DEPARTMENT OF TRANSPORTATION

MnDOT Pedestrian and Bicyclist Data Program: Strategic Plan for Counting People Walking and Bicycling

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Introduction

Active transportation plays an important mobility role in Minnesota. The benefits and popularity of active transportation are increasingly evident, and there is a need in Minnesota for a convenient and connected multimodal transportation network that serves people of all ages and abilities. Accordingly, the Minnesota Department of Transportation (MnDOT) has invested in facilities for people walking and bicycling throughout the state. In 2011, in collaboration with the University of Minnesota, MnDOT's Office of Transit and Active Transportation (OTAT) launched the Pedestrian and Bicyclist Data Program (Data Program)[1].

To date, MnDOT's Data Program is one of the most comprehensive in the United States for collecting count data about people walking and bicycling. MnDOT and partners collect data on a mix of facility types, both on and off MnDOT trunk highway right-of-way. Data collected throughout the state are used in a variety of contexts. The Arrowhead Regional Development Commission (ARDC) measured use along paved trails in the Duluth Region using MnDOT's portable counting equipment and combined these counts with survey data to calculate the breakdown of users that were locals and visitors, and average daily spending per trail user. This report allowed local and regional policymakers to estimate economic impacts of current and future trails. ARDC also used MnDOT counters to measure usage patterns along a temporary separated bike lane in Downtown Duluth, which gave policymakers solid data to guide their decision making about the installation's future. In the City of Mankato, MnDOT's automated counters were used to determine pedestrian demand on each side of a highway in a fast-growing part of the city. This allowed the city to determine the most effective side of the street on which to place sidewalks and also improved data for determining appropriate crossing locations.

MnDOT's Pedestrian and Bicyclist Data Program is one of the most comprehensive in the United States. However, it lags behind the robust and fully institutionalized programs that exist for motor vehicle traffic counts.

At the same time, the Data Program lags behind the robust and fully institutionalized count programs that exist for monitoring and analyzing motor vehicle traffic in Minnesota and elsewhere. MnDOT lacks a comprehensive view of active transportation use by location, facility type, and time. Data are not routinely considered in the Capital Highway Investment Plans (CHIP) and State Transportation Improvement Plans (STIP), for example. This gap represents a missed opportunity to consider the number of people walking and bicycling at all stages of the agency's work. Further progress is required to ensure a high level of accuracy and consistency as the state collects more active transportation volume data of its own and collaborates with agency partners to share data resources.

[1] Lindsey, G., Petesch, M., Vorvick, T., Austin, L., & Holdhusen, B. (2017). The Minnesota Bicycle and Pedestrian Counting Initiative: Institutionalizing Bicycle and Pedestrian Monitoring (No. MN/RC 2017-02; p. 114). Retrieved from Humphrey School of Public Affairs and the Minnesota Department of Transportation website: https://www.dot.state.mn.us/research/reports/2017/201702.pdf

Satisfying this gap, and building out MnDOT's Data Program, paves the way to several notable benefits, listed below:

1. Comprehensive pedestrian and bicyclist volume data across the state allows for accurate measurement and understanding of safety issues; volumes are used as an exposure metric when identifying and prioritizing crash-prone areas for safety improvements. Over half of MnDOT's permanent counter reference sites are on trails or shared-use paths. Collecting more data across other facility types, including along and across MnDOT highways, will help the agency build a more robust set of factor groups and adjustment factors. These can be used to translate short duration counts into reliable annual average daily pedestrian trips (AADPT) or annual average daily bicyclist trips (AADBT). Over the long term, these efforts can further allow MnDOT to create models that estimate the number of people walking and bicycling at *any* location statewide based on land-use, roadway, and demographic characteristics – even where no short duration counts have been conducted.
2. Pedestrian and bicyclist volume data can be used for prioritizing new facility locations, maintenance needs, and type of accommodation during construction activities. MnDOT leadership in this area is particularly important for smaller communities with less capacity to establish their own count programs.
3. Consistently collected volume data are essential for conducting before-and-after analyses to evaluate how facility improvements affect levels of use, safety, or both. Being able to document the effects of MnDOT's efforts in this area is a necessary step for demonstrating the benefits of improvements to political leaders and securing funding for further pedestrian and bicyclist investments.
4. MnDOT and local agencies collect large amounts of volume data from a variety of different sources: permanent counters, short duration counters, manual counts, various brands and technologies of counting equipment, etc. Managing these numerous data sources is not yet feasible given the manual overhead required to merge disparate data formats across a multitude of collecting organizations. Streamlining and institutionalizing data collection activities can increase the efficiency with which these data are combined and processed, allowing for ongoing and proactive use of the data that is not feasible or practical today.

Minnesota's Data Program is currently well ahead of many other state count programs, but institutionalizing the program more deeply – akin to what exists today for motor vehicle data collection – unlocks new opportunities as the agency invests in a "multimodal transportation system that maximizes the health of people, the environment, and the economy[2]."

This report presents a strategic plan for MnDOT's Data Program in the short- and long-term. The goals, strategies, and actions included in this plan represent ways in which MnDOT can advance the Data Program to prioritize investments on its own system of facilities as well as expand broader statewide practices for incorporating pedestrian and bicyclist volume data on all facilities and in coordination with local partners.

The next section documents background about count programs, including some identified challenges and opportunities for MnDOT's programs. Three key goals for the Data Program are listed, along with

[2] http://www.dot.state.mn.us/vision/

five core strategies that will lead the agency toward these goals. Finally, each of the strategies is described in detail along with concrete action items that MnDOT may complete in pursuit of the agency's goals.

Program Background

This section describes the general state of pedestrian and bicyclist counting in Minnesota, including an overview of key concepts and national guidance on count programs. The Minnesota Bicycle and Pedestrian Data Taskforce (Taskforce), a group of Data Program stakeholders from around the state, identified benefits of counting people walking and bicycling as well as challenges facing MnDOT's Pedestrian and Bicyclist Data Program, as part of the development of this strategic plan. These challenges and benefits are documented in this section as well.

Nonmotorized Counting Program Concepts and National Guidance

While most states have built robust and institutionalized measurement programs for the measurement, monitoring, and analyzing of motor vehicle traffic, no states have anything comparable to this for active transportation modes. Indeed, only a few have nonmotorized counting programs that are embedded into institutional budgets, processes, and planning efforts.

General Types of Nonmotorized Counts

There are essentially three types of nonmotorized counts currently being conducted in Minnesota and elsewhere: 1.) permanent continuous counts; 2.) regular short-duration counts; and 3.) as needed counts. Permanent counts by definition use permanently-installed automated counters to monitor volumes continuously over long durations. Regular short-duration counts—usually of a duration between two hours and two weeks—can be completed using either manual protocols or automated counters at a consistent set of locations, repeated over time. As-needed counts are usually done on an ad-hoc basis using similar tools and technologies as short-duration counts. As-needed counts may be deployed at locations perceived to have unique travel patterns, safety concerns, or where a one-off volume measure is needed for planning or design decisions.

Challenges of Nonmotorized Counts

Despite the importance of counting people walking and bicycling, many agencies (including cities, counties, and states) often struggle with counting these road users for the following reasons:

1. Active transportation users do not always follow constrained paths, and they can be difficult to consistently detect
2. Active transportation use patterns vary based on factors such as weather, geography, topography, day of week, and time of day, and are not well understood. Consequently, adjustment factors are often required to translate shorter duration counts into generalizable claims about active transportation volumes and patterns throughout the network.
3. Technology required to count pedestrians and bicyclists often differs from that used to count motor vehicle traffic; consequently, it can represent a large lump-sum cost.

National Guidance

Partially in recognition of the unique difficulties of counting active transportation users, the United States Department of Transportation has developed guidance for improving nonmotorized data collection, management, quality assurance, and monitoring procedures, including the following reference materials.

Traffic Monitoring Guide (TMG) (2013)[3]: This document provides state-level guidance for state departments of transportations (DOTs) for monitoring traffic on road networks. The document includes a chapter on pedestrian and bicyclist monitoring, listing primary technologies for monitoring nonmotorized traffic, describing key terms and concepts, and describing general processes for setting up a nonmotorized counting program.

National Cooperative Highways Research Program (NCHRP) 797: Guidebook on Pedestrian and Bicycle Volume Data Collection (2014) [4]: This document provides additional, more specific guidance than the TMG on methods and technologies for collecting nonmotorized volume data. Authors tested various data collection technologies and rated these technologies for accuracy. The guidebook also includes count data application, data collection planning and implementation, and guidance on adjusting count data to ensure accuracy.

Exploring Pedestrian Counting Procedures (2016)[5]: This document from the Federal Highway Administration (FHWA) focused on pedestrian counts. It includes a review of existing literature, interviews with practitioners, and an interactive webinar. It also includes recommendations, many of which are also applicable to bicycle counts. These recommendations are listed below:

1. Expand the use of multi-day/multi-week counts to reduce estimation error rates, and rotate counts around the network;
2. Validate equipment at installation and regularly thereafter;
3. Tailor quality checks as appropriate for low volume versus high volume locations;
4. Compute bias compensation factors (e.g., occlusion adjustment factors) to account for limitations related to equipment and locations; and
5. Conduct both short-duration and continuous counts to fully consider temporal and spatial aspects of pedestrian traffic patterns.

[3] U.S. Department of Transportation, Federal Highway Administration. (2016). Traffic Monitoring Guide (p. 473). Retrieved from https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_fhwa_pl_17_003.pdf

[4] Ryus, P., Ferguson, E., Laustsen, K. M., Schneider, R. J., Proulx, F. R., Hull, T., & Miranda-Moreno, L. (2014). Guidebook on Pedestrian and Bicycle Volume Data Collection (p. 160). Retrieved from UC Berkeley Institute of Transportation Studies website: https://escholarship.org/uc/item/11q5p33w#author

[5] Nordback, K., Kothuri, S., Petritsch, T., McLeod, P., Rose, E., & Twaddell, H. (2016). Exploring Pedestrian Counting Procedures: A Review and Compilation of Existing Procedures, Good Practices, and Recommendations (p. 128). Retrieved from U.S. Department of Transportation Federal Highway Administration Office of Highway Policy Information website: https://www.fhwa.dot.gov/policyinformation/travel_monitoring/pubs/hpl16026/

Counting Strategies and Equipment Present in Minnesota

MnDOT leads a Pedestrian and Bicyclist Data Program for the state. Several other state, regional, local, academic, and nonprofit/non-government agencies conduct counts as well.

State Agencies

Minnesota Department of Transportation

In 2011, in an effort to capture better pedestrian and bicyclist data, the Minnesota Department of Transportation funded a University of Minnesota research project aimed at establishing better methodologies for counting people walking and bicycling[6]. This collaboration led to the Pedestrian and Bicyclist Data Program[7], which initially relied on manual counts – standard practice at the time. However, this method of measuring nonmotorized usage had significant drawbacks: it relied on volunteers, it was only based on two hours of data at a time, and data outputs were inconsistent (and thus difficult to analyze). In 2013, MnDOT and researchers shifted to focus on automated counting of nonmotorized transportation, with an initial purchase of automated counters[8]. The program has grown, and the state now has 29 different permanent counters installed at 22 index sites statewide that are automatically and continuously measuring active transportation usage[9]. Seven of these locations host two counters, providing separate counts for nonmotorized users traveling in each direction[10]. Additionally, 10 of the 29 counters differentiate between pedestrians and bicyclists, versus counting bicyclists only or pooling pedestrian and bicyclist traffic totals. Each of MnDOT's eight districts hosts at least one permanent automated counter. The permanent counters are located on and off of the trunk highway system, with locations determined after appropriate coordination with local road authorities.

While creating permanent count locations is the centerpiece of MnDOT's Counting Program, the agency also provides access for local jurisdictions, especially those outside the Twin Cities Metropolitan Area, to conduct active transportation counts. MnDOT created the portable counter loan program; the agency maintains eight sets of portable counters around the state. Partner agencies, such as cities, counties, metropolitan planning organizations (MPOs) and regional development commissions (RDC), and even active transportation advocacy organizations, can borrow the automated short-duration counting equipment to conduct their own counts[11]. MnDOT identified district staff or staff from a partner agency (e.g., regional development organization) in each of the state's eight districts to be responsible for hosting the counting equipment library and handling the lending program.

Minnesota Department of Natural Resources

Minnesota Department of Natural Resources (DNR) conducts short duration manual counts in the summer season spanning Memorial Day weekend through Labor Day weekend; between 1997 and 2015,

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[6] Minnesota Department of Transportation. (2013). Protocols and Technologies for Monitoring Non-Motorized Traffic. 2013-24TS. http://www.dot.state.mn.us/research/TS/2013/201324TS.pdf

[7] Formerly called Bicycle and Pedestrian Counting Program

[8] Minnesota Department of Transportation. (2019). Bicycling - Manual counting. Retrieved June 3, 2019, from https://www.dot.state.mn.us/bike/bicycle-pedestrian-traffic-counts.html

[9] Petesch, M. (2018, May 22). Minutes: MN Bicycle and Pedestrian Data Taskforce Meeting #1. MnDOT.

[10] Lindsey, G., Petesch, M., Vorvick, T., Austin, L., & Holdhusen, B. (2017). The Minnesota Bicycle and Pedestrian Counting Initiative: Institutionalizing Bicycle and Pedestrian Monitoring (No. MN/RC 2017-02; p. 114). Retrieved from Humphrey School of Public Affairs and the Minnesota Department of Transportation website: https://www.dot.state.mn.us/research/reports/2017/201702.pdf

[11] Petesch, M. (2018, May 22). Minutes: MN Bicycle and Pedestrian Data Taskforce Meeting #1. MnDOT.

the DNR surveyed user volumes at 14 different paved state trails (eight were surveyed twice, usually 10-12 years later)[12]. The DNR sent staff on bicycles or motor vehicles to count users for one hour, with counts broken up by segments, times, and day of week. Staff also gathered qualitative information through mailed surveys of people using the trail. However, only a small percentage of the DNR's 680 miles of paved trails have had DNR counts conducted on them. MnDOT has also measured usage on some state trails, and a small number of state trails have been measured by both agencies (for example, the Paul Bunyan State Trail and the Root River State Trail). Unfortunately, since 2010, counts have been conducted less frequently, with only three of Minnesota's State-owned bicycle trails being updated since that time[13].

Non-State Groups

Parks and Trails Council of Minnesota

The Parks and Trails Council of Minnesota (Council) is a private, member-supported organization that advocates for the Minnesota State Trail system. The Council began a trail counting program in 2015 because of the perceived inadequacies of state trail counting efforts[14]. That year, the Council, along with volunteers, conducted manual trail counts at 25 different locations to provide a rough estimate of state trail usage. The counting process itself was an effective way for the Council to engage with local volunteers in the importance of the state trail system and the importance of conducting high-quality trail counts. For most locations, 10 hours of counts were measured. Once usage and user attributes were collected, the Council extrapolated data based on MnDOT and FHWA guidance. The Council then expanded their short duration counting efforts in 2017 by counting 30 sites on five different state trails[15]. This second count utilized automated counters (specifically Eco-Counter-manufactured passive infrared and pneumatic tubes).

In 2018, the Parks and Trails Council of Minnesota also used an outfitted bicycle with sensors to measure trail roughness and quality on all 600+ miles of paved state trails[16]. The sensor measured over 500,000 data points over the summer and an automated camera, which was also attached to the bicycle and took pictures every two seconds, captured some 65,000 photos on pavement quality. An estimated 40,000 geocoded photos are in the process of being placed into Google Streetview. While the main effort was focused on pavement quality, automated data collection methods could provide information about user volumes as well.

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[12] Kelly, T. (2014). User Characteristics and Use Trends Since the 1990s on Paved State Bicycle Trails (p. 26). Retrieved from Minnesota Department of Natural Resources, Operations Services Division website: https://files.dnr.state.mn.us/aboutdnr/reports/trails/1996_2013_trail_trends.pdf

[13] Holmes, T., Knight, J., Newman, D., & Wu, X. (2016). Monitoring Use of Minnesota State Trails: Considerations and Recommendations for Implementation (MURP Capstone Paper, University of Minnesota, Humphrey School of Public Affairs). Retrieved from https://conservancy.umn.edu/bitstream/handle/11299/180915/Humphrey%20Capstone,%20Monitoring%20use%20of%20MN%20State%20Trails%20FINAL.pdf?sequence=5&isAllowed=y

[14] Parks and Trails Council of Minnesota. (2015). State Trail User Count 2015: An exploratory look at how Minnesota's state trails are used (p. 56). Retrieved from Parks and Trail Council of Minnesota website: https://www.parksandtrails.org/wp-content/uploads/2015/09/2015-PTC-Trail-Count.pdf

[15] Parks and Trails Council of Minnesota. (2018). Minnesota State Trail User Count: 2018 Report (p. 22). Retrieved from Parks and Trail Council of Minnesota website: https://www.parksandtrails.org/wp-content/uploads/2015/09/2018-Trail-Count-Report-1.pdf

[16] Petesch, M. (2018, December 5). Agenda: MN Bicycle and Pedestrian Data Taskforce Meeting #4. MnDOT.

Local Jurisdictions

Local jurisdictions measure active transportation volumes using either manual counting, by conducing automated continuous counting, or by using a combination of these methods. The following examples are some of the more active jurisdictions in the state.

City of Minneapolis

The City utilizes manual counts organized by the Department of Public Works (DPW)[17]. DPW recruits volunteers who use a standard form and methodology for two-hour counts. Volunteers collect count data at 23 benchmark locations for pedestrians and 30 benchmark locations for bicyclists. These benchmark locations are used to measure year-by-year changes. Another 380 locations are counted on multi-year cycles and 150 additional locations have been counted at least a single time since the counting program's beginning. Daily figures are extrapolated to annual figures using factors, which are estimated using automated counters. The City presents the results of all counts on an interactive website[18].

The City is also partnering with MioVision[19], a vendor that gathers and organizes camera data at intersections. The City and MioVision are collecting video data from over 200 locations in Downtown Minneapolis, gathering traffic volumes and turning movements by mode to more accurately assess active transportation volumes (and, therefore, exposure rates for safety analysis).

City of Saint Paul

The City utilizes manual counts annually at 25 benchmark sites for pedestrian traffic and 30 benchmark sites for bicyclist traffic[20]. Data is collected by volunteers, counts are analyzed citywide, and an annual report summarizes results on the city's website[21].:.

Hennepin County

The County utilizes automated, short-term counters to collect bicycle volume and manual short-term collection processes for pedestrians. Data are collected for two hours at 30-35 locations for bicyclists, and about 20 locations for pedestrians[22,23]. In past years, the county has counted northern locations in even years and southern locations in odd years. The County uses county-owned MetroCount pneumatic tube counters to collect data over 48-hour periods for bicyclists, analogous to their motor vehicle counting program.

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[17] City of Minneapolis. (2019). Bicycling in Minneapolis | Minneapolis Pedestrian and Bicyclist Daily Traffic Counts. Retrieved June 3, 2019, from City of Minneapolis website: http://www.minneapolismn.gov/bicycles/res/WCMS1P-135614

[18] http://www.minneapolismn.gov/bicycles/res/WCMS1P-135614

[19] Petesch, M. (2019, March 19). Minutes: MN Bicycle and Pedestrian Data Taskforce Meeting #5. MnDOT.

[20] City of Saint Paul, Department of Public Works. (2015, October 19). Pedestrian and Bicycle Traffic Count. Retrieved June 3, 2019, from Saint Paul, Minnesota website: https://www.stpaul.gov/departments/public-works/bicycles/bicycle-traffic-count

[21] https://www.stpaul.gov/departments/public-works/bicycles/bicycle-traffic-count

[22] Hennepin County Public Works. (2016). Automated Bicycle Counting Program Report, 2015 (p. 58). Retrieved from Hennepin County Public Works website: https://www.hennepin.us/-/media/hennepinus/residents/transportation/biking/2015-bike-count-report.pdf?la=en&hash=11DA1595FD5CC9F732E4CBEC24E7DCC758919EB7

[23] Hennepin County Public Works. (n.d.). 2017-Bicycle-Count-Report 2017 (p. 51). Retrieved from Hennepin County Public Works website: https://www.hennepin.us/-/media/hennepinus/residents/transportation/biking/2017-Bicycle-Count-Report_Southern-Half_May-2018.pdf?la=en&hash=E07DBDC9C8AA6801F45E29ABA29CDA5BB64D1539

University of Minnesota

MnDOT's Data Program evolved over several years of collaboration between MnDOT and University of Minnesota Professor Greg Lindsey. MnDOT funded a series of projects to research counting methodologies, standardize data collection practices, and document the successes of MnDOT's program. This collaboration led to numerous reports documenting the Data Program's progress and providing guidance on nonmotorized traffic monitoring, including the following MnDOT-funded reports currently available from MnDOT's website[24]:

- **Minnesota's 2017 Walking and Bicycling Data Report**[25] – The latest statewide analysis of people walking and bicycling between 2014 and 2017.
- **Bicycle and Pedestrian Data Collection Manual**[26] – A Minnesota-specific manual for collecting pedestrian and bicyclist count data.
- **Assessing the Economic Impact and Health Effects of Bicycling in Minnesota**[27] – A study quantifying the Minnesota bicycling industry, economic impacts of bicycling events and facilities, and health benefits of bicycling in Minnesota.
- **The Minnesota Bicycle and Pedestrian Counting Initiative**: Institutionalizing Bicycle and Pedestrian Monitoring[28].

Unknown Sources

The Taskforce has discussed the likelihood that other pedestrian and bicyclist count data may be generated incidentally as part of routine traffic monitoring for the purposes of signal retiming. For example, a local consulting firm that collects video data to count traffic volumes and turning movements through intersections reported that pedestrian, bicyclist, and motorist volumes and movements are collected automatically through video processing software, even though most clients only plan to use the motor vehicle movements[29]. Agencies and departments that collect this type of data may not necessarily recognize these counts as having additional value beyond the immediate signal retiming efforts, so may not think to share the data with MnDOT's Data Program or local counting programs.

Benefits of Counting Pedestrians and Bicyclists

Accurate counting of pedestrians and bicyclists is crucial for multiple reasons, which are briefly described in this section.

[24] http://www.dot.state.mn.us/bike/bicycle-pedestrian-traffic-counts.html
[25] http://www.dot.state.mn.us/bike/documents/planning-research/bike-ped-report.pdf
[26] http://www.dot.state.mn.us/research/reports/2017/201703.pdf
[27] http://www.dot.state.mn.us/bike/economic-health-impact.html
[28] http://www.dot.state.mn.us/research/reports/2017/201702.pdf
[29] Interview with Mike Spack, July 2019.

More Accurate Safety Analysis

Determining active transportation volumes by location—whether that location is a corridor or an intersection—is important for accurately measuring safety levels and determining appropriate countermeasures. Historically, the safety of pedestrians and bicyclists is determined by crashes alone; this is unsurprising considering that this measurement is usually the most straightforward, and the most available to analysts, engineers, and designers. However, raw crash figures and raw fatality figures only tell part of the story; to be useful, corridor and intersection safety analysis requires information describing the numbers of people using the facility.

All else equal, a facility that has a high number of people walking and bicycling will see more crashes involving pedestrians and bicyclists than a facility with very few people walking and bicycling, simply because there are more pedestrians and bicyclists out and about. However, the rate of crashes *per person* walking and bicycling may in fact be lower in the high-volume facility. Accurate count data are useful in this case for differentiating between places with high numbers of pedestrian and bicyclist crashes due to high exposure (high volumes) and places with low exposure but systemic risk factors, and then selecting countermeasures to address the underlying issues.

Political Support for Bicycling and Walking

Determining hard figures for pedestrian and bicyclist traffic is crucial for demonstrating to policymakers that infrastructure improvements for these user groups are worthwhile investments. Although everybody is a pedestrian at some point in their journey, and many people also bicycle, these modes are often perceived as nonessential, or only associated with recreational use. However, counts can quantitatively demonstrate that people use these facilities for transportation and recreation, which can cut through cultural narratives and assumptions about how "nobody walks/bikes here." Demonstrating this use can lead to a greater willingness to spend funds on these modes, which in turn boosts use in a virtuous cycle. Measuring use before and after a facility is constructed or changed is a particularly powerful and effective way to elicit community and political support, especially while emphasizing the inexpensive nature of many active transportation facility improvements relative to motor vehicle infrastructure.

Other benefits[30] of providing accurate count data that were identified in the Taskforce include:

- Potential synergies between state trail routes that are popular with snowmobiles in the winter months and pedestrians and bicyclists in the non-winter months.
- Improving maintenance of well-used existing facilities and providing appropriate alternate routes during construction activities

[30] Moorman, E. (2019, May 23). Minutes: MN Bicycle and Pedestrian Data Taskforce Meeting #6. MnDOT.

Benefits of Institutionalizing Active Transportation Counting Procedures

There are several advantages to institutionalizing counting procedures (listed below). Institutionalizing counting measures may[31]:

1. **Provide greater data consistency for determining use and extrapolation factors.** While there is currently some MnDOT guidance, greater consistency in data collection and measurement techniques will improve the simplicity of this process.
2. **Improve count coordination statewide.** There have been instances where different agencies and organizations collected data on the same facility. Improved coordination could improve the efficiency of this process, and thus boost statewide count coverage.
3. **Improve safety analysis statewide, especially for smaller agencies that often have crash data, but may lack count data.** More institutionalized count data that improves collection practices can allow for more rigorous active transportation safety analysis.
4. **Allow more rapid data use after collection.** More standardized equipment usage, reporting formats, data storage methods, and extrapolation factors will allow data to be used with less "cleaning."
5. **Allow "apples to apples" comparison statewide.** More consistent count data will allow more accurate comparisons of use between different communities and different active transportation infrastructure types.

Challenges of Minnesota's Data Program

As mentioned, Minnesota's statewide Pedestrian and Bicyclist Data Program is more advanced than most states. Indeed, it is the only state department of transportation known to have a full-time staff member whose job is exclusively dedicated to the program's coordination[32]. Additionally, agencies within Minnesota have, and continue to collect, large amounts of active transportation volume data. However, there are several key limitations that, when overcome, will help the state's Data Program to realize more of the previously enumerated benefits of counting.

No Centralized Data Warehouse

First, Minnesota lacks a centralized portal for pedestrian and bicyclist count data where count data can be uploaded into a single location. It is currently difficult for practitioners and researchers to know locations that have been counted, the times that those locations have been counted, extrapolation factors (if any), and other relevant information. Ideally, this centralized warehouse would have an interactive mapping format so that end users can see where counts have occurred and under what conditions.

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[31] Lindsey, G., Petesch, M., Vorvick, T., Austin, L., & Holdhusen, B. (2017). The Minnesota Bicycle and Pedestrian Counting Initiative: Institutionalizing Bicycle and Pedestrian Monitoring (No. MN/RC 2017-02; p. 114). Retrieved from Humphrey School of Public Affairs and the Minnesota Department of Transportation website: https://www.dot.state.mn.us/research/reports/2017/201702.pdf

[32] MnDOT does not necessarily dedicate more staff time to the Pedestrian and Bicyclist Data Collection Program overall than other state DOTs, but the role of a dedicated program coordinator appears to be unique.

Different Equipment and Data Submittal Formats

While MnDOT is moving toward a common equipment type, other agencies and many smaller jurisdictions rely upon different equipment and/or conduct manual counts. Different equipment types lead to different data formats that cannot easily be compared. The FHWA provides guidance on data formatting and storage in the TMG and in the Travel Monitoring Analysis System (TMAS), a federal database that compiles datasets from state DOTs. Ensuring that any future system would be compatible with national level data standards and guidelines would be beneficial and boost the state of knowledge.

Different Data Collection Efforts, Purposes, and Uses

Different state agencies, local advocacy organizations, and local governments have different emphases for pedestrian and bicyclist travel. For example, recreationally-oriented agencies, such as DNR and local park districts, are likely more interested in quantifying recreational users (e.g., the number of people visiting a park). MnDOT, on the other hand, is interested in quantifying a broader range of activities, including common transportation metrics such as volumes or number of trips. While both agencies measure pedestrians and bicyclists, they may do so at different times of the day or year in hopes of capturing varying patterns of recreational and/or utilitarian uses. For counting, this also implies different extrapolation factors and a variety of other issues. Pooling data from parks or recreation-oriented organizations with MnDOT's data may require additional cleaning or calibration to make the data compatible.

Limited Staff Resources

Perhaps the most serious challenge facing the counting program in the state is the lack of staff time that can be devoted to statewide standardization and improvement efforts. Many members of the Minnesota Bicycle and Pedestrian Data Taskforce mentioned this as a primary concern, with many of the members able to devote less than 10% of staff time to pedestrian and bicyclist counting issues. This implies that greater buy-in is needed from partner agencies in order for MnDOT to successfully lead the state's counting program.

Program Overview Conclusions

Nonmotorized counting programs are typically characterized according to a four-point scale, indicating its stage of development. The levels range from (1) a nascent, experimental program to (4) a fully institutionalized program with widespread routine data collection and sophisticated analyses. MnDOT's current program likely falls into the second level – a basic program with simple reporting and analyses. For all the gaps and limitations of MnDOT's current program, it is still likely one of the most advanced statewide DOT counting programs in the United States. Indeed, the authors know of few if any other agencies presently that have a counting program more sophisticated than level 2 on this scale.

1. **Experimentation:** *Trial and error*; organizing manual counts at a specific location to meet a need
2. **Basic Program**: *Simple reporting*; protocols for reporting & basic analyses
3. **Systematic Program**: *High quality reporting & analysis*; analyses create clear narrative about nonmotorized travel

4. **Fully Institutionalized Program**: *Routine widespread data collection*; highly reliable data used to perform advanced analytics

Minnesota's Pedestrian and Bicyclist Data Program has received large amounts of data, but this data comes from many sources, in many different formats, and is used for many different reasons. Additionally, existing data is stored in many different locations, making statewide trend analysis, comparisons, and extrapolation factor creation and validation difficult.

The remainder of this document builds from this assessment of MnDOT's Data Program to establish goals, strategies, and actions for the advancement of pedestrian and bicyclist counting in Minnesota.

Data Program Goals for Counting People Walking and Bicycling

Minnesota's Data Program is currently well ahead of many other state count programs, but institutionalizing the program more deeply – akin to what exists today for motor vehicle data collection – unlocks new opportunities as the agency invests in a "multimodal transportation system that maximizes the health of people, the environment, and the economy[33]."

Purpose and Need

Why counting? As previously described, the benefits of systematically counting people walking and bicycling range from improved safety analyses to demonstrating the effectiveness of priorities and investments in active transportation to policymakers.

Why MnDOT? MnDOT has historically been a de facto leader in Minnesota in the realm of counting people walking and bicycling, including hosting the Taskforce. The Taskforce developed its own vision and goals over its first few meetings, described in *Appendix 1: Goals of the Taskforce and Progress*, but without strong institutional leadership, progress toward those goals has been limited. Given MnDOT's experience to date with the Pedestrian and Bicyclist Data Program, as well as its fully institutionalized data collection program for motor vehicles, the agency is best positioned to assume formal leadership of pedestrian and bicyclist counting activities across the state. Taskforce members, representing various state agency, local and regional government, nonprofit, and academic partners, support MnDOT assuming a stronger leadership role and have expressed enthusiasm to coordinate their data collection, sharing, and analysis activities.

What is needed? To achieve the goals outlined in this section, MnDOT is prepared to invest staff time and resources in pursuit of the strategies and action items described next. The Pedestrian and Bicyclist Data Program is currently led by a single full-time staff member in the Office of Transit and Active Transportation, with limited additional staff time in each district for the administration of the short duration counting equipment lending library. By contrast, the motor vehicle counting program has seven dedicated full-time staff in the Central Office[34], as well as staff resources in each district. While the strategies and actions in this plan are designed to efficiently leverage data sharing and inter-agency coordination, MnDOT will likely need to invest in additional staff resources to support data collection, cleaning, processing, and reporting operations, in addition to any identified equipment or maintenance needs.

[33] http://www.dot.state.mn.us/vision/

[34] As of mid-2019.

Goals

Goal 1: *Use count data and volume estimates to inform planning, design, and policy decisions to provide appropriate facilities for people walking and bicycling along and across MnDOT trunk highway [35], trails, and other corridors as needed.*

This goal calls for using count data and volume estimates across the full spectrum of MnDOT's multimodal work, including planning, design, and policy. It implies an awareness and understanding of count data across districts and departments, on par with the widespread use of motor vehicle volume data.

Goal 2: *Coordinate with other agencies and organizations at the state, regional, and local levels to increase the quantity and quality of pedestrian and bicyclist count data throughout the state.*

This goal aims to leverage collaboration with other agencies and organizations at all levels to make efficient use of data collection resources, as well as ensure consistency across reporting bodies. Many other organizations throughout Minnesota are currently engaged in pedestrian and bicycle counting activities; MnDOT will pursue a multi-pronged approach of expanding its own counting capacity as well as coordinating with partner organizations. MnDOT is not aiming to supplant ongoing local or regional count programs.

Goal 3: *Produce annual average daily pedestrian traffic (AADPT) and annual average daily bicycle traffic (AADBT) estimates for all road and trail segments throughout Minnesota.*

Providing an estimate of AADPT and AADBT for all segments in the state empowers MnDOT as well as all local and regional agencies to incorporate volume data into policy, planning, and design. This goal calls for a level of data provision analogous to the statewide annual average daily motor vehicle trips datasets that MnDOT already publishes.

MnDOT currently provides AADMVT on the following types of roads: Trunk Highways, including Interstates, US Highways, and MN State Highways; Local system roads, including County State Aid Highways, County Roads, and Municipal State Aid Streets; and other additional roadways as needed for federal reporting, such as Municipal Non-State Aid Streets, Township Roads, and Airport Roads[36]. AADMVT is usually not provided for local streets with low motor vehicle traffic volumes. For people

[35] MnDOT defines "Trunk Highways" to include: Interstates, US Highways, and MN State Highways.

[36] http://www.dot.state.mn.us/traffic/data/coll-methods.html#QL

walking and bicycling, however, these low-volume streets serve as important links in the transportation network. As these low-volume streets comprise a substantial majority of total transportation system mileage, performing counts for each and every segment would require an unprecedented data collection effort. Instead, strategies to achieve this goal make use of statistical modeling techniques to estimate pedestrian and bicyclist volumes on road segments where counts may not have occurred, so the level of effort required to achieve this goal is within reach.

Strategies and Actions

MnDOT has defined five strategies that will expand and refine the Data Program in ways that advance the goals defined in the previous section. Each strategy is accompanied by concrete action items that can be completed in the short, medium, or long term to implement the strategy. A single consolidated table with all five actions and corresponding strategies is in *Appendix 2: Combined Strategies and Actions Table*.

Strategy 1: Develop a strategic deployment plan for MnDOT-owned and managed pedestrian and bicyclist counters

MnDOT will strategically deploy, install, and maintain additional permanent and loaned, short-duration counters to expand the quality and breadth of active transportation count data collected. MnDOT currently uses both permanent and short-duration counters to collect pedestrian and bicycle traffic volume data primarily on shared use paths, as well as some trunk highways, throughout the state. Additionally, short-duration counters are loaned to partner agencies.

Although this system has gathered valuable count data, it also has several limitations. First, the current fleet of permanent counters (N=29) focuses coverage along trails and shared use paths, with limited coverage on MnDOT trunk highways or other facilities. The concentration of counters on a specific facility type limits the program's ability to paint an accurate picture of active transportation patterns. MnDOT envisions future expansion of the Data Program in which permanent counters are deployed strategically to capture a broader cross-section of MnDOT facilities. Secondly, MnDOT will work with local partners to ensure that portable equipment is installed at locations based on systematically identified priorities. The action items associated with Strategy 1 are listed in Table 1 and described in subsequent sections.

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
1.1	Develop a sampling strategy for permanent and temporary (short-duration) counts	☑					
1.2	Develop a plan to install five (5) permanent counters per year over the next five (5) years	☑					
1.3	Install five (5) permanent counters per year over the next five (5) years		➲	➲	➲	➲	☑
1.4	Create Short-Duration Counter Rotation Plans at the district level		☑				
1.5	Streamline and institutionalize the existing counter loan system		➲	➲	➲	➲	☑

Table 1. Action items for Strategy 1: Develop a strategic deployment plan for MnDOT-owned and managed pedestrian and bicyclist counters

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed

Action 1.1: Develop a sampling strategy for permanent and temporary (short-duration) counts

The purpose of a sampling strategy is to prioritize new count locations that enrich and expand the data being collected, to make the database at large more useful for statistical volume estimation, planning, and other activities. New permanent counters and short-term counters will use a sampling strategy for permanent and short-term count sites. The sampling strategy will consider factors such as the following:

Sample criterion	Notes
Expanding representation of on-street sites	Breadth of facility type coverage ensures that data are representative across the state for volume estimation.
Expanding representation of various volume levels	Permanent count locations need moderate or higher volumes in order to capture daily, weekly, and seasonal trends. Short duration count locations should cover the full spectrum of volume and activity levels. ACS commute data can be used to help guide this criterion where no volume data exist yet.
Sites along and across state highway corridors	Prioritize locations that help MnDOT plan its own facilities.
Natural pinch points in the system (bridges, tunnels)	These types of locations tend to concentrate activity, where alternate routes require lengthy detours.
CHIP (Capital Highway Investment Plans) and STIP (State Transportation Improvement Plans)	Prioritize locations with upcoming projects so that count data may help guide design decisions.
Broad coverage across factor groups[37]	Emphasize placing count locations in factor groups that are currently under-counted. Research recommends a minimum of 4 to 5 count sites for each factor group.
Adequate spacing	Locations with existing counters should be avoided unless there is a reason for additional counters at that location. Collaboration with other organizations that install and maintain counters (either state agencies like the Department of Natural Resources, or DNR, or local cities and counties) will be crucial.
Representative coverage to advance MnDOT's equity goals	Prioritize count locations on facilities used by people traditionally underrepresented in or excluded by traditional planning processes, including Black, Indigenous, and People of Color (BIPOC). MnDOT recognizes that counts of people walking and bicycling are representative of traffic at a site, but they may not be representative of the local population or community[38].

Table 2. Potential sampling strategy prioritization criteria

[37] Factor groups are collections of count locations with similar temporal patterns. These are explained in greater detail in a later section, "Strategy 3: Develop factor groups, adjustment factors, and models based on MnDOT data capacities and needs." Currently, the four standard factor groups are (1) Commute, (2) Multipurpose, (3) Commute-Mixed, and (4) Multipurpose-Mixed,

[38] Karner, A., & Niemeier, D. (2013). Civil rights guidance and equity analysis methods for regional transportation plans: a critical review of literature and practice. *Journal of Transport Geography*, 33, 126-134. Available from https://doi.org/10.1016/j.jtrangeo.2013.09.017

MnDOT permanent count sites will be determined based on a combination of all of the above factors. After a composite score is created, a list of possible locations will be created; that list will then be analyzed to determine locations that fill in missing gaps. MnDOT can coordinate with the Office of Transportation System Management to write these intentions into work plans for local partners (MPOs, RDCs, etc.).

Action 1.2: Develop a plan to install five (5) permanent counters per year over the next five (5) years

After identifying sampling strategies to determine priority locations, MnDOT will create an installation plan. This installation plan will produce top candidates for count location installation based on the sampling strategy and will match those roads with upcoming road (and possibly trail) projects to reduce costs. This statewide plan will be created with input from MnDOT District Offices, using staff expertise about appropriate projects in the development process. For state road projects, MnDOT will also consider mandating the installation of counters at high priority locations.

Action 1.3: Install five (5) permanent counters per year over the next five (5) years

Additional counters will allow for robust and accurate pedestrian and bicyclist count data statewide and by factor groups. To achieve this, MnDOT has funding committed to procure and install five additional permanent counters in each of the next five years (25 total counters). These counters will be installed at a variety of sampling locations to increase representativeness of the observed patterns, following the guidelines identified under Action 1.1 and plan described in Action 1.2. Wherever possible and relevant, the permanent counters will either distinctly count both pedestrian and bicyclist traffic, or separate counters will be installed at the site to capture these two traffic streams.

The near-term aim for these counters will be to achieve minimal coverage across a wide range of contexts, initially filling key gaps in the existing permanent data collection scheme. Specifically, state trunk highways and on-street facilities will receive priority, with smaller, lower-volume roads and paths/trails being less crucial. Following that, additional counters will provide a more refined understanding of the observed patterns.

Action 1.4: Create Short-Duration Counter Rotation Plans at the district level

Although short-duration counts are valuable in gathering data for the data warehouse (to be described below) and for computing adjusting factors, the current MnDOT District equipment hosts often do not communicate with each other or share best-practices with each other. There is a form accessed on the Minnesota DOT website that allows interested people or organizations to send emails to equipment hosts, but equipment hosts often rely on ad-hoc and informal lending practices, often through methods such as email.

Short-term lending use can be boosted by having MnDOT Districts create strategic planning documents that include usage over past periods and past data collection practices and processes. These plans will also offer examples of how counts have been used in the past year, so that this information will encourage wider count usage in decision-making processes and disseminate best-practices. These plans will also detail future strategies to boost data collection in line with statewide factor group needs, reference the goals and actions identified in the new District Bicycle Plans, and describe more

institutionalized lending practices (specifically related to the advertising of the counting equipment and the lending process).

Action 1.5: Streamline and institutionalize the existing counter loan system

Short-duration loaned counters play an important role in boosting the use of count data in local decision-making, gathering data required for different factor groups, and computing more accurate adjustment factors. A more institutionalized program will consider the following steps:

1. Create a centralized list of priority recommended locations that encourages counts at key locations. For example, applicants who want to use counters to measure usage along or across state highway facilities may receive priority over those requesting equipment to count along shared use paths, in light of MnDOT's goals to expand count coverage of Trunk Highways and non-trail facilities.
2. Give priority to jurisdictions and organizations that have a record of successfully completing counts.
3. Use an interactive calendar that allows borrowers to more effectively plan count dates and times without back-and-forth contact with the equipment host.
4. Study usage by MnDOT District, with the possibility of transferring counters and/or directly conducting counts through district offices (as is already done).
5. Create a stand-alone website for lending.
6. Create a task or deliverable template for adding counts to a project scope (e.g., before/after counts) so that district staff and project managers can easily include it in, for example, corridor analysis or project development scopes.
7. Automate and standardize count report generation from portable counter data

Strategy 2: Build a central data warehouse to store data from MnDOT and partner agencies and organizations

Although the State of Minnesota has a large amount of active transportation count data compared to other states, it lacks a central location where data can be gathered and compared for internal and external planning, research, and evaluation. This inhibits the creation of accurate adjustment factors and impedes quality control. Inaccessible or inaccurate counts means that volume and safety cannot adequately be assessed before and after a new facility is built.

The action items associated with Strategy 2 are listed in Table 3 and described in subsequent sections.

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
2.1	Select technical specifications for data warehouse	☑					
2.2	Build warehouse allowing internal and external data access		➲	☑			
2.3	Populate warehouse with MnDOT's existing count data			➲	☑		
2.4	Develop and implement data QA/QC procedures	☑					
2.5	Define process for incorporating partner data into warehouse				➲	➲	☑

Table 3. Action items for Strategy 2: Build a central data warehouse to store data from MnDOT and partner agencies and organizations

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed

Action 2.1: Select technical specifications for data warehouse

The use of the data warehouse will depend upon the quality and consistency of the data. MnDOT already has created several documents, namely the *Bicycle and Pedestrian Data Collection Manual*[39], that provide guidance on data collection best-practices, counter types, data management, analysis, and quality assurance/quality control. The new system will strive for consistency with that document, as well as the forthcoming Data Management Policy and Data Privacy Policy documents that will be developed under Strategy 4, Action 4.5. MnDOT will consider the value of cross-compatibility with Portland State University's Bike-Ped Portal[40] and other existing repositories, as well as TMAS (Travel Monitoring Analysis System), the FHWA count standard.

Action 2.2: Build warehouse allowing internal and external data access.

Easy data access and querying of data is crucial to encourage seamless data use in decision making. Therefore, the future warehouse will allow quick and easy data access and querying for MnDOT staff,

[39] Minge, E., Falero, C., Lindsey, G., Petesch, M., & Vorvick, T. (2017). Bicycle and Pedestrian Data Collection Manual (No. MN/RC 2017-03). Available from http://www.dot.state.mn.us/research/reports/2017/201703.pdf

[40] http://bikeped.trec.pdx.edu/

partner agencies, local governments, and researchers. It is envisioned that MnDOT will host the database itself, ensuring easy data access to its own staff. Ideally, the database will be designed to allow varying levels of external data access and cross-platform consistency with the motor vehicle traffic monitoring database.

Future warehouse functionalities will include the capacity to automatically query pedestrian and bicyclist estimates for different time periods. Longer-term, the warehouse could incorporate land use, demographic, and infrastructure data to allow for statistically estimating volumes in locations where counts do not exist. An automatic calculation in the database—with appropriate caveats about the estimating procedure—will produce meaningful statistics with minimal manual post-processing.

Action 2.3: Populate warehouse with MnDOT's existing count data

A future warehouse must consider the large amount of data that MnDOT and local partners already possess -- both short-duration and permanent count data. Retroactively inputting data will ensure that past efforts are incorporated into the creation of adjustment factors.

However, this data is currently spread across many files and file formats (including manual formats). To render this data useful for analysis purposes, MnDOT will need to reformat the data into the common format defined for the clearinghouse. If multiple count files are in a consistent format, computer scripting can be used to make the process more efficient. This data consolidation process should focus first on permanent count data, followed by automated short-duration count data, then by manual counts.

Given the large repository of existing data, MnDOT will prioritize preparing its own in-house data for entering into the database, and encourage partner agencies and governments to prepare their own data according to database specifications.

Action 2.4: Develop and implement data QA/QC procedures

All count data – automated and manual alike – require quality assurance and quality control (QA/QC) procedures relating to sample size minimums and counter validation. Data quality should be assessed based on minimum sample size (by time). To develop annual estimates, it is recommended that short-duration counts cover a period of at least one week. This allows the day-of-week patterns to be identified, which are needed to confirm a short-duration count's factor group assignment. Although one week is offered as a recommendation, longer short-duration counts, such as two weeks or a month, will produce more reliable estimates. Local agencies will likely continue to conduct shorter counts. Guidelines will ensure that data included in the warehouse meet acceptable minimum quality standards and may also push other organizations to count for longer durations.

The usability of data contained in the warehouse will depend heavily on the quality of the data collected. MnDOT will encourage the organizations with which it collaborates to follow standard

recommended QA/QC procedures, including those documented in MnDOT's reports and manuals[41,42]. Automated counters should be calibrated with a manual count during installation to ensure accurate results. A short observation period of 15 to 30 minutes (or until 25 total counts are obtained) is sufficient unless bicycle volumes are extremely low. In that case, staff can trigger the counter by riding a bike across the path of the counter several times. However, this should not be the default method since a bicyclist riding deliberately to check a counting device does not represent the varying user characteristics that occur. In addition to counter calibration, photos should be taken of each installation to allow follow-up counts to be installed in the exact location and with the same counter orientation.

Action 2.5: Define process for incorporating partner data into warehouse

Partner data will comprise an important part of the data warehouse; however, to ensure accuracy and consistency, MnDOT will define the expected frequency of data transmittals for short-duration counters from partner agencies. For the warehouse, data retention policies on the part of local agencies will also be clearly defined, which can be accomplished through annual training sessions. These procedures will build from the Data Management Policy and Data Privacy Policy recommended in Action 4.5.

[41] Lindsey, G., Petesch, M., Vorvick, T., Austin, L., & Holdhusen, B. (2017). The Minnesota Bicycle and Pedestrian Counting Initiative: Institutionalizing Bicycle and Pedestrian Monitoring (No. MN/RC 2017-02; p. 114). Retrieved from Humphrey School of Public Affairs and the Minnesota Department of Transportation website: https://www.dot.state.mn.us/research/reports/2017/201702.pdf

[42] Minge, E., Falero, C., Lindsey, G., Petesch, M., & Vorvick, T. (2017). Bicycle and Pedestrian Data Collection Manual (No. MN/RC 2017-03). Available from http://www.dot.state.mn.us/research/reports/2017/201703.pdf

Strategy 3: Develop factor groups, adjustment factors, and models based on MnDOT data capacities and needs

Factor groups and adjustment factors are used to convert short duration counts into an annualized average estimate based on temporal patterns at permanent counter reference sites.

Factor groups are characteristics of locations that allow analysts to extrapolate use for unmeasured segments with similar characteristics. Factor groups are often defined through primary use (for example, MnDOT currently defines four types of use patterns: commute, multipurpose, commute-mixed, and multipurpose-mixed). They can also encompass facility type (on- or off-street), land-use characteristics (such as density), and demographics. Additionally, factors can change year-over-year based on classification of inputs.

Adjustment factors use ratios to translate shorter-term and location-specific counts into more widely applicable statements about walking and bicycling patterns. For example, adjustment factors "annualize" data collected over several months, so that they can be compared to yearly data. The factors account for changes in weather, topography, day of week, and time of the day. Adjustment factors are calculated on a factor group basis, with count data from permanent counters used to develop adjustment factors for short-term counts in the same grouping.

Although MnDOT is planning to significantly boost the number of counters statewide as well as increase use of its short-duration counter library, it is likely that the agency will collect data only along a small percentage of the total system for the near future, given the sheer size of the transportation network and the practical realities of counting. Statistical models are a useful tool for estimating volumes along segments of the network where count data have *not* been collected. As the number of locations in which MnDOT conducts counts grows over time, these statistical models improve in reliability, producing increasingly useful estimates of AADPT and AADBT across the entire network.

The action items associated with Strategy 3 are listed in Table 4 and described in subsequent sections.

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
3.1	Evaluate previously developed factors against new data	➲	☑				
3.2	Define process for annual update of factor group definitions		➲	☑			
3.3	Apply adjustment factors to existing short duration count data			➲	➲	➲	➲
3.4	Develop a methodology for estimating pedestrian and bicyclist volumes for all road and trail segments in MN					➲	☑

Table 4. Action items for Strategy 3: Develop factor groups and adjustment factors based on MnDOT data capacities and needs

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed

Action 3.1: Evaluate previously developed factors against new data

MnDOT has sponsored research on factor groups and adjustment factors and offers guidance on the process within the *Bicycle and Pedestrian Data Collection Manual* (2017)[43], and within the *Minnesota Bicycle and Pedestrian Counting Initiative: Methodologies for Non-motorized Traffic Monitoring* (2013)[44]. However, both the factor groups and adjustment factors from such reports were derived from a limited number of permanent counts several years old. Ensuring that these outputs correspond with newer permanent count data is crucial.

MnDOT will create a methodology for evaluating the existing factor groups and adjustment factors for accuracy; this could be done by using the adjustment factors upon relevant permanent counters—instead of short-duration counters—to create expected count figures, and then comparing those with observed numbers.

Action 3.2: Define process for annual update of factor group definitions

Factor groups can change annually based on various data inputs, as well as the number of permanent counters. MnDOT should develop an annual process for updating different factor groups. This process will likely involve some of the following steps:

1. Regularly grouping permanent—including newly installed—count stations, reviewing volume distributions of existing permanent count stations by time of day, day of the week, and month of the year to begin assessing patterns.
2. Separate these distributions into factor groups based on visual analyses (i.e., does this distribution follow typical commute patterns?).
3. Apply statistical analysis to separate groups and identify data characteristics and outliers. Over time, explore automating this process to free up staff time.

Action 3.3: Apply adjustment factors to existing short-duration count data

In Minnesota, adjustment factors will be used to transform short-duration counts to estimated long-term figures. The process usually contains the following steps:

1. Assign relevant factor groups to short-duration count locations;
2. Apply statistical analysis of permanent counts to compute adjustment factors at these locations;
3. Apply these adjustment factors to estimate AADPT and AADBT figures for trail and trunk highway volumes.

[43] Minge, E., Falero, C., Lindsey, G., Petesch, M., & Vorvick, T. (2017). Bicycle and Pedestrian Data Collection Manual (No. MN/RC 2017-03). Available from http://www.dot.state.mn.us/research/reports/2017/201703.pdf

[44] Lindsey, G., Petesch, M., Vorvick, T., Austin, L., & Holdhusen, B. (2017). The Minnesota Bicycle and Pedestrian Counting Initiative: Institutionalizing Bicycle and Pedestrian Monitoring (No. MN/RC 2017-02; p. 114). Retrieved from Humphrey School of Public Affairs and the Minnesota Department of Transportation website: https://www.dot.state.mn.us/research/reports/2017/201702.pdf

4. Publish factor groups, adjustment factors, and mathematical methods for using these annually[45]. This will help local jurisdictions conduct their own adjustments on data if they are interested and have the capacity.

Action 3.4: Develop methodology for estimating pedestrian and bicyclist volumes for all road and trail segments in MN (even those where a count has not been taken)

While this will take significantly more staff resources, and is thus longer-term, an increased number of permanent counters will support a wider variety of factor groups and more accurate adjustment factors, allowing estimation of all road types and locations. MnDOT should therefore work on boosting the number of permanent counters, ensuring that those counters are placed strategically (i.e., per the sampling plan developed under Action 1.1), and identifying missing factor groups. The focus should be on measuring and estimating use on trails and state trunk highways first, however.

[45] These may be published on MnDOT's website for the Pedestrian and Bicyclist Data Collection Program, in an annual newsletter for technical professionals, or in other communication methods pursued under *Strategy 5: Monitor and communicate count data performance measures and applications internally and externally*, especially *Action 5.4: Create online presence for communicating performance measures*.

Strategy 4: Lead inter-agency coordination around pedestrian and bicyclist count data collection and use

While several state agencies, local jurisdictions, and advocacy groups collect pedestrian and bicyclist count data, MnDOT is the only organization capable of systematically collecting, organizing, and analyzing counts at the statewide level. However, coordination will be crucial for achieving this goal. Coordination is also necessary *within* MnDOT. MnDOT's goal should be to put in place inter-jurisdictional structures that institutionalize collaboration and data use in decision-making.

The action items associated with Strategy 4 are listed in Table 5 and described in subsequent sections.

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
4.1	Develop a memorandum of understanding (MOU) with participating agencies and organizations	➲	☑				
4.2	Develop directory detailing historic and ongoing count efforts around the state	☑					
4.3	Convene Taskforce at least quarterly	➲	➲	➲	➲	➲	➲
4.4	Coordinate installation of permanent counters among agencies and organizations under a strategic framework that includes the Bike and Pedestrian Data Collection Manual				➲	➲	☑
4.5	Create and update Data Management Policy and Data Privacy Policy documents for inter-agency data sharing		➲	➲	☑		
4.6	Facilitate supplemental data collection that meets data warehouse standards through non-MnDOT channels	➲	➲	☑			

Table 5. Action items for Strategy 4: Lead inter-agency coordination around pedestrian and bicyclist count data collection

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed

Action 4.1: Formalize the relationship between MnDOT and Data Program participating agencies and organizations.

MnDOT and its partners will formalize their involvement together in the Data Program through a memorandum of understanding (MOU) or similar document. This document will transparently lay out roles and responsibilities, including the following.

- How data is collected
- What data is collected
- How it is used and by whom
- Collection frequency
- Transmission frequency

- Retention practices and duration
- Proper data practices including personal data privacy protections

Depending on the size of the document, it may take the form of an expanded formal agreement, rather than an MOU. This document will provide legal certainty regarding data issues, which is especially important for smaller communities that may lack legal resources and be consequently reluctant to share data with MnDOT (through the data warehouse). Agreeing to this MOU could also be made a condition of borrowing short-duration counters. This document will reference the Data Management Policy and Data Privacy Policy that MnDOT will develop under Action 4.5, though individual agreements among collaborators may specify customized or alternate data management or privacy policies tailored to the unique circumstances of each partnership.

Action 4.2: Develop directory detailing historic and ongoing count efforts around the state

A comprehensive directory, especially if done in an interactive downloadable format like GIS (possibly hosted on MnDOT's site) would boost the program's exposure, encourage participation from jurisdictions statewide, and allow factor groups and adjustment factors to be more widely shared among researchers, planners, engineers, and the general public. It also serves as an immediate-term resource for MnDOT and Data Program collaborators until longer term strategies, such as the development of a data warehouse, have been implemented. MnDOT will initiate an editable directory and invite Taskforce members and other relevant stakeholders to document their historic and ongoing count efforts in the directory.

Action 4.3: Convene Taskforce at least quarterly

MnDOT will convene the Minnesota Bicycle and Pedestrian Data Taskforce to meet at least quarterly to maintain momentum around the installation of new permanent counters, greater use of the short-term counters, the creation of the data warehouse, and other goals. This group may also deal with active transportation issues not related to counting, if relevant topics arise. At the outset, it may make sense to meet more often than quarterly. MnDOT will also encourage working subgroups within the larger Taskforce to form around specific topics or areas of interest, to ensure that momentum is not lost between projects. These working groups can accomplish smaller goals and tasks corresponding to the main goals of this plan. MnDOT will monitor Taskforce success and progress over time.

Action 4.4: Coordinate installation of permanent counters among agencies and organizations under a strategic framework that includes the Bike and Pedestrian Data Collection Manual

One of the benefits of inter-agency collaboration is the ability to leverage data from multiple organizations to develop robust expansion factors and estimation models. To achieve this benefit, MnDOT will coordinate its own permanent counter installation with local jurisdictions to reduce the chances of redundancy and maximize the types of areas covered by permanent counter reference sites.

Action 4.5: Create and update the Pedestrian and Bicyclist Count Data Management Policy, as well as the Pedestrian and Bicyclist Count Data Privacy policy.

Throughout this strategic planning process, Taskforce members expressed concern for how their agencies' data would be used, stored, and shared if transmitted to MnDOT. These concerns ranged from data compatibility across platforms to public data sharing and data misuse. MnDOT will detail in advance how the Data Program will collect, use, store, and distribute data that is shared with MnDOT by other organizations. Data management practices may include delineating areas of responsibility for QA/QC both before and after data sharing, acceptable submission formats, data update and maintenance requirements, and how the data will be used. The data privacy policy will cover topics such as redistributing or sharing other organizations' data between MnDOT and state agencies, regional and local governments, nonprofits, private organizations, academic or educational institutions, activist groups, and the general public. For example, MnDOT may decide that raw, unprocessed data that organizations share with MnDOT may only be shared within the agency or with researchers at universities, whereas processed and aggregated data may be published on a public-facing website. Individual MOUs or other collaboration agreements, as per Action 4.1, may amend these policies as necessary for a specific organization's data.

Action 4.6: Facilitate supplemental data collection that meets data warehouse standards through non-MnDOT channels

Interviews with Taskforce members and consultants revealed that pedestrian and bicyclist count data are collected ad-hoc as part of other projects around the state regularly. Video data collection for traffic signal retiming collects data on people passing through an intersection by any mode. Even when the focus is on motor vehicle flows, counts of people walking and bicycling through are generated passively. MnDOT will prepare a short guide for cities, counties, and other agencies and organizations on how to harness this data and use it to enrich ongoing pedestrian and bicyclist counting efforts. This may include working with data collection consultants to share MnDOT's count data warehouse specifications and submission requirements and drafting tasks and deliverables about pedestrian and bicyclist data that cities and counties can add to motor vehicle data collection scopes.

Strategy 5: Monitor and communicate count data performance measures and applications internally and externally

Much of the success of MnDOT's Pedestrian and Bicyclist Data Program will depend upon the degree to which data is used to proactively track statewide use through performance measures, identify infrastructural needs locally and statewide, and then communicate a narrative through MnDOT, partner organizations, and the public. This will require setting up systematic processes to ensure that data and performance measures are presented clearly, and in a timely manner to relevant audiences.

Beyond expanding data collection and use within Minnesota, MnDOT will continue to lead and contribute to the national discussion about non-motorized data collection.

The action items associated with Strategy 5 are listed in Table 6 and described in subsequent sections.

Action 5.1: Identify needs for non-motorized count data from MnDOT agencies and partner organizations.

With input from Taskforce members, MnDOT will create a stakeholder list of agencies and organizations that would benefit from knowing more about nonmotorized transportation volumes. This list could include state agencies, local governments, and relevant groups/advocacy organizations, along with the count data in which they are most interested. Passing count data along to this group would boost the Data Program's exposure inside and outside of MnDOT, while increasing the use of this data. MnDOT will also work to define the frequency and format of this data and send it consistently.

Taskforce members have already identified some of these stakeholders and how their data needs vary by role. For example, for the general public and elected officials, data should demonstrate that active transportation is a normal and valued way to travel through and within communities. For elected officials, data should also demonstrate the value of active transportation to justify expenditures and get buy-in from others. For the public, data should show how investments in bike/ped facilities create stronger communities and lead to economic, public health, and mobility benefits.

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
5.1	Identify needs for non-motorized count data from MnDOT agencies and partner organizations	➲	☑				
5.2	Annually calculate AADPT/AADBT for short-duration count sites	➲	➲	➲	➲	➲	➲
5.3	Define process for estimating pedestrian/bicyclist miles traveled statewide			➲	➲	☑	
5.4	Create online presence for communicating performance measures	➲	➲	☑			
5.5	Explore how to include pedestrian and bicycle count data into CHIP and STIP	➲	➲	➲	➲	➲	➲
5.6	Communicate program achievements locally and nationally	➲	➲	➲	➲	➲	➲

Table 6. Action items for Strategy 5: Monitor and communicate count data performance measures and applications internally and externally

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed

Action 5.2: Annually calculate and publish AADPT/AADBT for short-duration count sites

Providing annual pedestrian and bicyclist volumes for short-duration count sites will allow local agencies and partner organizations to measure facility demand, and if repeated, year-over-year change in use. If adjustment factors have already been created, then these calculations may be performed immediately after the count is completed. These AADPT/AADBT estimates can be published in real-time on a website or in regular reports to share with stakeholders.

Action 5.3: Define process for estimating pedestrian and bicyclist miles traveled statewide

With more permanent counters and short-duration counters, more diverse factor groups and more accurate adjustment factors will be created and stored. Ultimately, these figures will allow MnDOT to estimate a broader range of statewide figures for active transportation use, including estimates of total miles traveled by walking or bicycling. That process will involve:

1. Gathering data for all factor groups statewide
2. Classifying all road segments in the state into factor groups
3. Using adjustment factors to estimate use on all state segments
4. Summing all segments statewide

Total distance traveled can be a useful metric to share because it can be used to discuss the benefits of active transportation across multiple dimensions. Miles traveled by walking or bicycling is associated with miles not traveled by auto, greenhouse gas emissions averted, physical activity duration, and other associated outcomes.

Action 5.4: Create online presence for communicating performance measures.

An online presence will likely boost the use of pedestrian and bicycle data in decision-making. Specifically, the online presence should:

- Integrate with general performance measures currently hosted by the Office of Transportation System Management (OSTM) MinnesotaGo dashboard[46].
- Be mobile-friendly
- Be Interactive and allow selectable locations
- Integrate with GIS systems

Action 5.5: Explore how to include pedestrian and bicyclist count data into County Highway Investment Plan and State Transportation Improvement Plan applications.

An important aspect of measuring how much people walk and bike along Minnesota roads and paths is using this information for planning, policy, and design decisions. The Capital Highway Investment Plan (CHIP) and State Transportation Improvement Plan (STIP) are two mechanisms by which pedestrian and bicyclist volumes could influence MnDOT's activities. MnDOT will consider how nonmotorized volumes may be used in identifying and prioritizing improvements in the CHIP and STIP.

Action 5.6: Communicate program achievements locally and nationally

MnDOT's legacy of investment in the Pedestrian and Bicyclist Data Program and in supporting research has made the agency a national leader on the subject. MnDOT will continue to lead and contribute to the national discussion about non-motorized data collection through representation and involvement on panels, engagement in national and local research opportunities, and advancing the field through presentations at relevant conferences and related venues (e.g., APBP, NACTO, Walk Bike Place, APA, etc.).

[46] https://performance.minnesotago.org/bicyclepedestrian

Conclusions and Next Steps

This strategic plan describes MnDOT's goals for collecting and monitoring data about the number of people walking and bicycling along and across Minnesota Trunk Highways and other segments in the transportation system.

Through a series of five strategies, each with concrete short-, medium-, and long-term action items, MnDOT will pursue the following goals:

1. Use count data and volume estimates to inform planning, design, and policy decisions to provide appropriate facilities for pedestrians and bicyclists along and across MnDOT trunk highways[47], trails, and other corridors as needed.
2. Coordinate with other agencies and organizations at the state, regional, and local levels to increase the quantity and quality of pedestrian and bicyclist count data throughout the state.
3. Produce annual average daily pedestrian traffic (AADPT) and annual average daily bicycle traffic (AADBT) estimates for all road and trail segments throughout Minnesota.

Many of the action items identified can be started immediately, such as developing a prioritization framework for systematically doubling the number of permanent counter reference sites over the next five years, or drafting an MOU or similar agreement with collaboration partners around the state. Other action items form a series of dependent steps that build on one another, working toward long term strategies like a consolidated warehouse for count data.

MnDOT's progress toward these goals will bring the agency closer to realizing the multitude of benefits of monitoring active transportation, ranging from more robust safety analyses to data-driven prioritization and evaluation of infrastructure improvements.

[47] MnDOT defines "Trunk Highways" to include: Interstates, US Highways, and MN State Highways.

Appendix 1: Goals of the Taskforce and Progress

The Minnesota Bicycle and Pedestrian Data Taskforce has compiled a list of goals and objectives. While the Taskforce is facilitated by MnDOT's Bicycle and Pedestrian Data Coordinator, these goals do not necessarily represent MnDOT's own direct goals. Nonetheless, these goals represent the priorities of agency stakeholders who actively collaborating with MnDOT to grow the program; the Taskforce's goals serve as a useful foundation from which MnDOT may derive its own goals and objectives. For this reason, it is a useful exercise to inventory the progress that the Taskforce has made to date since they initially convened in 2018.

Goals and objectives of the Minnesota Bicycle and Pedestrian Data Taskforce are listed below. Many of the earlier meetings focused on assessing present conditions and gathering information, and so the "progress" column on the right described these initial steps. Data inputs for this chart are excerpts from compiled minutes from the first five Taskforce meetings.

Goal 1: Central data repository

Table 7. Objectives and progress around Taskforce Goal 1: Establish a central repository where agencies or organizations in Minnesota can archive, share, and access bicycle and pedestrian traffic data.

Objectives	Progress to date, as per meeting minutes, by members of the Taskforce:
1. Track and summarize methods and procedures used by Minnesota agencies and partners to collect, analyze, and archive bicyclist and pedestrian data.	• Researched counter equipment used by MnDOT, as well as counting equipment of other companies such as Metro Count, MioVision, and Trailmaster. Members also compiled desired features of any future system (i.e. a friendlier user interface, data access ease and compatibility across equipment and formats, and the ability to distinguish between pedestrians and bicyclists). • Researched and found wide variation in best practices for mobile count durations (MnDOT standard is one week to account for weekday and weekend variation). • Compiled a list of communities still using manual counts. • Communicated with a University of Idaho professor's research on estimated Annual Average Daily Bicyclists (the method has already been demoed for the State of Washington and appears promising).
2. Explore use of existing data warehouses maintained by federal, state and other organizations (e.g., FHWA TMAS, MnDOT, Portland State University)	• Explored examples of existing data clearinghouses that could be modified for use with bike/ped data. • Prototyped Geoform, an ArcGIS-based interactive portal that allows users to input metadata and create customizable map displays. • Communicated with the Bike Ped Portal in Portland as a possible data template (talked with them in November 2018).
3. Standardize quality-assurance, quality control (QA-QC) procedures for bicyclist and pedestrian data stored in common databases.	• Examined the QA-QC procedures used by the National BikePed Portal (based on outlier data).
4. Confirm or establish standard data formats (i.e. TMAS and TMG) that can be used across equipment types and counting techniques (i.e. manual vs. automated) for reporting, analysis, and archiving.	• Served as beta-testers for Eco-Counters new TMG format outputs (EcoCounter is currently developing TMG format outputs to streamline submissions to TMAS).
5. Integrate non-motorized and motorized traffic data management systems to inform multi-modal planning and engineering.	

Objectives	Progress to date, as per meeting minutes, by members of the Taskforce:
6. Get copies of vendor data in-house for security and so applications and models can be directly linked to the data	
7. Create a public, online, and interactive map that enable users to identify all continuous and short duration monitoring sites and to download data for analysis, including photos, pdfs of reports, and other analyses.	• Informally compared ESRI Story Maps, the National BikePed Portal, and Geoform.

Goal 2: Factor groups and expansion factors

Table 8. Objectives and progress around Taskforce Goal 2: Generate factors and factor groups for extrapolation of short duration counts into estimates of annual average daily bicyclists (AADB), annual average daily pedestrian (AADP), or annual average daily non-motorized traffic (AADNT; i.e., undifferentiated bicyclist and pedestrian, or mixed-mode traffic).

Objectives	Progress to date, as per meeting minutes, by members of the Taskforce:
1. Create and standardize reliable and replicable methods for generating factors (e.g., day-of-year, month-of-year, day-of-week, hourly factors)	• Researched and discussed the newest extrapolation factors used by bicycle and pedestrian count professionals. • Attempted to set up a course at University of Minnesota for Fall of 2018; and tried again in Spring of 2019. The members also worked to connect with professors statewide who teach courses that may allow students to help with counts and training. • Identified future sites required to generate adequate factors (MnDOT). MnDOT is assembling ACS bicycling commuting data, running a regression analysis to determine how independent variables impact those bicycling rates, building a model to predict where bicycle commuters are most likely to be found, ground truthing with internet, maps, and locals, installing short duration counters to capture travel patterns, and then depending on those results, installing permanent sites based on results.
2. Determine minimum number of continuous counters and site locations required for development of robust factors that can be used to minimize error in estimation of AADB, AADP, and AADNT.	• Gathered the latest research that found accurate factoring could be achieved with 4-5 count sites. MnDOT currently uses counters that primarily represent 2 of 4 factor groups (need utilitarian/commuting, and recreational types). • Determined that new Minnesota permanent counter sites should be strategically placed so that the limited number of counters can capture different factor groups
3. Publish factors on MnDOT website with guidance for application and use in planning and engineering.	
4. Determine appropriate short duration count methodology.	

Goal 3: Develop metrics and performance measures

Table 9. Objectives and progress around Taskforce Goal 3: Use data to develop metrics and performance measures and to report progress on advances in active travel.

Objectives	Progress to date, as per meeting minutes, by members of the Taskforce:
1. Survey agencies partners to identify individual data needs and applications (i.e. health effects, economic activity, rider comfort, safety risks, etc.)	• Reached out to different agencies and jurisdictions and determined that the main need is staff time and capacity (bike/ped counting perceived as lower priority). • Determined that further training is required because of staff turnover/lack of institutional knowledge.
2. Identify how partners interpret and share data to improve understanding of what stories are told and who is informed	• Determined that for 1.) For the general public and elected officials, data should demonstrate that active transportation is a normal and valued way to get around communities; 2.) For elected officials, data should demonstrate the value of active transportation to justify expenditures and get buy-in; 3.) For the public, data should show how investments in bike/ped facilities create stronger communities and pays economic, public health, and mobility benefits. • Compiled and shared a list of SHIP communities with bicycle and pedestrian count data. • Collected and organized case studies of how bike and ped data influenced decision making.
3. Create a plan for sharing data with specific audiences (i.e. planners, engineers, the media, etc.)	
4. Publish annual reports that use common metrics to summarize performance and trends	

Goal 4: Future Planning

Table 10. Objectives and progress around Taskforce Goal 4: Future Planning

Taskforce Objectives	Progress to date, as per meeting minutes, by members of the Taskforce:
1. Be innovative	
2. Be collaborative	
3. Determine resources required to continue and support work of the Taskforce.	
4. Provide guidance (i.e. collection, analysis, submission, interpretation, sharing, etc.) beyond the Minnesota Bicycle and Pedestrian Data Collection Manual.	
5. Identify additional bike and ped data that can or should be incorporated (i.e. phone app data, other vendors).	• Were informed of an effort by the MN Parks and Trail Council (that group hired an intern, who rode 600 miles of paved state trails during Summer of 2018 to assess trail pavement quality and inform maintenance crews). • Explored StreetLight Data (Minneapolis already has access to it and DNR is interested in using it). • Explored—and continue to follow—the results of MioVision Data Portal Demonstration in Minneapolis. o 24 hours of video and analyzed at an approximate cost of $450/intersection for all modes. o Challenges: QA-QC issues across weather types, dates, and times. Also, factoring to extrapolate pedestrian and bicyclist volumes.
6. Evaluate best and current practices for effectiveness.	
7. Integrate into larger plans, projects, and systems.	

Appendix 2: Combined Strategies and Actions Table

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
1.1	Develop a sampling strategy for permanent and temporary (short-duration) counts	☑					
1.2	Develop a plan to install five (5) permanent counters per year over the next five (5) years	☑					
1.3	Install five (5) permanent counters per year over the next five (5) years		➲	➲	➲	➲	☑
1.4	Create Short-Duration Counter Rotation Plans at the district level		☑				
1.5	Streamline and institutionalize the existing counter loan system		➲	➲	➲	➲	☑
2.1	Select technical specifications for data warehouse	☑					
2.2	Build warehouse allowing internal and external data access		➲	☑			
2.3	Populate warehouse with MnDOT's existing count data			➲	☑		
2.4	Develop and implement data QA/QC procedures	☑					
2.5	Define process for incorporating partner data into warehouse				➲	➲	☑
3.1	Evaluate previously developed factors against new data	➲	☑				
3.2	Define process for annual update of factor group definitions		➲	☑			
3.3	Apply adjustment factors to existing short duration count data			➲	➲	➲	➲
3.4	Develop a methodology for estimating pedestrian and bicyclist volumes for all road and trail segments in MN					➲	☑

ID	Action	Y0	Y1	Y2	Y3	Y4	Y5
4.1	Develop a memorandum of understanding (MOU) with participating agencies and organizations	➲	☑				
4.2	Develop directory detailing historic and ongoing count efforts around the state	☑					
4.3	Convene Taskforce at least quarterly	➲	➲	➲	➲	➲	➲
4.4	Coordinate installation of permanent counters among agencies and organizations under a strategic framework that includes the Bike and Pedestrian Data Collection Manual				➲	➲	☑
4.5	Create and update Data Management Policy and Data Privacy Policy documents for inter-agency data sharing		➲	➲	☑		
4.6	Facilitate supplemental data collection that meets data warehouse standards through non-MnDOT channels	➲	➲	☑			
5.1	Identify needs for non-motorized count data from MnDOT agencies and partner organizations	➲	☑				
5.2	Annually calculate AADPT/AADBT for short-duration count sites	➲	➲	➲	➲	➲	➲
5.3	Define process for estimating pedestrian/bicyclist miles traveled statewide			➲	➲	☑	
5.4	Create online presence for communicating performance measures	➲	➲	☑			
5.5	Explore how to include pedestrian and bicycle count data into CHIP and STIP	➲	➲	➲	➲	➲	➲
5.6	Communicate program achievements locally and nationally	➲	➲	➲	➲	➲	➲

Table 11. All Strategies and Action Items

Table symbol key: ➲ Action item ongoing or progress ☑ Action item completed