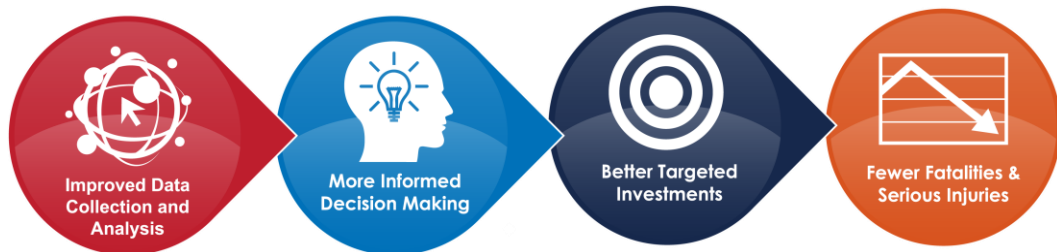# Traffic Volume Collection and Estimation on Non-Federal Aid System Roads

NEW YORK STATE DEPARTMENT OF TRANSPORTATION

ENGAGEMENT OF LOCAL AGENCIES IN TRAFFIC VOLUME COLLECTION AND RANDOM SAMPLING PROCEDURES

CASE STUDY

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16. Abstract

This case study highlights two noteworthy practices at the New York State Department of Transportation (NYSDOT) regarding traffic data collection agreements with local agencies and random sampling procedures to select short-duration traffic count locations. Through agreements with local agencies, NYSDOT provides traffic counting equipment and training in exchange for short-duration traffic counts. The agreement stipulates the minimum number of counts local agencies must conduct each year, a number equal to the breakeven point between the cost of the counters and cost of conducting short-duration traffic counts. The benefits of these agreements include reducing duplicate traffic data collection efforts and costs for NYSDOT while providing additional data and analysis to partnering local agencies. NYSDOT conducted a one-time project to collect short-duration counts on a random sample of local roads not typically counted as part of the traffic data collection program. This project supplements existing count data so that at least 10 percent of the local road mileage in each municipality has short-duration counts to support local road annual average daily traffic (AADT) data collection. Random sampling provides an unbiased method to select segments for short-duration traffic counts to increase the amount of measured AADT on local roads.

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ACRONYMS

Table 1. Acronyms.

Acronym	Description
AADT	Annual Average Daily Traffic
DOT	Department of Transportation
FAS	Federal Aid System
MOA	Memorandum of Agreement
MPO	Metropolitan Planning Organization
NFAS	Non-Federal Aid System
NYSDOT	New York State Department of Transportation
VMT	Vehicle Miles Traveled
WGS	World Geodetic System

EXECUTIVE SUMMARY

This case study highlights two noteworthy practices at the New York State Department of Transportation (NYSDOT) regarding traffic data collection agreements with local agencies and random sampling procedures to select short-duration traffic count locations. Through agreements with local agencies, NYSDOT provides traffic counting equipment in exchange for short-duration traffic counts. The agreement stipulates the minimum number of counts local agencies must conduct each year, a number equal to or exceeding the breakeven point between the cost of the counters and cost of conducting short-duration counts. The benefits of these agreements include reducing duplicate data collection efforts and costs for NYSDOT while providing additional data and analysis to collaborating local agencies. NYSDOT conducted a one-time project to collect short-duration counts on a random sample of local roads not typically counted as part of their traffic data collection program. This project supplements existing count data so that at least 10 percent of the local road mileage in each municipality has short-duration counts to support local road annual average daily traffic (AADT) data collection.

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INTRODUCTION

The purpose of this case study is to highlight two noteworthy practices at the New York State Department of Transportation (NYSDOT) for collecting short-duration traffic count data:

- Partnership agreements with local agencies

- Random sampling procedures

The local road network within New York is extensive, and NYSDOT is a leader in developing partnerships and projects to collect short-duration traffic counts on local roads. Through agreements with local agencies, NYSDOT provides traffic counting equipment and training in exchange for short-duration traffic counts. Agreements with counties, cities and metropolitan planning organizations (MPOs) stipulate the minimum number of counts local agencies must conduct each year. This number equals or exceeds the breakeven point between the cost of the counters and cost of conducting short-duration traffic counts. The benefits of these agreements include reducing duplicate traffic data collection and costs for NYSDOT and providing additional data and analysis to collaborating local agencies.[1]

In addition to ongoing agreements with local agencies, NYSDOT conducted a one-time project to collect short-duration counts on a random sample of local roads not typically counted as part of their traffic data collection program. This project supplements existing count data with a target of covering at least 10 percent of the local road mileage in each municipality with short-duration counts to support annual average daily traffic (AADT) data collection. NYSDOT chose random samples from all local roadways in each municipality to develop aggregate statistics of the amount of travel on local roadways. The benefits of this random sampling procedure include an increase in the number of short-duration traffic counts, as well as more complete and accurate AADT for local roads. Selecting locations randomly generates an increase in the number of counts on non-Federal Aid System (NFAS) roads.

BACKGROUND

New York has approximately 115,000 miles of public roads, of which about 86,000 miles are functional class local or rural minor collectors. Traffic counts at bridges and railroad crossing total approximately 9,000 miles of counts and another 8,000 counts from random sampling of local roads to support local road AADT collection and subsequent vehicle miles traveled (VMT) estimation. NYSDOT supplemented its existing count data with a target of counting at least 10 percent of the mileage in each of the 1,500 municipalities in the state to ensure a wide distribution of count data. NYSDOT conducts a few thousand counts every year through agreements with local agencies. NYSDOT provides traffic counters, supporting equipment, software, and training to the agencies. In return, agencies provide traffic counts, many of which are on rural minor collectors and local roads that NYSDOT would not otherwise count. NYSDOT compiles approximately 12,000 short-duration traffic counts annually.

NYSDOT conducts very few traffic counts itself, taking around 2 percent of the counts annually. Local agencies (14 percent) and contractors (84 percent) take the remaining counts. Contractors' costs vary widely depending on the type of count and location. For example, a simple volume count costs $100, while a more complex classification count costs $1,800. The statewide average count costs roughly $200. During a statewide project that involved data collection on local roads, contractors charged $120 per count. The traffic counters purchased by NYSDOT cost roughly $800 each. The benefits of having local agencies conduct counts become clear when comparing the cost of equipment to the cost of contractors.

DATA COLLECTION PARTNERSHIPS

NYSDOT partners mostly with counties to collect traffic data and has partnerships with about half of the 62 counties in the state. Occasionally, NYSDOT collaborates with cities and MPOs. NYSDOT provides traffic counting equipment, training, and support; in return, local agencies provide short-duration traffic counts. These partnerships are mutually beneficial. They save NYSDOT time and money by reducing duplicate data collection and provide counties with data analysis and equipment. Approximately 14 percent of the counts taken annually in New York are by local agencies. NYSDOT establishes standards for all traffic monitoring activities, including short-duration traffic counts. These standards ensure that all traffic data are consistently collected, allowing for easy data transfer and upload to NYSDOT's database.

AGREEMENTS

NYSDOT uses a memorandum of agreement (MOA) to facilitate partnerships with counties. As part of this partnership, NYSDOT purchases and provides traffic counters and supporting equipment, software, and training to the counties, which in turn conduct a minimum of two counts per counter per year for five years. If a county does not fulfill its obligation to the state, it must return the equipment.

The agreements between NYSDOT and local agencies are simple and executed with an MOA, as shown in Figure 1.

Figure 1. NYSDOT Traffic Counts MOA.

AGREEMENT

The following terms and conditions are applicable to the Traffic Counting Partnership between _____ County and New York State Department of Transportation.

New York State Department of Transportation agrees to provide:

1. New automatic traffic recorders.

2. All necessary software, training and support.

_____ County agrees to:

1. Accept ownership of the automatic traffic recorders after fulfilling the qualified count obligation.
2. Assume responsibility for all repairs to the counters.
3. Supply all peripheral equipment (road tube, nails, clamps, etc...).
4. Return the automatic traffic recorders, Pocket PC, and software to New York State Department of Transportation, if the County decides not to participate in the Traffic Counting Partnership.

_____   _____   _____   _____
NYSDOT Representative   Date   County Representative   Date

Inventory of Counters delivered to _____ County

Source: Michael Fay, Director Highway Data Services Bureau, NYSDOT

NYSDOT benefits through a reduced need for staff and contractual resources to collect traffic data. Counties benefit by receiving the equipment, software, training, and analysis as well as having local and statewide data in a consistent and uniform format they can more efficiently use.

DATA COLLECTION

NYSDOT partners with local agencies to enrich the available traffic count data and eliminate duplicate efforts. Federal funding, construction, maintenance, planning, and safety projects use traffic count data. To ensure that data collected by local agencies integrates into NYSDOT's database, local agencies must follow the same procedures as NYSDOT and contractors. NYSDOT developed a guide, titled *New York State Traffic Monitoring Standards for Short Count Data Collection* (https://www.dot.ny.gov/portal/pls/portal/mexis_app.pa_ei_eb_admin_app.show_pdf?id=11926), to help local agencies and contractors meet data collection requirements.[2]

The guide includes minimum standards for short-duration traffic counts, safety, traffic count sites, and data. The amount of data collected by local agencies varies depending on an agency's size and budget. Local agencies must conduct a minimum of two counts per counter per year for five years; however, many counties conduct additional counts. Local agencies in New York conduct approximately 14 percent of the short-duration counts.

To meet the minimum count requirement, NYSDOT must take 10 counts per counter on the Federal Aid System (FAS), sections with bridges, or sections with railroad crossings, for which NYSDOT would otherwise have to expend funds to collect. In addition, local agencies provide all count data collected to NYSDOT for processing. Local agencies take the majority of counts on NFAS roads that NYSDOT would not have otherwise counted.

NYSDOT requires traffic counts to comply with the Federal Highway Administration's *Traffic Monitoring Guide*.[3] The NYSDOT traffic count program has the following minimum standards for short-duration counts:

- All counts are in 15-minute intervals.

- At least 48 hours of data are required, while 72 hours are preferred, for weekday counts. The counts must include at least two valid counts for each hourly interval.

- Weekend counts are done at NYSDOT request. Each weekend count must have one hour of valid data for a 24-hour interval and must be accompanied by a weekday count taken adjacent to the weekend period.

- Volume counts are taken by direction, and classification counts are taken by lane.

- NYSDOT specifies no part of a weekday or weekend count used for AADT estimation may contain data collected during a holiday interval.

FIELD PROCEDURES

NYSDOT lists several procedures that local agencies must follow in the short duration count data collection guide. . In addition, all work must conform to NYSDOT's *Work Zone Traffic Control Manual*.[4] NYSDOT identifies count locations using GPS coordinates and describes them using the road number, road name, beginning termini, ending termini, end milepoint, section length, factor group, and functional classification. NYSDOT trains local agencies on equipment setup and use so that the counts are valid. Agencies record the GPS coordinates as close as possible to actual traffic count locations.

DATA TRANSFER

Agencies transfer data to NYSDOT weekly through email or an FTP site. NYSDOT has procedures for file naming and related documents to help identify count locations and determine data validity. NYSDOT works with traffic counter manufacturers to ensure that each type of recorder can produce the required output format. This allows local agencies to easily export data in NYSDOT's required format.

As a part of the agreement with local agencies, NYSDOT provides software for the counters and agrees to process the data. After processing, local agencies send the data to NYSDOT for inclusion in the database. To identify where counts were taken and ensure data validity, NYSDOT requires the following information:

- A cover letter detailing the organization conducting the count, work week, NYSDOT region, road name, count type, duration, lanes, and data collection method.

- Count files.

- Field logs detailing where the counter was placed, when data were collected, counter model, counter serial number, a map of the data collection location, and how the counter was set up.

- Site photos.

- File with geospatial coordinates recorded in decimal degrees in World Geodetic System (WGS) 1984.
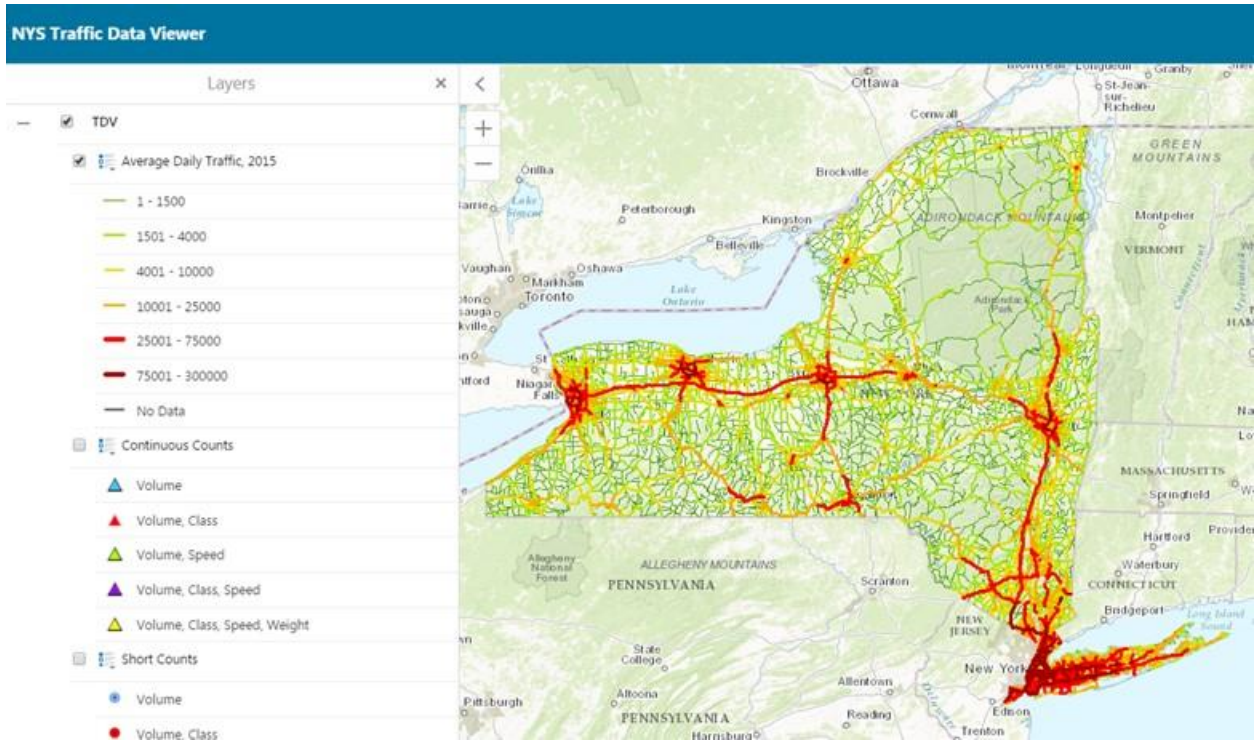
- Raw data files downloaded from counters.

- Other information on counter placement activities.

NYSDOT conducts quality control checks of all traffic count data using manual procedures or automatic checks built into the traffic count software. Checks include procedures such as:

- Ensuring there are no counts of zero during peak hours.

- Confirming that the number of counts at noon is greater than at midnight.

- Comparing directional splits.

- Comparing differences between certain vehicle classes.

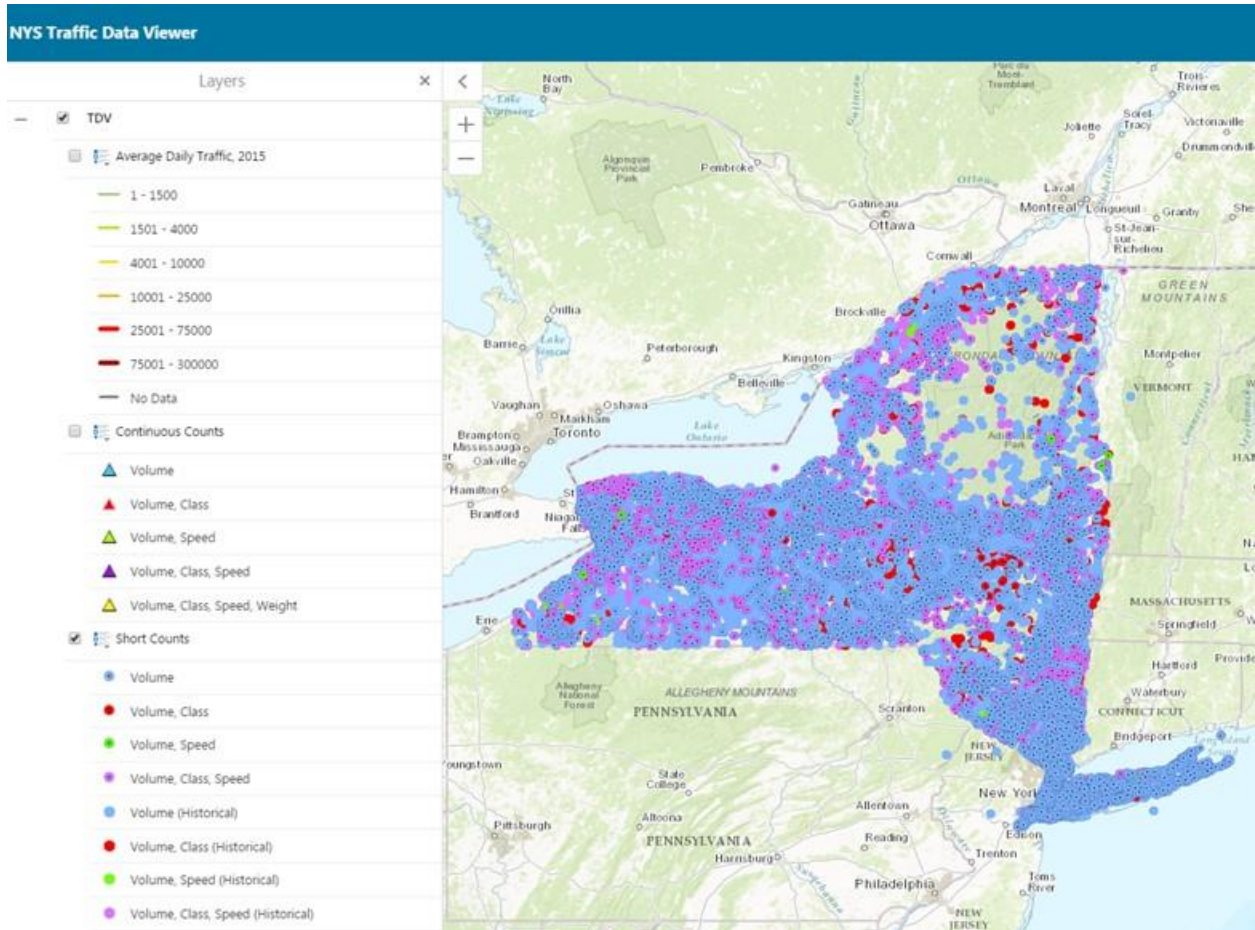- Ensuring a normal distribution of speeds.

When NYSDOT receives and verifies traffic count data, it applies axle correction factors and adjustment factors for day of week and month of year to the short-duration counts based on data from permanent count sites. The data are then uploaded to a traffic data viewer accessible on the Internet (http://gis3.dot.ny.gov/html5viewer/?viewer=tdv).[5] The traffic data viewer displays a variety of information, including AADT (Figure 2), continuous count locations, short-duration count locations (Figure 3), bridge locations, and grade crossing locations.

Figure 2. AADT in New York in 2015.

Source: http://gis3.dot.ny.gov/html5viewer/?viewer=tdv

Figure 3. Short-Duration Traffic Count Locations in New York.

Source: http://gis3.dot.ny.gov/html5viewer/?viewer=tdv

RANDOM SAMPLING DATA COLLECTION PROCEDURE

In addition to partnering with local agencies, NYSDOT conducted a one-time project to collect additional NFAS traffic data. Over the last few years, NYSDOT conducted about 8,000 short-duration counts under a special project to collect a random sampling of local roads to support local road AADT data collection. NYSDOT supplemented its existing count data with a target of counting at least 10 percent of the mileage in each of the 1,500 municipalities in the state to ensure wide distribution of data. NYSDOT used its existing local highway inventory to select count locations. All locations were collectively sampled, including mainlines, alleys, cul-de-sacs, and dead ends.

To randomly select roads to collect short-duration traffic counts, NYSDOT extracted NFAS road segments from its statewide inventory of public roads. The total mileage of NFAS road segments in each municipality was compared to the mileage of segments with traffic counts. A random number was generated for each segment in municipalities with counts on less than 10 percent of the total mileage. NYSDOT sorted each municipality individually by the random number and selected segments to be counted until reaching 10 percent of the mileage. About 8,000 segments were selected for counts, in addition to the already counted segments, to reach the 10 percent coverage of NFAS roads. Contractors then conducted short-duration traffic counts and provided the data to NYSDOT.

APPLICABILITY TO OTHER STATES

NYSDOT is innovatively and actively developing agreements with local agencies to enrich traffic data collection on NFAS roads. Other states can adopt a similar partnership agreement with counties to supplement traffic data collection. States may see high upfront costs to purchase the equipment, but they can recover these costs by requiring a minimum number of traffic counts that equals the cost of hiring a contractor or collecting the data using DOT staff. NYSDOT also proactively developed a random sampling method to increase the number of short-duration traffic counts on local roads.

DATA COLLECTION PARTNERSHIPS

Lessons learned from NYSDOT regarding data collection partnerships include the following:

- Partnering with local agencies that have data collection programs may reduce duplicate efforts. Local agencies may be collecting short-duration traffic counts that are also collected by the DOT, and vice versa.

- A mutually beneficial partnership will reduce costs for the DOT and provide hardware, software, training, and data analysis to the local agency.

- The minimum number of counts can be set so that the DOT will at least break even when providing local agencies with traffic counters and related equipment, training, and support compared to the cost of hiring contractors.

- Working with the manufacturer of the traffic data recorders is crucial. To ensure data compatibility, NYSDOT works with the traffic recorder manufacturer to provide the required format as one of the output options. This allows for seamless upload of data to NYSDOT's traffic count database.

- Adequate training and standards are necessary to ensure valid data collection. NYSDOT guides local agencies on collecting and transmitting data that NYSDOT can then easily validate and incorporate into the state wide traffic database.

- Developing good working relationships with other agencies and understanding their needs, priorities, and objectives can improve the probability of success.

RANDOM SAMPLING DATA COLLECTION PROCEDURE

Lessons learned from NYSDOT regarding random sampling procedures include the following:

- Random sampling provides an unbiased method to select segments for short-duration traffic counts and can be applied to a one-time count program or an annual count program.

- Many short-duration traffic counts on NFAS roads can be collected in a short period. These counts will drastically improve AADT coverage and thus improve the accuracy of analyses using AADT data.

- Roadways with several shorter adjoining segments could be combined into one longer segment to reduce multiple counts on the same road. Multiple adjoining segments with similar geometric features could be combined into one segment.

- Coordination with local agencies and community members will help with program success. Community members may be unfamiliar with traffic data collection equipment and its purposes, so informational material and advanced coordination can inform them on the value of short-duration traffic count data collection.

- The concept of random sampling and statistical data collection was difficult for NYSDOT regions, MPOs, and local officials to understand. Each tended to recommend selected locations (what it considered important roads) to count rather than randomly selected sites. It was especially difficult to accept a need for counts on roads like short dead ends and cul-de-sacs, even though those roads constitute much of the total mileage. Providing frequent communication, explaining the purpose of these counts, and offering to count some important locations when feasible was helpful during this process.

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