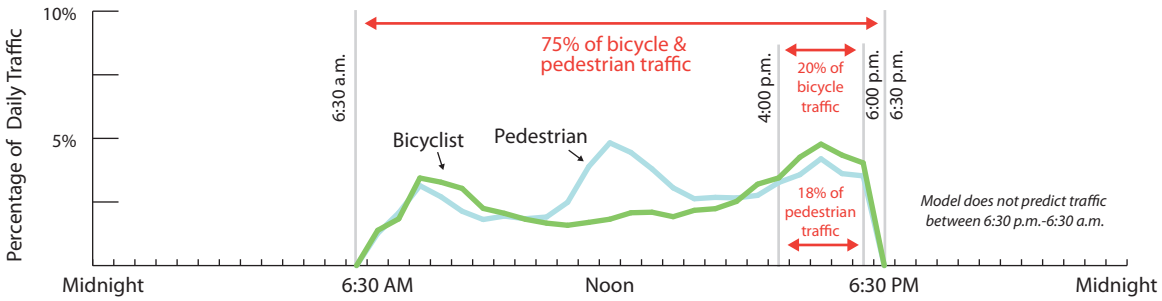

Figure 3 - The model used to calculate EDT assumes that 75 percent of bicycle and pedestrian traffic occurs from 6:30 a.m. - 6:30 p.m. The model also assumes that 20 percent of bicycle traffic and 18 percent of pedestrian traffic occurs from 4:00-6:00 p.m.

Estimates for One-Way Pairs

For two-hour counts conducted along some one-way pairs, an adjusted model is used to estimate daily bicycle traffic. It is assumed that traffic is weighted in the morning for inbound streets and weighted in the afternoon for outbound streets. For these locations, the 4:00-6:00 p.m. bicycle traffic percentage is adjusted to 10 percent for inbound streets and 30 percent for outbound streets. These figures are based on an analysis of 12-hour counts and special video counts. No one-way pair adjustments are made for pedestrian traffic.

Model Considerations

The model used to calculate EDT has been scrutinized and adjustments are often proposed. The proposed adjustments are based on following:

- **Evolving 12-hour model:** Each year, Public Works adds new 12-hour locations to the EDT model. Since 2007, the percentage of bicycle trips from 4:00-6:00 p.m. has remained at or near 20.0 percent. However, in recent years, pedestrian traffic has fallen slightly from 18.0 to 15.7 percent.

- **24-Hour Video Data:** In September of 2011, 24 hours of video was collected at 70 south Minneapolis intersections as part of a signal retiming study. Traffic for all modes was tabulated, including bicycles and pedestrians. The share of trips from 4:00-6:00 p.m. for bicycles was 16.5 percent and 15.7 percent for pedestrians.

This growing knowledge base reveals variation between the models - although the differences may be considered marginal. If anything, the new data suggests that current estimation methods are conservative and actual daily traffic may be higher at some locations. While it is simple to make adjustments to the model, numerous revisions to the model may make it difficult to accurately track changes in traffic over time. For this reason, Public Works plans to continue using the current model for the foreseeable future.

Minneapolis Public Works Standardized Bicyclist/Pedestrian Count Form

Name: _____ Date: _____

Screen Line (see attached map for a visual): _____

Instructions (Questions? Call Simon Blenski at 612-616-7345):

- Use tally marks in groups of 5 to indicate each bicyclist or pedestrian (4 = ||||, 5 = 𝍸).
- Count all bicyclists and pedestrians crossing your screen line.
- Count both sides of street, including sidewalks and/or paths in both directions.
- Count repeat trips if noticeable.
- If you were late, please note the precise time you began counting here: _____

Notice any thing exceptional that may affect the count (construction, parade, traffic crash)?

Please note it on the back.

15 Minute Time Periods	**Bicyclists**[1]		**Pedestrians**	
	Riding in Street	Riding on Sidewalk and/or Path	Walking or Using Assisted Devices[2]	Other[3]
: - :				
: - :				
: - :				
: - :				
: - :				
: - :				
: - :				
: - :				
Total				

[1] Count the number of people bicycling, rather than the number of bicycles (Tandem = 2 bicyclists, Trailer w/2 children = 3). Individuals on unicycles, tricycles, & electric-assist bicycles as bicyclists. Someone walking a bicycle is a pedestrian.

[2] Includes individuals walking, crawling, using wheelchairs, electric scooters, children being carried or in a stroller.

[3] Includes skaters, roller bladers, skateboarders, skiers, segways, and kick scooters. Do not count motor scooters or golf carts.

Please mail completed count form to 350 S 5th Street, Rm 203, Minneapolis, MN 55415 or scan and email to simon.blenski@minneapolismn.gov. Thank you!

Bike Walk Twin Cities BICYCLIST/PEDESTRIAN COUNT FORM FALL 2010

Name: _____ Location: _____ Site # _____

Date: _____ Time Start: _____ Finish: _____

Time (period)	Bicyclists		Child	*NR*	Sidewalk Riding	Pedestrians		Child	Asst
	Male	*Female*				*Male*	*Female*		
4:00 - 4:15 (1)									
4:15 - 4:30 (2)									
4:30- 4:45 (3)									
4:45- 5:00 (4)									
5:00 - 5:15 (5)									
5:15 - 5:30 (6)									
5:30- 5:45 (7)									
5:45- 6:00 (8)									

See Additional Instructions on Back of count sheet.

Comments/observations: Describe any factors that may have affected your count (rain, vehicle crash at site, road construction, snow or ice on travel way etc.)

Counter Instructions

Plan to arrive at your count location at least **10 minutes in advance** to get organized (park, lock bike, survey the situation). The count map identifies the screen line location and suggested observation location. Counters may wish to choose a different point of observation due to the weather and light conditions, but try to avoid this unless absolutely necessary. It is acceptable to use a different point of observation **provided the screen line is the same**. Be sure to make a note if the point of observation is changed.

Arriving a the count location

- Begin count at exactly 4:00 PM and note the time on the count sheet.
- Make a note of weather conditions including temperature, if known
- Additionally note any conditions on the sidewalk or roadway that may impact travel including:
  - Pot holes and general disrepair
  - Snow or ice in the travel way
  - Barriers or obstructions (i.e. temp construction, illegally parked car)

Please return completed count sheet to:

Tony Hull
Transit for Livable Communities
Bike Walk Twin Cities
626 Selby Ave
St Paul, MN 55104

Conducting the count

Use the count sheet to record every pedestrian and bicyclist **each time they cross the screen line**

Record a mark for each individual bicyclist-male/female or pedestrian-male/female in the appropriate column.

What if gender is not clear? - There is always the possibility that a person's gender will be unclear from simple observation, if unsure use male as a default and make a note of the number of uncertain gender occurrences in the notes at the bottom of the page.

Record **an additional mark** for other attributes (columns shaded in gray) as follows:

- **Child** – record additional mark for any individual appearing to be under 16 (use best judgment).
- **NR** – record a mark for each bicyclist that is riding a NiceRide Bike Share Bicycle
- **Sidewalk Riding** – At locations where applicable additional mark for cyclists riding on the sidewalk on either side of the street.
- **Asst** – Record additional mark for individuals using any sort of assistive device including but not limited to; walkers, canes, wheelchairs (automatic or manual) crutches, Segways, skateboards, in-line skates (all variations), strollers, and/or being carried by another pedestrian (such as a small child)

Counting Bicycles

Emphasis is on each person on a bicycle not the number of actual bikes. Count each person crossing the screen line on a bicycle, this includes small children in seats, children in a trailer, individuals riding in addition to the cyclist.

Counting Pedestrians

The counter should record every person each time the screen line is crossed as either a male or female pedestrian and record an additional mark for child or Asst or both when applicable.

Space for additional Comments/Notes:

THANK YOU!