AN ASSESSMENT OF DATA COLLECTION TECHNIQUES FOR HIGHWAY AGENCIES

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ABSTRACT

Over the last decade, many agencies within Canada and the United States have initiated programs to assess the effectiveness of their traffic monitoring programs and the value gained from their traffic monitoring dollars. This paper is the result of a project initiated by the British Columbia Ministry of Transportation (BC MoT) to assess the accuracy of their existing traffic monitoring system and to compare it to alternatives for estimating traffic volumes on their highway network. The study included a review of findings from similar projects by the New Brunswick Department of Transportation and the Prince Edward Island Department of Transportation and Public Works. This paper briefly outlines the traffic data collection options considered by all three provincial agencies and the accuracy and cost implications that can be expected from each option. Two methods for expanding short-term traffic counts to estimate average daily traffic volumes are also briefly discussed. The reported accuracy estimates allow practitioners to better understand cost and accuracy tradeoffs.

INTRODUCTION

The British Columbia Ministry of Transportation retained the services of Geoplan Consultants in December, 2000 to assess the accuracy of their existing traffic monitoring system and to compare it to the factoring method used in the United States. Geoplan completed similar studies for the New Brunswick Department of Transportation and the Prince Edward Island Department of Transportation and Public Works. This paper reviews the accuracy of the regression analysis approach used by the three provincial agencies for estimating traffic volumes and compares it to the accuracy of the factoring method.

TRAFFIC MONITORING METHODOLOGIES

Agencies in Canada and the United States use similar approaches for collecting traffic volume data on their highway networks. Basically, two types of counts are completed - continuous counts at a limited number of permanent counting sites and short-term counts at a greater number of temporary counting sites.

The permanent counting sites provide a measure of the variation in traffic volumes over the entire year. Volumes are typically recorded in 15 minute or hourly intervals, 7 days a week, 365 days a year. These counters are located in areas to capture the different traffic patterns such as urban, rural and recreational flows on the various classes of highways in a province or state.

Short-term counters collect data over a period typically ranging from 1 to 7 days in length. Volumes are recorded in 15 minute or hourly intervals over the sampling period. These counters provide samples of traffic volumes over a greater extent of the highway network and are often referred to as coverage counts.

Summary measures such as annual average daily traffic (AADT) volumes and summer average daily traffic (SADT) volumes are estimated from the short-term counts using the seasonal patterns from the permanent counters. This process is often referred to as expanding the short-term count. Many transportation agencies in Canada use

variations of a method developed by the Ontario Ministry of Transportation for expanding short-term counts, which is based on regression analysis. State agencies use an approach commonly called the factoring method for expanding their short-term counts to AADT volumes.

Regression Based Approach

The premise behind all short count expansion is the assumption that the seasonal variation of a short count can be estimated from a dataset of permanent counters with similar variation patterns. In the regression-based system, a short-term count is matched to a permanent counter using regression analysis. Once collected, the short count data is compared to data from the permanent counters during the same time period. The intent is to find a permanent counter whose volume variation pattern compares well with the short count's variation. (The comparison can be made on hourly or, more commonly, daily traffic volumes)

Least squares linear regression is the most common regression method of comparison. The coefficient of determination (R^2) is calculated for each permanent-short count regression. The permanent counter having the highest R^2 value is selected as the one with a variation in traffic volumes best matching the short count. Summary measures such as annual, monthly, summer and winter average daily traffic volumes (AADT, MADT, SADT and WADT) are then estimated using the equation developed from the regression analysis.

British Columbia

The British Columbia Ministry of Transportation (BCMoT) is responsible for approximately 45,000 km (28,000 mi) of highways and established a counting program in the 1990's to monitor traffic on its highway infrastructure. At the time of Geoplan's study, the Ministry's counting program maintained approximately 300 permanent traffic monitoring points (TMPs) which were combined to form approximately 90 permanent stations. The Ministry also had approximately 2000 short count locations where traffic volumes were collected, usually over an 8-day period. Approximately 500 short counts were completed annually, primarily during the summer for rural areas and in

October for urban areas. Data from the permanent counters were used to expand the short counts and to estimate AADT, MADT, and SADT volumes for the short counts. Least squares linear regression was used as the method of expansion. The fifteen minute short count data was linearly regressed against the permanent count data. Summary measures such as AADT were estimated for the short counts using the equation from the regression analysis.

Prince Edward Island

Prince Edward Island's primary and secondary road system totals 3,700 km (2,300 mi) in length. There also exists just under 900 km (560 mi) of gravel and clay roads which provide additional access to the extensive agricultural activities in the province.

At the time of Geoplan's study, the provincial counting program maintained 112 short-count station sites with approximately half of these on the primary highway system. In addition to these, there were nine permanent counting stations which collected hourly data for the combined lanes at each location. The permanent counters were distributed geographically throughout the province to reflect both arterial and collector traffic patterns.

The existing data collection program included one 48 hour count in the spring, summer and fall for a total of six days of data. The collection cycle operated for system-wide coverage every two years. The sample data was expanded to AADT estimates using least squares linear regression on the daily short count traffic volumes. Permanent counters having the closest temporal traffic variation pattern to a short count were used to expand the short counts to summary measures.

New Brunswick

New Brunswick's provincial road network is comprised of approximately 18,000 km (11,200 mi) of roadways. During the study's review of the New Brunswick Department of Transportation's counting program, the Traffic Engineering Branch maintained 31 permanent counters throughout its highway network. The counting program also

included approximately 500 short-term counting locations on arterial, collector and local roadways within the province. The program collected one 24 hour count every two months of the year with the exception of July/August when a weekend count was completed as well. System-wide coverage was completed every two years by counting traffic on arterials and collectors on alternating years. The sample data was expanded to AADT estimates using least squares linear regression on the daily traffic volumes.

Factoring Approach

The factoring approach is widely used in the United States primarily because it is recommended in the Federal Highway Administration's (FHWA) Traffic Monitoring Guide (Office of Highway Policy Information, 2001), (Office of Highway Information Management, 1995), the American Association of State Highway and Transportation Official's Guidelines for Traffic Data Programs (AASHTO, 1992), and the ASTM Standard Practice for Highway Traffic Monitoring (ASTM, 1994). This approach uses data from permanent counters to develop group factors, which are applied to short-term counts to estimate summary measures. Daily and monthly factors to expand short-term counts in an agency's jurisdiction are developed following the approach described in these guidelines.

A day-of-the-week factor compensates for differences between the monthly average daily traffic volume and the average volume on a Monday, Tuesday, Wednesday, etc. In effect, it is used to estimate an MADT volume from a 24-hour count. There are, therefore, seven day-of-the-week factors for each month for a total of 84 factors for the year. If a short count is taken on a Monday in July, then the day-of-the-week factor for a Monday in July is used to expand the short count to an average daily traffic volume for the month.

Similarly, there is one seasonal factor for each month for a total of 12 factors. Using the previous example, an AADT volume can be estimated from the short count by multiplying the MADT estimate by the seasonal factor for July. It is recommended in the most recent Traffic Monitoring Guide (Office of Highway Policy Information, 2001) that factors be calculated using the current year of data.

Developing seasonal factors for a jurisdiction involves two tasks:

1. Grouping of permanent counters with similar variability; and
2. Identifying unique characteristics for each group.

It is important for an agency to have a firm understanding of all the traffic characteristics within its jurisdiction to ensure an adequate number of groups are developed describing each seasonal pattern. Ideally, the variability within each group should be minimized while the variability between groups is maximized. In most jurisdictions, three to five groups tend to adequately reflect the variation exhibited by all counters. (Office of Highway Information Management, 1995)

The factors applied to individual short counts are averages calculated for each group of permanent counters. Permanent counters are grouped based on a clustering analysis, which segments the permanent counter population based on seasonal or regional variability. The determination of seasonal and daily factors requires a minimum dataset to ensure statistical validity. It has been found by the FHWA that five to eight individual counters should be included in each group to determine average factors that are statistically significant. This results in a minimum of 25 permanent counters to determine expansion factors for a jurisdiction. (Office of Highway Information Management, 1995)

Short-term counts are assigned to a group by reviewing characteristics such as functional classification, seasonal patterns, geography and levels of surrounding development. The assignment process requires a good knowledge of the agency's transportation system and professional judgment.

Current Collection Methodologies

A literature review was completed to review the methods used by different agencies to collect and expand short-count data. The review focused on the number of days traffic volumes were measured for short-term counts and the accuracy of AADT estimates using the short-count data. A recent study (B.C. Ministry of Transportation, 2000)

provided an overview of sampling procedures for short-count data in six provinces and twenty-eight states. It was found that the majority of agencies, 80 percent, measure traffic volumes at a short-count site less than once per year. Generally, sites are monitored on a two or three year cycle. A three year cycle is recommended in the FHWA Traffic Monitoring Guide.

Traffic volumes at a site are monitored over a number of days ranging from less than 24 hours to 8 days. The most common sampling approach is to monitor traffic for 2 days or 48 hours. In most U.S. jurisdictions, a single 48 hour count is completed in the year. This practice follows the FHWA Traffic Monitoring Guidelines. The study survey (B.C. Ministry of Transportation, 2000) found seven agencies, or 20 percent of the sample, collect traffic volumes over a single one-week period. Six agencies (18%) only sample data for a 24 hour period. In Canada, four out of the six agencies interviewed also use 48 hour counts, however, more than one count is taken in a year. Manitoba and Saskatchewan collect traffic data for two 48-hour periods in a year, and New Brunswick and Prince Edward Island collected data for four 48-hour periods throughout the year. It should be noted that New Brunswick and Prince Edward Island modified the frequency of their short-term counts after Geoplan completed their studies.

ACCURACY OF COLLECTING PROCEDURES

Geoplan's evaluation of British Columbia's, New Brunswick's, and Prince Edward Island's traffic monitoring systems included determining the accuracy of AADT, SADT, and MADT estimates using the factoring method and regression analysis to expand short-term counts. Expansion factors were calculated for each of the three provinces following the procedures in the Traffic Monitoring Guide. Annual average daily traffic volumes were then estimated using the factoring method and the existing regression analysis approach. A random sample of 30 permanent traffic monitoring points was treated as a source of short-term count data. Traffic volumes were selected from this permanent counter database following the sampling procedure being evaluated. For example two 24-hr counts in a year, one 48-hr count in a year, or three 48-hr counts in a year were used. The samples were then expanded to AADT volumes using either regression analysis, the factoring method, or both. The AADT volumes

estimated from the sampled data were then compared to the true AADT volumes calculated from the complete permanent counter database.

The true AADT volumes were calculated as part of the evaluation process, even if the agency had already determined them, to ensure there were no errors in the summary measures. This was important because these values were used as the true values to compare to estimates using the factoring method, regression analysis, and alternative sampling schemes. The summary measures were calculated using the AASHTO Guidelines for Traffic Data Programs which are summarized below:

Calculate the average daily traffic (ADT) volumes for each day of the week in each month if there are 1 to 2 days of data for each day. The minimum number of days required depends on the procedures for editing field data. This will result in 84 ADT volumes (7 days x 12 months) if the minimum data requirements are met.
Average the ADT volumes for each day of the week over the period of interest. For example, average all the volumes for a Monday, then for Tuesday, etc. over 12 months for an annual aDT volume, or 2 to 3 months for a summer ADT volume. etc. The result is 7 values, one for each day of the month.
Average the values for seven days of the week for the final summary measure.

It is recommended in the AASHTO Guidelines and the ASTM Standard Practice for Highway Traffic Monitoring that summary measures be calculated using edited field data only. Missing days should not be replaced. This allows for a statistical evaluation of the accuracy of the summary value, e.g. a confidence interval.

Thirty observations of estimated and true values for AADT volumes were available for various combinations of sampling strategy and expansion approach reviewed in each province. The errors in the estimates were found to be normally distributed using the Chi-squared test. The statistical accuracy of the estimates was then determined at a 90 percent confidence interval.

Studies by Geoplan Consultants Inc. (Geoplan Consultants, 1989, 1991, 1992, 2001) reviewed the accuracy of AADT estimates for a range of short-count samples. The results are detailed in Tables 1 through 3.

It was found that accuracies using the regression analysis were comparable between New Brunswick and Prince Edward Island. Both agencies based their regression analysis on daily traffic volumes and required a minimum sample size of six. An accuracy of ± 10 percent was only achieved using a sample size of at least eight days collected over three or more seasons. The factoring methodology was compared to the regression approach for four sampling strategies reviewed for Prince Edward Island. It was found that the regression analysis produced more accurate results in all four cases.

Reviewing AADT accuracies using the factoring approach from all three provinces, a 6 day sample over more than one season gave an accuracy of 12 to 15 percent and the accuracy for a 2-day sample during one season ranged from 13 to 25 percent. The wide range in accuracies for the 2-day sample may be the result of a difference in traffic characteristics between the provinces. Both Prince Edward Island and British Columbia have a higher percentage of recreational traffic than New Brunswick and the percent accuracies of estimates from 2 day samples in these provinces were greater than New Brunswick's.

Specific findings on the accuracy of the factoring method under various sampling strategies for British Columbia's system are listed below. They were ranked on the overall accuracy of AADT, SADT, and MADT volumes and are presented from the most accurate to the least accurate.

1. Three 48-hour counts annually, one each in spring, summer and fall.
2. One 7-day count annually, at a randomly selected time between April 1 and October 31.
3. Two 48 hour counts annually, one in the summer and the other in the spring or fall.
4. One 48-hour count annually, at a randomly selected time between April 1 and October 31.

The error estimates for one 7-day count were close to those for two 48-hour counts. However, the two 48-hour counts gave additional information on seasonal variation, which is useful for assigning short-term counts to a factor group. The error resulting from assigning a 7-day short-term count to the wrong group may in fact offset the error of collecting two 48-hour counts instead. Reviewing the ranking, it can be concluded that conducting shorter samples over more than one season may provide a more accurate count than a long sample during the same season.

British Columbia's traffic monitoring system at the time of the study estimated AADT within ± 32 percent, 9 times out of 10. The results of the regression methodology for B.C. were based on their existing system which differed from Prince Edward Island's and New Brunswick's in two respects:

- The regression analysis was based on 15 minute volumes rather than daily intervals;
- Traffic volumes were sampled only during the summer months rather than seasonally.

Factoring Approach and Regression Analysis Comparison

The following section outlines some advantages and disadvantages of the factoring approach and regression analysis.

Matching Short Counts to Permanent Counters

Factoring Approach. Developing factors is only the first step in estimating summary measures using the factoring approach. The next step is to assign short-term counts to a factor group. In these studies, the assignment was not necessary because the short-term counts used for the evaluation were drawn from permanent counters whose factor groups were known. Short-term counter classification into factor groups requires significant professional judgment and local knowledge.

In a practical application a sampling strategy, which counts the short-term location during different seasons, can utilize the ratio of the count's MADT factors to assign the location to a factor group. This is particularly effective when at least one count is taken during the summer and non-summer months. For example, assume a short-term site was counted in April and July and the MADT volumes were 3,000 and 5,000, respectively. The ratio of the counts would be 3,000/5,000 = 0.60. Table 4 lists MADT ratios from British Columbia for the same two months for four factor groups.

Reviewing the values in the table, the short-term counter would be matched to the recreational group, which has a ratio of 0.58.

Assigning a short-term counter to a factor group becomes more difficult if traffic is counted at the short-term location for only one season of the year. If traffic is only sampled once, then it may be necessary to redefine the factor groups according to highway functional classifications or geographic regions to aid matching. Grouping the permanent counters according to functional class and/or region will assist in assigning the short-term counters to a defined class.

Introducing these additional criteria to group the permanent counters will reduce the accuracy of the factors, as group variability will increase. However, it will make it easier to match the short-term counters to the most appropriate factor group. The FHWA's Traffic Monitoring Guide *(1)* recognizes that this trade-off is often necessary to complete the assignment step.

Regression Analysis. As discussed earlier, regression analysis is used to match short-term counts with permanent counters. The analysis selects the permanent counter that has the most similar temporally aligned variation in volume counts when compared to the short-term count. This approach differs from the factoring method because the matching between the short and permanent counters is based on an analysis of variation in traffic volumes rather than a subjective assignment process.

In the British Columbia study, the regression analysis produced less accurate estimates of summary measures than the factoring approach. One of the main reasons for this is because the short-term counts are only completed during one season. In New Brunswick and Prince Edward Island, short counts are matched to permanent counters using regression analysis of daily volumes collected over three seasons. This approach resulted in more accurate estimates of AADT volumes than the factoring approach.

Minimum Data for Short Counts

Factoring Approach. The factoring approach can be used to estimate summary measures from short counts of 24 hours or longer. However, the error in estimates from short counts increases as the duration of the count decreases. In other words, the shorter the count, the larger the error in AADT, MADT, and SADT volume estimates. In British Columbia, AADT estimates using one 48-hour count had an error of $\pm$ 25 percent, 9 times out of 10. The accuracies of AADT estimates in British Columbia, New Brunswick and Prince Edward Island are plotted against the duration of the short count in Figure 1. The negative slope of a trend line through the data supports this finding.

It is recommended in the AASHTO Guidelines that:

"*A sample of traffic data that is less than 24 hours should not be used for estimating annual traffic summary statistics. This includes manual turning movement counts at intersections that are less than 24 hours.".*

Factors can be developed to estimate AADT volumes from counts that are less than one day in length. However, summary measure estimates using these data would have a very high error associated with them. Agencies must balance the costs associated with higher counting frequencies with their corresponding accuracies.

Regression Analysis. Theoretically, a linear regression analysis can be completed using three points, however the number of significant data points should be maximized to ensure a robust correlation. The number of points available for matching a short counter to a permanent counter depends on the data collection intervals. If 15-minute volumes are used then 96 points will be available for every day of data collected. Most agencies require a minimum number of days for count validation. New Brunswick and Prince Edward Island's systems require six points, or six days of data, for the regression analysis. In either case, the minimum number of days for regression analysis is greater than the minimum required for the factoring approach.

COST CONSIDERATIONS

The budget associated with maintaining a traffic counting program is composed of both overhead and activity-based costs. The maintenance of permanent and short-term counter equipment, personnel salaries, and travel expenses are the most significant of these. In general however, the costs can be accounted under the following structure:

Salaries of counting program personnel

Travel expenses

Field Supplies

Computing resources

The budgets maintained for the counting programs by the three departments studied ranged substantially in magnitude. At the time of study, the New Brunswick Department of Transportation maintained approximately 30 permanent counters and 500 short-term counting stations with an annual budget of $335,000 (CAN2002$). Coverage, staffing levels and equipment availability directly affect the costs associated with a program. While all three programs studied were administered internally, the same is true for contracted collection programs.

The main costs associated with operating a traffic counting program are primarily related to staffing and travel requirements for placing and retrieving portable counters in the field (Geoplan Consultants Inc, 1989). While a comprehensive comparison of sampling strategies based on cost requires local staffing and equipment levels, a preliminary cost can be done based on coverage only. Assuming 500 short-term counting sites, the sampling strategies can be assessed based on days of data collected, the number of site visits required, and the most accurate expansion method. These calculations are presented in Table 5 for five sampling strategies. Although regression analysis of daily traffic volumes over several seasons results in more accurate estimates than the factoring method, the number of site visits needed to meet the minimum data requirements for regression analysis is 2 to 3 times higher than the minimum required for the factoring method. The most appropriate method for an agency will depend on the level of accuracy they require for their summary measures and their budget limitations.

CONCLUSIONS

While transportation agencies in the United States have tended to adopt a standardized method for their traffic collection procedures to match federal guidelines, their Canadian counterparts have developed their programs independently, following strategies that may be significantly different than their neighbors'. As a result, many

Canadian transportation agencies have initiated studies in recent years to determine if more economic alternatives with equivalent or better accuracies are available. This study provides a summary of three of these evaluations.

The main objectives of the studies were to assess the accuracy of provincial transportation agencies' existing traffic data collection systems and compare them to common methods used for estimating average volumes from short-term counts. In the study for the Ministry of Transportation of British Columbia the factoring method produced the most accurate estimates for most of the summary measures when compared to the regression analysis used in their existing system. The factoring method is the most common methodology employed by transportation agencies in the United States.

These results are contrary to findings in studies for New Brunswick and Prince Edward Island where estimates from a regression analysis approach were more accurate than from the factoring method. One reason for this difference lies in the count duration and frequency used in British Columbia when collecting short-term counts. The Ministry of Transportation generates their regression equations using one week of data collected once per year. The resulting regression equation is often not representative of the variation in traffic volumes that may occur during the remainder of the year. New Brunswick and Prince Edward Island collect only one more day of data, but spread the sample out over three seasons. As a result, the regression equations produce more accurate estimates than the factoring approach. Of course, collecting short-term counts more than once per year has a significant cost implication.

Reviewing the accuracy of AADT estimates from the three studies, it was found that:

At least an 8-day sample over 3 seasons was required to estimate AADT volumes within $\pm$ 10 percent regardless of the expansion method used.

AADT estimates from the more common approach of expanding a single 48 hour count using the factoring method had an accuracy of 13 to 25 percent, 9 times out of 10.

Estimating AADT volumes using linear regression of daily short count volumes gave more accurate results than the factoring method. Theoretically a minimum of three points of data is required to apply the linear regression analysis, however most agencies require more than this theoretical minimum.

The agencies also had to consider the following factors in addition to accuracy levels when selecting a sampling strategy and expansion methodology:

Two to three more site visits are required to collect the minimum data required for regression analysis compared to the minimum data required for the factor method.

The regression analysis approach matches short-term counts to permanent counters on the basis of the actual variation in the short-term count. A more subjective approach is required for the factoring method, which may result in less than ideal average group factors.

The regression analysis approach used by agencies often requires significantly more computational resources and is more complex than the factoring method.

An evaluation of any counting program invariably defines a tradeoff between accuracy (counting frequency) and cost. A single count's duration can be lengthened to develop an estimate of weekday traffic variation however seasonal variation cannot be captured consistently and effectively by conducting a single count of any length. Land use, functional classification and regional traffic patterns of a facility are often reviewed and used to improve a factoring procedure to account for this limitation. The accuracy estimates reported from the evaluations discussed in this paper allow practitioners to better understand these tradeoffs and augment the information available to evaluate their own program.

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LIST OF TABLES AND FIGURES

TABLE 1 Error in AADT Estimates in New Brunswick Study (9 times in 10) (Geoplan Consultants, 1992)

Sampling Strategy	**Regression of Daily Volumes**	**Factoring Methodology**
One 24 hr count bimonthly plus 1 summer weekend (8 days)	± 6.0%	Not calculated
One 48 hr count during the spring, summer and fall, plus a summer weekend (8 days)	± 9.5%	Not calculated
One 72 hr count in the spring, summer and fall, plus a summer weekend (11 days)	± 9.5%	Not calculated
One 72 hr count, in the summer and fall (6 days)	± 15%	Not calculated
One 48 hr count in the spring, summer, or fall (2 days)	Not calculated	± 13%
Two 24 hr counts (2 days)	Not calculated	± 15%
One 72 hr count (3 days)	Not calculated	± 17%

TABLE 2 Error in AADT Estimates in Prince Edward Island Study (9 times in 10) (Geoplan Consultants, 1992)

Sampling Strategy	**Regression of Daily Volumes**	**Factoring Methodology**
One 24 hr count bimonthly plus one summer weekend (8 days)	± 7.0%	± 9.5%
One 24 hr count bimonthly (6 days)	± 8.5%	± 12.0%
One 48 hr count spring, summer and fall (6days)	± 12.5%	± 13.0%
One 48 hr count spring, summer, fall, and early winter (8 days)	± 6.5%	± 9.5%
One 48 hr count (2 days)	Not calculated	± 18.5%

TABLE 3 Error in AADT Estimates in British Columbia Study (9 times in 10) (Geoplan Consultants, 2001)

Sampling Strategy	**Regression of 15 minute volumes**	**Factoring Methodology**
One 48 hr count. Two days total.	Not calculated	± 25%
One 48 hr count in the spring or fall and the summer. Four days	Not calculated	± 19%
One 48 hr count in the spring, summer and fall. Six days.	Not calculated	± 12%
One 168 hr count in the summer or fall. Seven days (existing system)	±32%	± 20%

TABLE 4 April MADT to July MADT Ratios for Factor Groups in British Columbia

Factor Group	April MADT / July MADT
Urban	0.939 / 0.985 = 1.0
Rural	0.732 / 1.088 = 0.67
Recreational	0.622 / 1.074 = 0.58
Highly Recreational	0.576 / 1.127 = 0.51

TABLE 5 Staffing/Travel Assessment (Geoplan Consultants, 1989)

Sampling Strategy	No. Visits per Site	Total Visits	Most Accurate Expansion Method
One 48 hr count (2 days)	2	1000	Factor Method
One 72 hr count summer and fall (6 days)	4	2000	Regression Analysis
One 48 hr count spring, summer and fall (6 days)	6	3000	
One 168 hr count summer or fall (7 days)	2	1000	
One 24 hr count bimonthly plus one summer weekend. (8 days)	6	3000	

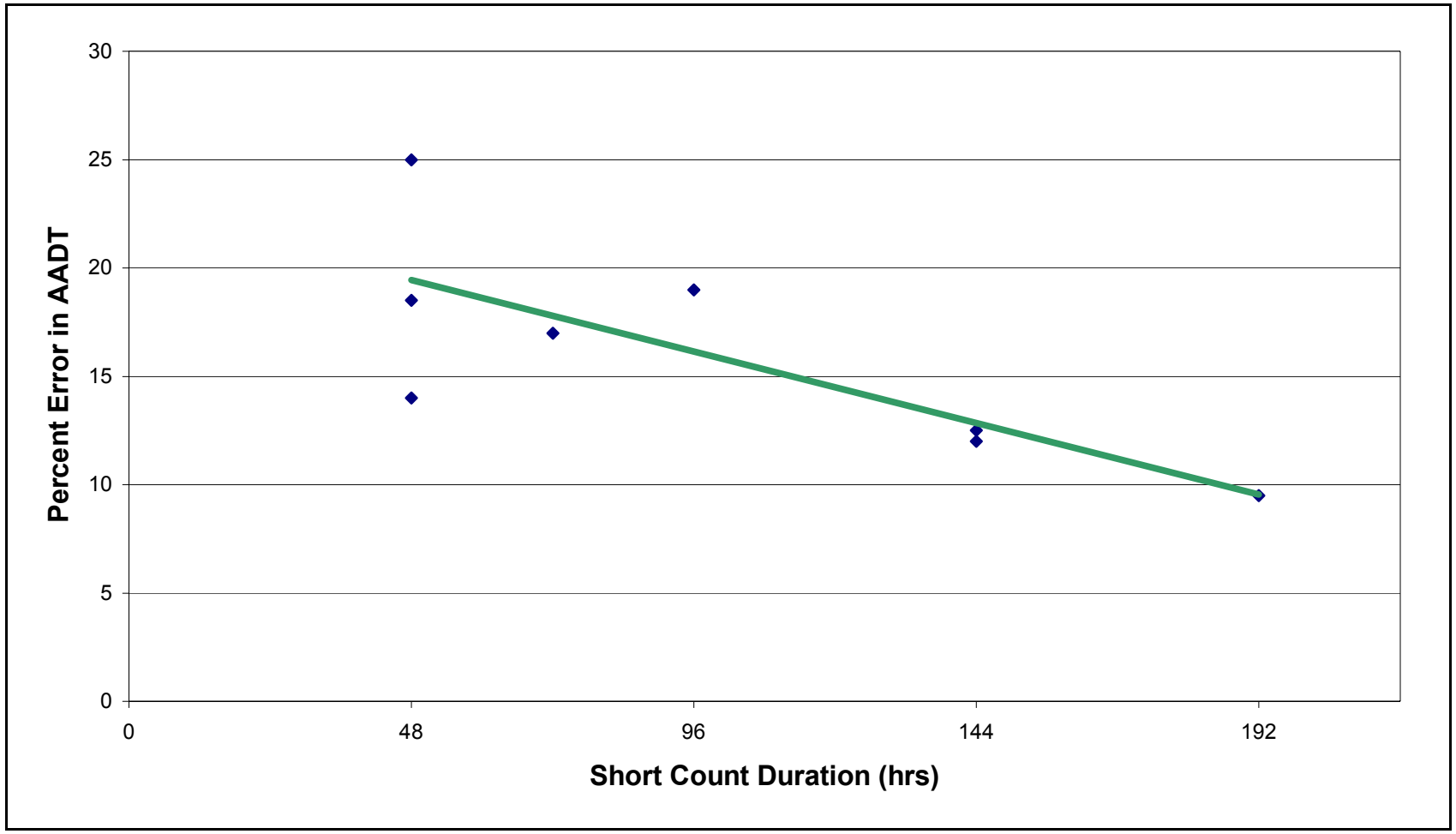

FIGURE 1 AADT Error versus Short Count Duration.