



Traffic Data Collection Processes Study

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Disclaimer:

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The following members comprise the project's Technical Advisory Panel (TAP) that contributed to the development of the testing process:

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Executive Summary

In conjunction with the Minnesota Department of Transportation (MnDOT) Office of State Aid for Local Transportation (SALT), MnDOT's Traffic Forecasting and Analysis Section (TFA) (within the Office of Transportation System Management formerly known as Transportation Data and Analysis and commonly referred to as TDA) collects traffic volume counts for cities and counties outside of the Twin Cities Metro Area. Volume "coverage" counts are performed on various roads including trunk highways, county roads, county state aid highways, and municipal state aid streets. The counts assist with planning, design, development, maintenance priorities and snow removal.

MnDOT TFA collects selected traffic volume counts for cities and counties outside of the Twin Cities Metro Area as part of its statewide traffic counting program.

At the outset of the project, there was discussion on whether local agencies could conduct the counts in a more timely and efficient manner due to reduced travel time and good knowledge of local conditions and needs.

The goal of this research implementation project is to look at a few other options for cities and counties to use to gather traffic data; the focus of this project was to shadow three data collection processes, gather and compare data/information and write a summary report. The three collection processes are:

- **MnDOT TFA:** Traffic data collected in the "typical" way with MnDOT staff. MnDOT field technicians recorded their efforts to perform traffic counts in Le Sueur County.
- **County:** County staff used MnDOT equipment and collected traffic data. Sibley County hired an intern to conduct counts during the summer of 2013, who worked with a County GIS technician to perform the data collection and management duties. The intern was trained by MnDOT TDA staff on the correct way to collect and submit the data collected to MnDOT. County staff documented their work on the project.
- **Consultant:** A traffic consultant prepared a cost estimate to collect the same traffic data as Sibley County.

To address some of these questions, three methods of traffic data collection were conducted and compared during the summer of 2013.

To guide this research implementation project, a series of Technical Advisory Panel (TAP) meetings with project participants and stakeholders was conducted. The focus of these meetings was to plan the data collection, guide and monitor the data collection, review the findings and assist in drafting the conclusion and this report.

As part of this research implementation project, pre and post data collection surveys were conducted with both MnDOT TFA and County staff to assess each party’s expectations and lessons learned.

Labor Comparison

The table below shows the number of hours that each agency used to perform the traffic counts. These hours include drive time, office/prep time, first pass count attempts, and recount attempts. The hours required for Sibley County and MnDOT represent recorded hours during data collection performed in 2013. Sibley County counted sites within its county limits. MnDOT counted sites in Le Sueur County.

Table 1 also included the total hours per site for a typical county data collection program. The consultant estimate was determined from a budgetary estimate of a complete data collection effort in Sibley County. Although this process and these values are not directly comparable (e.g. a more accurate comparison would have been to have each agency conduct counts at the same place), this study tried to leverage existing counts already scheduled and draw some time comparisons.

Labor Comparison per Collection Process

Agency	Number of Sites with Acceptable Data	Total Hours	Total Hours Per Accepted Site
Sibley County	151	250	1.66
MnDOT	270	204	0.76
Consultant	180	250	1.39

Note: This was not a fully-controlled scientific study. Many of Sibley County’s setups were with dual tube counters which required additional field setup time and thus could skew the results.

MnDOT’s time per site is the lowest due to their personnel specialization (full time traffic data collection specialists) and relative proximity to the counties in the District, and their streamlined process of data management with Central Office which saves significant time. MnDOT averaged 4.6 minutes per volume count setup and 16 minutes per vehicle classification (VC) count setup. Sibley County averaged 7.3 minutes per volume count setup and 12 minutes per VC setup.

Problems Encountered

The following issues were encountered throughout the data collection process. Many of these issues could be mitigated in the future based on the results of this project. These issues are further explained in the full report.

- Equipment failures

- Lack of equipment
- Procedural problems
- Lack of experience
- Difficulty in transferring data to MnDOT efficiently

Lessons Learned

This project generated many lessons learned and documented many positive outcomes that were expressed in the project interviews.

- During this project MnDOT TFA made several outreach efforts to counties at various District SALT meeting. This resulted in significantly **improved relationships** between the counties and MnDOT TFA. Each entity understood the role that the other plays in the data collection process.
- Improved Sibley County's **understanding of the nuances of traffic count procedures**.
- Importance of **quality, structured training** from MnDOT TFA. Although MnDOT TFA conducted a short training session, including an opportunity to test the counter setting method, a second training session was necessary after Sibley County had some more experience with setting counters. It was concluded that staff new to data collection should "shadow" experienced staff for one or two days to repeatedly practice setups encounter and solve typical issues.
- Importance of **experience** in conducting traffic counts. Sibley County rapidly became more efficient after some practice. Agencies should expect some early inefficiency.
- Necessity of **careful planning** around construction and events. Some count locations were not able to be counted during the defined data collection period.
- Traffic counting **staffing must be flexible** enough to be able to accommodate spring and fall data collection to work around summer construction activities. Thus a summer intern may not be able to perform all counts.
- Necessity of adequate **working equipment** for efficient counting. Test equipment before deploying it.
- **Efficient data processing procedures** of sending data to MnDOT for analysis. Think through the data processing procedures and define areas to improve the process.
- Importance of **quick data analysis turnaround** for conducting recounts. Being able to quickly recount a site can improve the chance of a valid recount.
- MnDOT's process for eliminating redundant counts can reduce the number of sites that need to be collected, but this process was not did not eliminate as many counts as was expected.
- The relative cost of traffic collection varies between simple volume counts and vehicle classification (VC) counts. MnDOT typically uses a 2-to-1 ratio for the time to setup VC versus standard counts. Prior to the project, Sibley County felt the ratio should be 2-to-1 or less. However, after completing the data collection, Sibley County felt a 3-to-1 ratio would be more appropriate.

Introduction

In conjunction with the Minnesota Department of Transportation (MnDOT) Office of State Aid for Local Transportation (SALT), MnDOT's Traffic Forecasting and Analysis Section (TFA) (within the Office of Transportation System Management formerly known as Transportation Data and Analysis and commonly referred to as TDA) collects traffic volume counts for cities and counties outside of the Twin Cities Metro Area. Volume "coverage" counts are performed on various roads including trunk highways, county roads, county state aid highways, and municipal state aid streets. The counts assist with planning, design, development, maintenance priorities and snow removal.

MnDOT TFA collects selected traffic volume counts for cities and counties outside of the Twin Cities Metro Area as part of its statewide traffic counting program.

The goal of this project was to compare the effectiveness of various entities performing traffic counts including MnDOT forces, local county forces and a consultant. Perceived advantages of local agencies performing these counts include:

- Data collection done when needed (versus MnDOT schedule)
- Reduced travel time
- Better local knowledge of the roads
- Better knowledge of the county's needs
- Improved knowledge and ability to coordinate around local events and construction
- Selection of enhanced count (vehicle classification) locations
- Coordination with mowing activities

The perceived disadvantages include:

- Most counties lack the technical expertise/experience with traffic counting
- Additional need for coordination between MnDOT and counties
- Annually, MnDOT needs to collect and submit data to FHWA; a portion of this data includes and is integral to the MnDOT traffic data collection
- Additional need for counting equipment

This report summarizes the findings of the project with respect to these considerations.

Background

Managed by MnDOT TFA through the Districts Offices, traffic counts are conducted for cities and counties outside the Twin Cities Metro Area. Counts are programmed and each count station is counted periodically based on a statewide program. Most counts are repeated every four years. The resulting data is provided to cities and counties among other data users. Some cities and counties have expressed interest in collecting their own counts to obtain data in "real time" (versus the four year cycle).

Currently, counties and cities have MnDOT collect traffic volume data. One question this project looked to answer was whether costs for counties and cities would be less or greater when completing the work themselves. Specifically:

- Compared to the MnDOT Office, can the counties collect the traffic data more efficient due to less travel time to collection sites and their knowledge of the area?
- Often counties need specific counts/classification for design purposes; could the counties collect data more relevant to their interests?

Methodology

To address some of these questions, three methods of traffic data collection were conducted and compared during the summer of 2013:

- **MnDOT TFA:** Traffic data collected in the “typical” way with MnDOT staff. MnDOT field technicians recorded their efforts to perform traffic counts in Le Sueur County.
- **County:** County staff used MnDOT equipment and collected traffic data. Sibley County hired an intern to conduct counts during the summer of 2013, who worked with a County GIS planner to perform the data collection and management duties. The intern was trained by MnDOT TDA staff on the correct way to collect and submit the data collected to MnDOT. County staff documented their work on the project.
- **Consultant:** A traffic consultant prepared a cost estimate to collect the same traffic data as Sibley County.

To guide this research implementation project, a series of Technical Advisory Panel (TAP) meetings of project participants and stakeholders were conducted. The focus of these meetings were to plan the data collection, guide and monitor the data collection, review the findings and assist in drafting the conclusion and this report.

As part of this research implementation project, pre and post data collection surveys were conducted of both MnDOT TFA and County staff to assess each party’s expectations and lessons learned.

Sibley County did not have dedicated traffic staff for this project; however, in cooperation with MnDOT SALT, they hired a seasonal intern to conduct the field work for the traffic data collection. MnDOT TFA conducted training sessions for conducting traffic counts for the Sibley County staff. MnDOT TFA also provided ongoing support and assistance throughout the project to help Sibley County resolve various equipment and procedural issues.

Results

Traffic data collection occurred in the summer of 2013.

MnDOT TFA:

- Provided actual and/or estimated labor data for traffic counts on Le Sueur County sites during April-September 2013.

Sibley County:

- Assigned 168 traffic counting sites.
 - 95 were volume counts.
 - 73 were vehicle classification (VC) counts.
- The process took longer than expected including sorting out equipment issues and mitigating procedural problems for much of the first three weeks.
- The intern performed 258.5 hours of labor related to traffic data collection activities including training (32.3 8-hour days). A GIS planner also assisted with 56.8 hours of data collection.

Consultant:

- Provided budgetary labor estimate for 240 sites.
- Reported that volume and VC counts require equivalent labor effort, however inputting this data into MnDOT's database may require more effort for VC counts.

Findings

Labor Comparison

The table below shows the number of hours that each agency used to perform the traffic counts. These hours include drive time, office/prep time, first pass count attempts, and recount attempts. The hours required for Sibley County and MnDOT represent recorded hours during data collection performed in 2013. Sibley County counted sites within its county limits. MnDOT counted sites in Le Sueur County. Le Sueur County is about one hour away from MnDOT's District 7 office. The consultant time incorporates travel time from Minneapolis to Sibley County.

Labor Comparison per Collection Process

Agency	Number of Sites with Acceptable Data	Total Hours	Total Hours Per Accepted Site
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MnDOT	270	204	0.76
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Notes. *This was not a fully-controlled scientific study. Many of Sibley County's setups were with dual tube counters which required additional field setup time and thus could skew the results.*

These numbers account for recounts. MnDOT's recount rate is about 25 percent statewide. Sibley County's recount rate was about 48 percent, although 23 percent of the recounts were due to equipment failure. The consultant recount rate is assumed to be comparable to MnDOT's rate.

The table above also includes the total hours per site for a typical county data collection program. Sibley County spent 20 hours on training, 102 hours on field data collection, and 128 hours on data management. The consultant estimate was determined from a budgetary estimate of a similar data collection effort in Sibley County. Although this process and these values are not directly comparable (e.g. a more accurate comparison would have been to have each agency conduct counts at the same place), this study tried to leverage existing counts already scheduled and draw some time comparisons.

MnDOT's time per site is the lowest due to their personnel specialization (full time traffic data collection specialists) and relative proximity to the counties in the District, and their streamlined process of data management with Central Office which saves significant time. MnDOT averaged 4.6 minutes per volume count setup and 16 minutes per VC setup. Sibley County averaged 7.3 minutes per volume count setup and 12.1 minutes per VC setup.

For comparison, Sibley County spent more time with data management than performing the counts (127 hours compared to 102 hours). The Sibley County estimate also includes 20 hours of training (no training time was included in either the MnDOT nor consultant hours).

Sibley County experienced several obstacles at the beginning of the project, including equipment failure, incorrect procedures and planning and coordination issues with construction projects. After completing additional training with MnDOT and acquiring some new equipment, the project ran more smoothly. MnDOT assisted with procedural problems and improved Sibley County's productivity.

Throughout the project, it became clear that traffic counting experience is extremely important to an effective traffic counting program. From office tasks (such as planning) to field tasks (such as traffic counter setup), traffic counter takedown to dealing with equipment problems, Sibley County felt they underestimated the expertise required and the efficiencies gained with previous experience. Both MnDOT and Sibley County felt the process would go more smoothly if Sibley

County were to continue conducting traffic counts. However, if the process is handed over to other counties and cities, similar startup issues may occur.

Lessons Learned

This project generated many lessons learned and documented many positive outcomes that were expressed in the project interviews.

- During this project MnDOT TFA began outreach efforts to counties at various District SALT meeting. This resulted in significantly **improved relationships** between the counties and MnDOT TFA. Each entity understood the role that the other plays in the data collection process.
- Improved Sibley County's **understanding of the nuances of traffic count procedures**.
- Importance of **quality, structured training** from MnDOT TFA. Although MnDOT TFA conducted a short training session, including an opportunity to test the counter setting method, a second training session was necessary after Sibley County had some more experience with setting counters. It was concluded that staff new to data collection should "shadow" experienced staff for one or two days to repeatedly practice setups encounter and solve typical issues.
- Importance of **experience** in conducting traffic counts. Sibley County rapidly became more efficient after some practice. Agencies should expect some early inefficiency.
- Necessity of **careful planning** around construction and events. Some count locations were not able to be counted during the defined data collection period.
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- MnDOT's process for eliminating redundant counts can reduce the number of sites that need to be collected, but this process was not did not eliminate as many counts as was expected.
- The relative cost of traffic collection varies between simple volume counts and vehicle classification (VC) counts. MnDOT typically uses a 2-to-1 ratio for the time to setup VC versus standard counts. Prior to the project, Sibley felt the ratio should be 2-to-1 or less. However, after completing the data collection, Sibley County felt a 3-to-1 ratio would be more appropriate.

The following sections highlight some of the lessons learned from this project. Both MnDOT and Sibley County agreed that many of the issues encountered could be avoided in future data collection.

Lack of Equipment/Equipment Failures

MnDOT provided Sibley County with 40 traffic counters along with about 40 sets of tubes and clamps at the beginning of the project. An additional 40 clamps and four new data cards were provided in the second week of data collection to replace broken parts and supplement the lack of working equipment (for comparison, MnDOT count staff can set up to about 80 counters per week). The counters provided for Sibley County were from the MnDOT TFA's warehouse and were spare units. Most of the counters were TimeMark which, for class counts require two tubes and sets of clamps. Since Sibley County used a class setup for volume sites there was not enough tubes and clamps to match the counters.

Sibley County experienced many equipment problems during the first several weeks which greatly stifled progress. The following problems were encountered:

- Faulty pneumatic ports on counters
- Non-functional batteries (would not hold a charge)
- Tubes tearing

In many cases, the equipment was repairable and the count was rerun, however, about 5 percent of the equipment could not be repaired. Having more and better equipment would have decreased the amount of County Staff time. MnDOT District Staff have enough counters to cover the loss and maintain their counting rate.

Procedural Problems

Sibley County encountered a few procedural problems that could be avoided in the future. These included incorrectly placing and tightening tubes, incorrectly clamping tubes and the use of improperly sized tubes (too long). These problems were generally mitigated as staff learned through training and experience. Sibley County also gained speed at setting up and taking down collection sites with additional experience.

Inefficient Data Transfer Process and Recounts

As Sibley County completed counts using the TimeMark counters, the memory cards were mailed to MnDOT TFA to be processed and it was determined whether or not a recount was necessary. Recounts are necessary when the traffic volumes vary too much from the previous traffic counts (traffic counts conducted in previous years). MnDOT estimates that this occurs at about 20-30 percent of sites. During this study Sibley County's recount rate was almost 50 percent (although some was due to equipment problems).

During the post data collection interviews and TAP meetings it was agreed upon that it would have been more efficient if Sibley County had access to the software that MnDOT District staff use to process the memory cards. This would have allowed them to process the memory cards without mailing them to MnDOT and could perform necessary recounts at a more optimal time (e.g. when collecting data at nearby sites). As it happened, recount determination was delayed

while MnDOT was processing the memory cards and Sibley County often had to perform recounts in previously collected quadrants of the county.

Another problem in the data transfer process came from miscoding sites. A misunderstanding about how to code the sites led to about 20 percent of the data being incorrectly coded; these errors were eventually fixed.

Planning and Coordination

The planning and coordination required to complete the traffic counts greatly exceeded the expectations of Sibley County. Originally, it was believed that most duties could be handled by the intern. However, additional Sibley County staff spent significant time working with MnDOT staff. Due to the lack of familiarity with the equipment and processes; if traffic data collection becomes a “normal” function within a county, some of this time would be reduced.