ENHANCING ESTIMATES OF ANNUAL AVERAGE DAILY TRAFFIC (AADT) ON MANITOBA'S PROVINCIAL HIGHWAYS

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A Thesis
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Abstract

This thesis is an empirical analysis of methods to enhance estimates of annual average daily traffic (AADT) on Manitoba's provincial highways. It develops methods to evaluate and improve the quality of AADT estimates in order to enhance the decision-making potential of this essential traffic statistic.

Three methods of enhancing AADT estimates are presented: (1) human-intervention techniques to evaluate the estimates, (2) developing new traffic pattern groups (TPGs) to improve the representation of provincial highway traffic patterns, and (3) developing a "transparent" methodology for assigning short-count sites to appropriate TPGs and control stations.

In Manitoba, AADT estimates are produced through the Manitoba Highway Traffic Information System (MHTIS). AADT estimates are essential for the operation of highway agencies to perform various transportation-related functions. This thesis describes the engineering needs for AADT estimates and other traffic information in the transportation profession in Manitoba.

AADTs can be obtained by direct measurements from permanent counters, or by estimating from a short-count. A short-count estimate of AADT is obtained by relating the short-count site to a TPG and a control station. Estimating AADTs from short-counts involves a procedure which requires the manipulation of many numbers, tables and computer programs. During this process, problems can occur which can affect the quality of AADT estimates that are produced. Currently, no systematic procedures have been developed for evaluating AADT estimates that are produced through the system.

This thesis develops human-intervention techniques for evaluating AADT estimates on Manitoba's provincial highways, including visual route consistency checks, comparison of current year estimates with historical estimates, and checking for intersection balancing. These techniques allow AADT estimates to be evaluated systematically in order to improve its quality.

This research also investigates whether improved TPGs can enhance the quality of AADT estimates on Manitoba's provincial highways. To date, TPGs have been developed based on permanent counter data from Manitoba. This research develops new TPGs for an expanded study region consisting of Manitoba and Saskatchewan, based on the premise that traffic patterns are not affected by the political boundary that separates two provinces, rather these patterns are characterized by the transportation, activity and flow systems of a region. Based on the analysis conducted for this research, the new TPGs are found to improve the quality of AADT estimates for the majority of Manitoba's short-count sites.

The TPG and control station which are assigned to a short-count site depends on the method which is used for assignment. An inappropriate assignment method leads to inconsistent and non-reproducible assignments, which in turn affects the quality of AADTs estimated from short-count sites. This research develops a "transparent" methodology to assign Manitoba's short-count sites to TPGs and control stations. Unlike the previous method, the new method involves a documented rule-based procedure to assign short-count sites to appropriate TPGs and control stations.

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Acronyms

AADT:	Annual Average Daily Traffic, measured in units of vehicles per day.
AASHTO:	American Association of State and Highway Transportation Officials
ASDT:	Average Summer Daily Traffic
ATR:	Automatic Traffic Recorder (Saskatchewan)
AVC:	Automatic Vehicle Classification
CV:	Coefficient of Variation
ESAL:	Equivalent Single Axle Load
FHWA:	Federal Highway Administration
MADT:	Monthly Average Daily Traffic
MDHT:	Manitoba Department of Highways and Transportation
MHTIS:	Manitoba Highway Traffic Information System
PCS:	Permanent Counting Station
PR:	Provincial Road
PTH:	Provincial Trunk Highway
SHRP:	Strategic Highway Research Program
STC:	Short-Term Counter
TMG:	Traffic Monitoring Guide
TPG:	Traffic Pattern Group
UMTIG:	University of Manitoba Transport Information Group
WIM:	Weigh-in-Motion

CHAPTER 1
Introduction

1.1 The Thesis

This thesis is an empirical analysis of methods to enhance estimates of annual average daily traffic (AADT) on Manitoba's provincial highways. The thesis develops methods to evaluate and improve the quality of AADT estimates in order to enhance the decision-making potential of this essential traffic statistic.

1.2 Background

Traffic data is essential for the operation of highway agencies. The most important and commonly used traffic measurement is AADT. AADT is defined as the number of vehicles passing a point on an average day of a given year, and is measured in units of vehicles per day [Ref. 1].

In Manitoba, AADT estimates and other traffic information on provincial highways are produced by a traffic monitoring system operated jointly by the Manitoba Department of Highways and Transportation (MDHT) and the University of Manitoba Transport Information Group (UMTIG). In this system, MDHT is responsible for collecting traffic data in the field, and UMTIG is responsible for creating summary traffic statistics including AADT.

AADT is the single most important traffic measurement produced through the MHTIS. AADTs can either be measured directly or estimated. Direct measurements of AADT are obtained from permanent counting stations given perfect operating conditions. Permanent counting stations are permanent traffic recording devices

which operate continuously throughout the year and are located on a selected number of sites on provincial highways.

The AADTs for the majority of Manitoba's provincial highways must be estimated from short-counts. These short-counts are typically conducted in the summer months for a period of 48-hours twice during a year. Currently, short-counts are conducted once every two years on roads with AADT greater than 200 vehicles per day, and once every four years on lower volume roads [Ref. 2].

In order to expand a short-count to an AADT estimate, short-count sites are assigned to control stations and traffic pattern groups (TPGs). A control station is a permanent counter which exhibits similar traffic variations patterns as the short-term count site to which it is assigned. A TPG is a *group* of permanent counters which exhibit similar traffic variation patterns. TPGs are developed by grouping Manitoba's permanent counters into different groups, each group consists of a number of permanent counters which exhibit similar traffic variation patterns. The short-count is expanded to AADT using information from its control station or TPG.

The quality of an AADT estimate obtained from a short-count site depends on: (1) the procedure used to obtain the estimate, (2) the appropriateness of the TPG (and control station) which is assigned to the short-count site, and (3) the method of assigning TPGs and control stations to the short-count site.

The procedure of estimating AADTs from short-counts requires the manipulation of many numbers and tables and relies heavily on a computerized system. A potential shortcoming with this method is that system operation errors can occur in the process which can affect the quality of AADT estimates that are produced. Currently there are no systematic methods of checking the resulting AADT estimates. This research develops human-intervention techniques to systematically evaluate AADT estimates

in order to detect errors and inconsistencies, and to improve the quality of the estimates.

The quality of AADT estimates which are derived from short-counts also depends on the TPG and control station which are assigned to the short-count site. Research by Sharma (1996) has found that a short-count site's assignment to a TPG (or control station) has more influence on its AADT estimate than the duration of the short-count itself. This finding was also confirmed in research by Davis (1997) which indicated that a short-count estimate of AADT will be close to the true AADT only if the short-count site is assigned to an appropriate TPG. This means that a TPG which does not reflect the actual traffic pattern at the short-count site to which it is assigned will result in poor quality AADT estimates. Similarly, a control station which is inappropriately assigned to a short-count site will also result in AADT estimates which do not reflect the true AADT at that location.

To date, Manitoba's TPGs have been developed by using permanent counter data from Manitoba. This research develops new TPGs for an expanded study region by drawing on permanent counter data from Manitoba and its neighboring province to the west, Saskatchewan. This idea is based on the premise that traffic patterns are not affected by the political boundary that separates the two provinces. Traffic patterns are a function of the transportation, activity, and flow systems within the study region. The new TPGs developed in this research are evaluated to determine if it improves AADT estimates for Manitoba's short-count sites.

The quality of AADT estimates are also affected by the method which is used to assign short-count sites to TPGs and control stations. The current method is inadequately documented and does not create reproducible assignments of short-count sites to appropriate TPGs and control stations. The current assignment process requires subjective human judgment which can lead to inconsistent and non-

reproducible assignments. This research develops a transparent procedure for assigning Manitoba's short-count sites to appropriate TPGs and control stations.

1.3 Relevance of the Research

Provincial highway AADTs are used in many applications in Manitoba. The major users of AADT estimates in Manitoba includes the MDHT and transportation consulting firms. AADT data is required for planning, design, project selection, policy making, and other engineering-related functions. The need for accurate traffic data continues to grow as more policy decisions, plans and designs are based on this statistic.

The use of AADT data to guide decisions is critical. Too low an AADT can result in inadequate traffic lanes or thickness of pavements causing low levels of service and surface failures. Too high AADT values can result in overbuilding a facility. In both cases, inaccurate AADT estimates can result in costly errors, and these errors expand significantly as the data are forecast to the design year.

In addition to being used to guide many decisions in the transportation profession, AADT estimates are also used as the foundation of many other traffic statistics. Traffic statistics such as average summer daily traffic (ASDT), percent trucks, and design hourly volumes are all expressed in terms of the highway's AADT. These statistics are important for many applications, and would not be meaningful without a reference to the actual highway traffic volume.

The American Association of State and Highway Transportation Officials (AASHTO) *Guidelines for Traffic Monitoring Programs* [Ref. 5] indicates that out of all data collected by state agencies, traffic data is viewed as being the most commonly used and the most important in almost every decision-making process. The *Guidelines* also point out that the cost of improving the quality of traffic data should be compared

with the cost of providing data users with less precise data. The cost of imprecision, and the benefit of increased precision, accumulates each time data are used. The *Guidelines* indicates that quality assurance should be an integral part of a traffic monitoring program.

1.4 Objectives of the Research

The objectives of this research are:

- To determine the engineering needs for AADT estimates and other traffic information in the transportation profession in Manitoba.
- To develop human-intervention techniques for evaluating and improving the quality of AADT estimates on Manitoba's provincial highways.
- To develop new TPGs using the expanded permanent counter database from Manitoba and Saskatchewan.
- To evaluate how the improved TPGs alter the AADT estimates at Manitoba's short-count sites.
- To develop a systematic methodology which creates reproducible assignments of TPGs and control stations for short-count sites in Manitoba.
- To provide recommendations as to how AADT estimates and other related traffic statistics on Manitoba's provincial highways may be further improved.

1.5 Organization of the Thesis

- Chapter 2 describes Manitoba's provincial highway network and how AADTs are estimated for these highways.
- Chapter 3 describes and generally evaluates human-intervention techniques for enhancing the quality of AADT estimates.
- Chapter 4 describes the engineering needs for AADT estimates and other traffic information in the transportation profession in Manitoba.

- Chapter 5 develops new TPGs on Manitoba's and Saskatchewan's provincial highway networks, and evaluates how the new TPGs affect AADT estimates at Manitoba's short-count sites.

- Chapter 6 develops a transparent procedure for assigning Manitoba's short-count sites to appropriate TPGs and control stations.

- Chapter 7 presents the summary and conclusions of this research and suggests recommendations for further research.

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CHAPTER 2

The Manitoba Highway Traffic Information System

This chapter describes Manitoba's provincial highway network, explains how traffic on the provincial highways is monitored through the Manitoba Highway Traffic Information System (MHTIS) to create estimates of AADT and other summary traffic statistics, and discusses potential shortcomings of the current methods for estimating AADTs for Manitoba's provincial highways.

2.1 Manitoba's Provincial Highway Network

There are 315 highways in Manitoba's provincial highway network which total a length of approximately 18,000 kilometers. The two types of provincial highways in Manitoba are: (1) Provincial Trunk Highways (PTH), and (2) Provincial Roads (PR). Figure 2-1 shows a map of PTHs and PRs in Manitoba.

Provincial Trunk Highways (PTH)

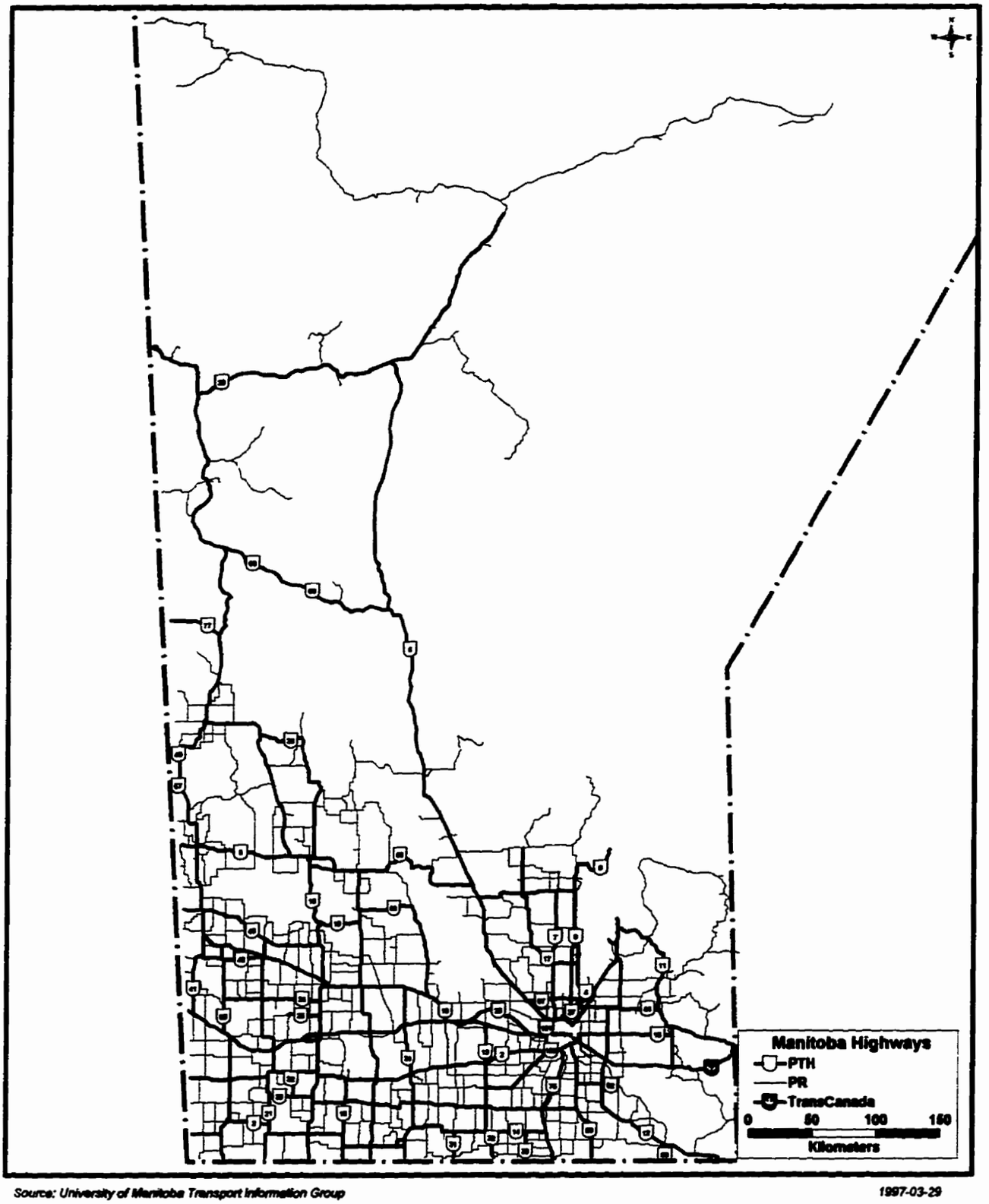
There are 51 PTHs in the province, which total approximately 8,000 kilometers of highway segments, or forty percent of the provincial highway network.

Provincial Roads (PR)

There are 264 roads designated as PRs. This accounts for over 10,000 kilometers or sixty percent of the total provincial highway network.

Figure 2-1

Provincial Trunk Highways (PTH) and Provincial Roads (PR) in Manitoba



Source: University of Manitoba Transport Information Group

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2.2 The Manitoba Highway Traffic Information System (MHTIS)

Traffic on Manitoba's provincial highways is monitored through the Manitoba Highway Traffic Information System (MHTIS). Traffic monitoring is conducted in four phases: (1) traffic data collection, (2) editing traffic data, (3) creating summary traffic statistics, and (4) reporting summary traffic statistics. Each of these steps are discussed in detail in the following sections, and summarized in Figure 2-2.

2.2.1 Traffic Data Collection

Provincial highway traffic data is collected by MDHT using permanent and portable traffic monitoring equipment. MDHT's traffic data collection program is currently made up of four main components:

1. Permanent Counting Stations Program - this program is designed to monitor traffic continuously at selected locations throughout the province, and is the foundation of the traffic information system. Permanent counting stations employ the use of permanently installed traffic recording devices which operate continuously throughout the year. Currently, there are fifty-seven permanent counting stations in Manitoba. Figure 2-3 shows a map of the locations of permanent counting stations in Manitoba.

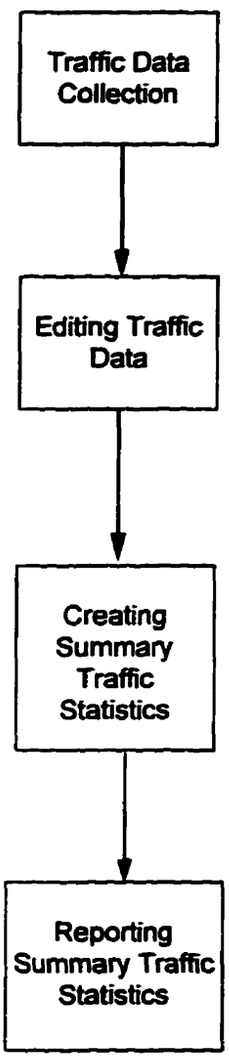
2. Short-Term Counting Stations Program (or Coverage Counting Stations) - the majority of Manitoba's provincial highways are monitored through the short-term counting program. Currently, there are 2013 sites counted under the coverage count program in Manitoba. Short-term count sites are counted on a two- or four-year cycle. Sites which have an AADT of greater than 200 veh/day are counted once every two years, lower volume sites are counted once every four years.

   Two types of equipment are used for collecting short-counts in the field: loop and tube counters. A loop counter is capable of detecting a vehicle as it passes by the count location and records one count for each vehicle that passes. Tube counters detect axles of a vehicle. It records once count for every two axles that pass by the counter. Tube counts must be corrected with axle correction factors prior to being summarized.

3. Weigh-in-Motion (WIM) and Automatic Vehicle Classifier (AVC) Program - these stations monitor vehicle weights and classifications. There are currently

Figure 2-2

The Manitoba Highway Traffic Information System



The collection of traffic data is the responsibility of MDHT and involves the use of permanent and portable traffic counting equipment. Traffic data is collected through four main programs: permanent counting stations, short-term counting stations, AVC/WIM stations, and special counts (including intersection turning movement counts and town counts).

After traffic data is collected, it is sent to UMTIG via modem, on count sheets or on disk for processing. At UMTIG traffic data is edited (screened) to remove errors and anomalies. The purpose of editing traffic data to ensure that field measurements are valid prior to being summarized and reported. Editing incorporates criteria from ASTM standards. Raw data which are deemed to be inappropriate for further analysis are removed from the master database, however, none of the data are patched or filled in.

The most important phase of the MHTIS is creating summary traffic statistics. Traffic information is of little use if it is provided to data users in its raw form. What is more commonly needed is a summary of the data. At UMTIG, traffic data are summarized into statistics including AADT, ASDT, percent trucks, and 30th highest hours.

The final step in the MHTIS is reporting summary traffic statistics. Currently, traffic data on Manitoba's provincial highways is reported in four sources: *Traffic on Manitoba Highways, Truck Traffic on Manitoba Highways*, Station Detail Reports, and through the MHTIS Internet site. In addition, traffic data can also be obtained through the Help-Desk at UMTIG's office at the University of Manitoba.

fifteen WIM/AVC sites located throughout the province. MDHT recently purchased eight new AVC counters to increase coverage of truck data collection sites in the province.

4. Special counts - these consist of intersection turning movement counts and town counts. Special counts are conducted on an as-request basis only.

2.2.2 Editing Traffic Data

After traffic data have been collected in the field, they are edited. Editing traffic data involves screening the raw data to remove (1) errors and anomalies which may be present due to counter malfunctions, (2) counts which may be conducted during atypical periods such as festivals and unusual weather conditions, and (3) counts which are less than the specified minimum count duration, 48-hours.

Permanent Counting Stations

Data from permanent counting stations are received at UMTIG through modem. The data are screened according to the criteria set by ASTM standards which include:

- Checking data for sudden increases or decreases in traffic volume
- Checking data for repeated zeroes.

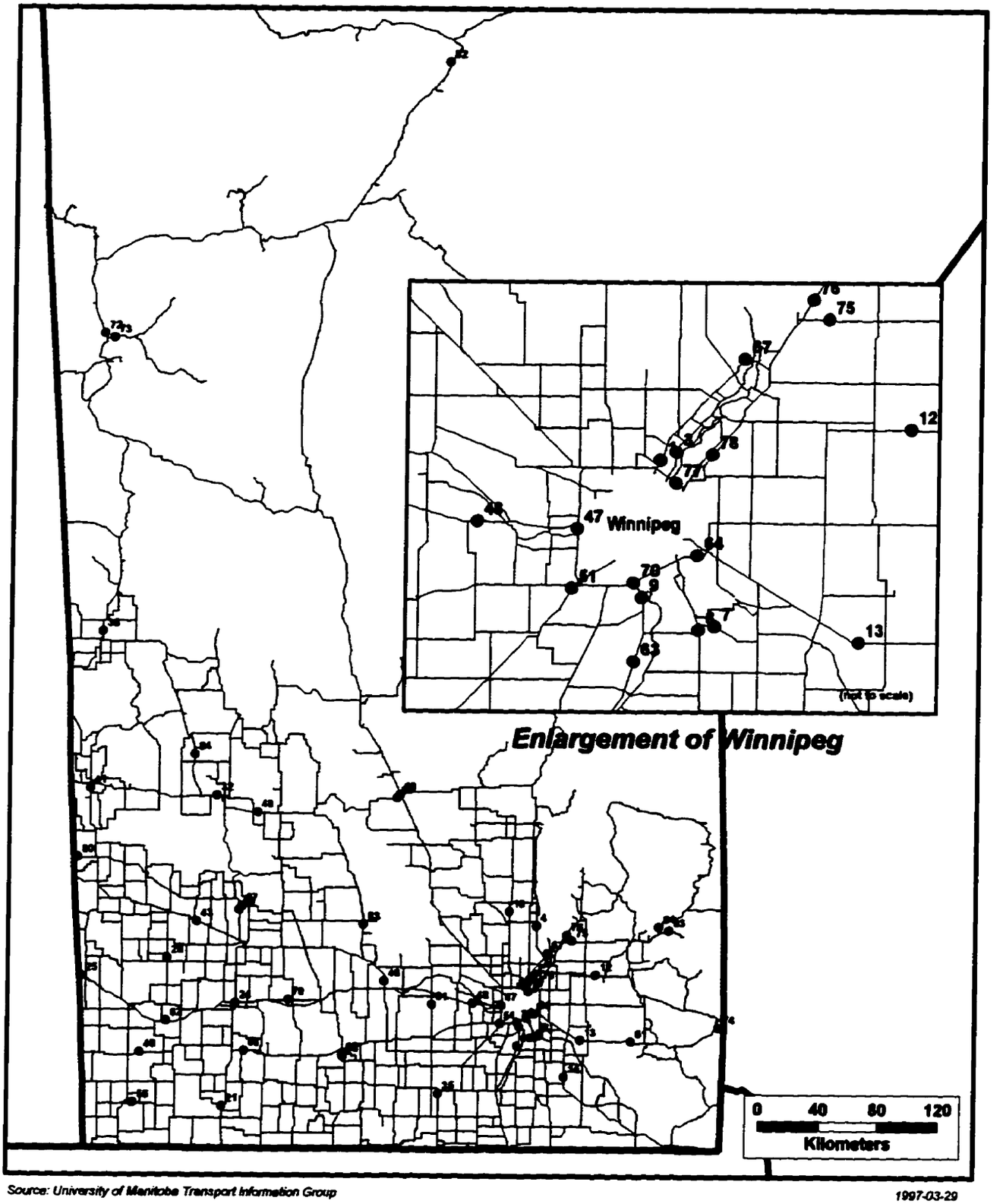
Data which are suspected to contain errors or anomalies are removed from the master database. This master database stores all current year traffic volume data from permanent counting stations, short-term counting stations and WIM/AVC stations.

Short-Term Counting Stations

Short-term counts are received at UMTIG in the form of count sheets. This data is entered manually into the master database by an operator. The raw counts are checked to ensure that minimum count durations have been completed, the minimum count duration for short-term counts is 48-hours [Ref. 2]. Data which are suspected to be errors or anomalies are rejected but not patched (missing values or not filled in).

Figure 2-3

Locations of Permanent Counting Stations in Manitoba



Source: University of Manitoba Transport Information Group

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WIM/AVC Stations

Similar to the permanent counting stations program, WIM/AVC data are downloaded at UMTIG via modem once a week. The data are processed using the SHOWMAN+ software which is capable of producing hourly volume counts from the raw data files. The screened data is then saved into the master database.

Special Counts

UMTIG receives turning movement count data via modem and town count data on count sheets similar to data for short-term counts. No screening procedures have been implemented to verify turning movement counts. Town counts are processed and checked in the same way as the short-term count data.

2.2.3 Creating Summary Traffic Statistics

Summarization of traffic data is a critical part of the traffic monitoring process. The AASHTO *Guidelines* indicates that when traffic data are summarized they also have the potential to be misused [Ref. 4]. If summarization is inconsistent or inappropriate, the results can be misleading.

At UMTIG, traffic data are summarized using standard procedures to produce statistics including AADT, average summer daily traffic (ASDT), highest hourly volumes, and percent trucks. The procedures used to produced these summaries are well-documented, consistent, clear, and reproducible.

2.2.4 Estimating AADT

The single most important piece of traffic data produced through the MHTIS is AADT. AADT represents the number of vehicles that use a road on an average day of the year. AADTs are estimated from three major sources (1) permanent counting stations, (2) short-term counting stations, and (3) WIM/AVC stations.

Permanent Counting Stations

At permanent count sites, AADT estimates are made at the end of the data year based on standard methods specified by ASTM Standard Practice E1442-94, *Standard Practice for Highway-Traffic Monitoring*, and the *AASHTO Guidelines for Traffic Data Programs* [Ref. 4]. The following describes this procedure:

1. Calculate the seven monthly average days of the week (MADW), from Monday through Sunday for each month.

2. Calculate the monthly average daily traffic (MADT) for each month. This is simply the sum of the month's MADWs divided by the number of MADWs (usually seven MADWs for each month).

3. Calculate the AADT by dividing the sum of the MADTs by the number of MADTs (usually 12 MADTs for each data year).

This procedure is shown by an example for station 25, located in Manitoba on PTH 1 just east of the Manitoba and Saskatchewan border. To calculate the 1995 AADT for this station, the first step is to calculate the seven MADWs from January until December 1995. Next, the MADWs are calculated as the average of the MADTs for each month, shown in Table 2-1. Finally, the AADT is estimated by averaging the 12 MADTs, and rounding the value to the nearest 10 vehicles.

Table 2-1
Calculation of AADT for Station 25 on PTH 1

Month	MADW							Monthly Average Daily Traffic (MADT)
	Sun	Mon	Tue	Wed	Thu	Fri	Sat	
January	1798	2422	1589	1159	1289	1335	1078	1524
February	1953	1680	1584	1752	1824	2112	1680	1798
March	2322	1968	1896	2519	2735	3177	2151	2395
April	3714	2502	2235	2453	2892	3027	3013	2834
May	2544	3432	3120	3264	2928	3168	2424	2983
June	2830	2544	2520	2712	3840	4344	2616	3058
July	5340	5060	3840	3624	3834	4392	4752	4406
August	3843	3912	4255	4536	4825	4344	3720	4205
September	2914	2928	2712	2634	2731	4123	3504	3078
October	3166	2712	2904	2688	2640	3120	2352	2797
November	2064	2232	1722	2398	2473	2420	1876	2169
December	2234	1392	1747	2056	2208	2944	2901	2212
						Average: (rounded to nearest 10)		2790

Short-Term Counting Stations

Short-term counts are expanded to AADT estimates by using one of two methods: control stations or traffic pattern groups. A *control station* is a permanent counter which exhibits similar traffic flow patterns as that of the short-term count site. If data for the control station is not available for expanding the short-term count then the short-term count is expanded based on a traffic pattern group. A *traffic pattern group* is a *group* of permanent counters which exhibit similar temporal traffic characteristics. Since the traffic pattern at a short-count site is unknown, the short-count site is assigned to a TPG and a control station in order to estimate AADT from the short-count.

To estimate the AADT at a short-count site using a control station or a TPG, a "factorless" expansion procedure is used. This expansion method relates the short-count period to that of its control station or its TPG in order to estimate AADT:

$$\frac{AADT_{site}}{Vol_{site}} = \frac{AADT_{ControlStation}}{Vol_{ControlStation}} \qquad \text{(Equation 2.1) [Ref. 1]}$$

where $AADT_{site}$ = the AADT at the short-term count site (to be calculated).

Vol_{site} = traffic volume recorded at the short-term count site.

$AADT_{ControlStation}$ = the AADT at the site's control station.

$Vol_{ControlStation}$ = the traffic volume at the site's control station during the same time period as the short-term count.

This method was developed by Lucas [Ref. 1], and has the advantage over traditional methods because it does not require calculation of fixed expansion factors. This allows short-term count estimates to be made at the end of the data year instead of having to first develop expansion factors. In addition, his method has been shown to produce consistent and realistic AADT estimates [Ref. 1]. This method assumes that unusual phenomena such as unusual weather conditions affect both the short-term

counter and its control station. Localized events are still checked to ensure that it is accounted for by both counters before estimating the AADT at the short-term counter.

Short-counts which are conducted using tube counters must be corrected for axle counts using an axle correction factor. This factor is determined using the following equation:

$$\text{Axle Correction Factor} = (1 - \%T) + (2.5 \times \%T) \qquad \text{(Equation 2.2) [Ref. 1]}$$

where %T = Percent trucks at the location.

The calculation of AADT for a short-term count is shown by an example. Consider a short-count that was taken at Station 357 (combined direction) which is located on PTH 5, south of PTH 1 in 1995. The short-count data that was recorded by the field crew is shown in Table 2-2. This table shows the dates and times when the short-counts were started, the end dates and times of the count, the type of counter used to collect the counts, as well as the actual raw traffic counts that were recorded during this period.

Table 2-2

Short Count at Station 357, West of PTH 5

Stn	Dir'n	Start Date	Start Time	End Date	End Time	Loop?	Count	Hwy	Location Description
357	C	95.05.15	11:28	95.05.17	11:28	Y	4366	5	South of PTH 1
357	C	95.07.18	09:46	95.07.20	09:46	Y	4548	5	South of PTH 1

Since the count at Station 357 was conducted using a loop counter it does not need to be corrected using an axle correction factor (if the count was conducted using a tube counter, the raw counts must first be corrected using the axle correction factor before expansion). The control station for short-count Station 357 is Station 24 [Ref. 7]. Based on the short-count information shown in Table 2-2, the raw counts during these

same periods at Control Station 24 were 10228 vehicles for the first period, and 11836 vehicles for the second period. The AADT for Control Station 24 in 1995 was 4570 [Ref. 7].

The AADT for Station 357 is calculated as the average of the two AADTs obtained from the two counts, shown below:

For the first period:

$$\frac{Vol_{357}}{AADT_{357}} = \frac{Vol_{24}}{AADT_{24}}$$

$$\frac{4366}{AADT_{357}} = \frac{10228}{4570}$$

$$AADT_{357} = 1950$$

For the second period:

$$\frac{Vol_{357}}{AADT_{357}} = \frac{Vol_{24}}{AADT_{24}}$$

$$\frac{4584}{AADT_{357}} = \frac{11836}{4570}$$

$$AADT_{357} = 1770$$

The AADT estimate for Station 357 is: 1/2(1950+1770) = **1860**.
This is the AADT estimate which is reported for Station 357 for the year 1995.

WIM/AVC Stations

AADT estimates from WIM/AVC data are produced in the same manner as the permanent counting stations. At the present time, WIM equipment does not produce reliable traffic counts or vehicle weights. Further research is being conducted to analyze and enhance the utility of data from WIM traffic recording devices.

Special Counts

Town counts are currently not expanded to an AADT because there are no control stations located within towns to allow appropriate expansion of short-term counts that are conducted within towns. Currently, town counts are reported in the annual report as the raw count divided by the number of days which the count was conducted. All town counts obtained in this manner are flagged to note that these counts are obtained in a different manner than regular short-term counts.

Turning movement counts are also not expanded to AADT estimates because the majority of these counts are conducted within towns.

2.2.5 Reporting Summary Traffic Statistics

After traffic data has been edited and summarized, it is reported. UMTIG reports AADT and related traffic estimates in five sources. Table 2-3 summarizes the types of traffic reports produced through the MHTIS and the frequency of production of each source.

In addition, traffic data users can obtain AADT data and other traffic statistics through the MHTIS Help Desk at the University of Manitoba. Users can request traffic information by phone, fax, or e-mail.

Table 2-3

Types of Traffic Data Reports Produced through the MHTIS

Report Name	Types of statistics reported	Frequency of Production
Traffic on Manitoba Highways	This annual report lists traffic statistics from: 1. Permanent Counting Stations - this section reports the station's current year AADT, graphs of average hourly and monthly traffic variations, highest 100 hourly volumes, and annual traffic volumes since 1989 for each permanent counter. 2. Coverage Counting Stations - this section reports the AADTs for the current and previous years since 1993, ASDT, 30th highest hour, and percent trucks for all coverage counting stations. In addition, this report includes a section which describes the methodology used to obtain traffic statistics, a list of the raw short-term count data, and its assignments to TPGs and control stations. Also included is a section on how users can obtain traffic statistics through the Internet, and maps showing the locations of permanent and short-term counters in the province.	• Annual.
Truck Traffic on Manitoba Highways	This report details truck traffic on Manitoba's provincial highways in terms of truck flows and truck classifications.	• Annual.
Station Detail Reports	These standard reports show detailed information about specific traffic monitoring stations. Information presented in these reports include a complete description of the station, the AADT, ASDT, 30th highest hour, percent trucks, TPG, and control station.	• On-request. • Updated on an annual basis.
Turning Movement Count Reports	Raw traffic counts for the 14-hour count period and expanded 24-hour estimates are produced. Turning movement counts are reported as either car-truck-pedestrian type studies or FHWA vehicle classification studies.	• On-request. • A list of the sites counted in the data year are published in a report format at the end of the year.
MHTIS Internet site	In this method, users can access traffic statistics by pointing and clicking on individual stations shown on the map or by entering a specific count station number. The types of traffic data reported includes AADTs since 1989 (where available), ASDT, percent trucks, the control station and traffic pattern group which the station is assigned to.	• Users can access traffic statistics at any time. • The site is updated on an annual basis.

2.3 Potential Problems with the Current Method of Estimating AADTs

The current method of estimating AADTs is based on standard procedures. These methods are transparent and produce reproducible results. This means that given a raw traffic count for a permanent or short-count site, the AADT estimate for that site can be re-created by using the same procedure. Although these methods allow the re-creation of AADT estimates for any count site, the entire procedure requires the manipulation of many numbers and tables, which can result in many sources of error.

In 1995, 1,006 sites were counted under the short-count program, and based on these sites a total of 2,158 surveys were conducted (most sites are typically counted twice, others are counted more often). Each of these surveys are edited and processed in order to create AADT estimates. Several problems can occur during this process due to the handling and manipulation of numerous databases and numbers. Some of these problems may occur due to system operating errors, and the others may be a result of human errors. Several potential sources of error include:

- insufficient computer resources
- rounding errors
- inadequate screening procedures
- transfer of data between different mediums
- human-error

Any one of these problems can result in poor quality AADT estimates being produced. To date, no systematic methods have been developed to evaluate AADT estimates that are produced through the current AADT estimation process.

Chapter 2 References

1. Lucas, Brian. "Design, Development, and Implementation of the Manitoba Highway Traffic Information System". Master of Science Thesis. Department of Civil and Geological Engineering, University of Manitoba. 1996.

2. Federal Highway Administration. "Traffic Monitoring Guide". Third Edition, February 1995.

3. Escobar, Luis. "Advanced Automated System for Weigh-in-Motion Data Analysis". B.Sc. graduation project. University of Manitoba, 1996.

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6. Clayton, Alan, Lucas, Brian, et al. "Design, Development, and Implementation of a Traffic Monitoring System for Manitoba Highways and Transportation". University of Manitoba Transport Institute, April 1993.

7. "Traffic on Manitoba Highways 1995". University of Manitoba Transport Information Group, June 1996.

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CHAPTER 3
Enhancing AADT Estimates through Human-Intervention Techniques

This chapter develops human-intervention techniques for evaluating and improving the quality of AADT estimates on Manitoba's provincial highways. The human-intervention techniques discussed in this chapter are route consistency checks, comparison of current year AADT estimates with historical AADT estimates, and checking for intersection balancing.

3.1 Introduction

The previous chapter discussed potential shortcomings of the current method of estimating AADT in Manitoba, which involves a complex procedure requiring the manipulation of numbers, tables and several computer programs. These problems give rise to the development of human-intervention techniques to improve the quality of AADT estimates on Manitoba's provincial highways.

Three different human-intervention techniques are presented in this research to evaluate AADT estimates: (1) route consistency, (2) comparison of current year AADT estimates with historical AADT estimates, (3) intersection balancing techniques.

3.2 Route Consistency

Route consistency involves examining AADT estimates in a spatial context to identify irregularities in traffic volume estimates. An effective method for conducting route consistency checks is by using a Geographic Information System (GIS). The

GIS is used to plot a highway map which shows scaled-AADT estimates. AADT estimates are displayed graphically using a scaled-line theme, where the thickness of the line represents the AADT at the location. This allows discontinuities in traffic estimates, such as sudden increases or decreases in AADT along a roadway to be identified by the data analyst.

Example Application

An example of how a route consistency check is conducted for Provincial Trunk Highway 11 (PTH 11) is shown in Figure 3-1 (a) and (b). The traffic flow maps were plotted using *Transcad*, a GIS-based software, and show the 1995 AADT estimates on each highway link as a scaled-line theme. Figure 3-1 (b) shows the enlargement of PTH 11, in addition, it shows the combined AADT estimates for 1995 on each highway link. Each link has been assigned to a control station, which is the source of the AADT estimate along that link.

To begin the route consistency check, a starting point on PTH 11 is selected, in this case, the starting point is selected just east of the intersection of PTH 11 and PTH 59. The first link on PTH 11 has an AADT of 750 vehicles per day, the connecting link to the east has an AADT of 2370 vehicles per day. This represents a sixty-eight percent increase in traffic volume, and is flagged for further analysis to determine the source of the inconsistency. Either one or both of the links could be potential sources of error.

The control stations assigned to each of these highway links are Station 119 for the first link, and Station 659 for the second link. The actual traffic counts at these stations are shown in Table 3-1. The actual traffic counts at both of the stations appear to be as expected, with approximately the same or slightly higher volumes in July compared to May and June. Based on these counts, the AADT is recalculated and

Figure 3-1 (a)

1995 Traffic Flow Map for Winnipeg and Surrounding Northeastern Region

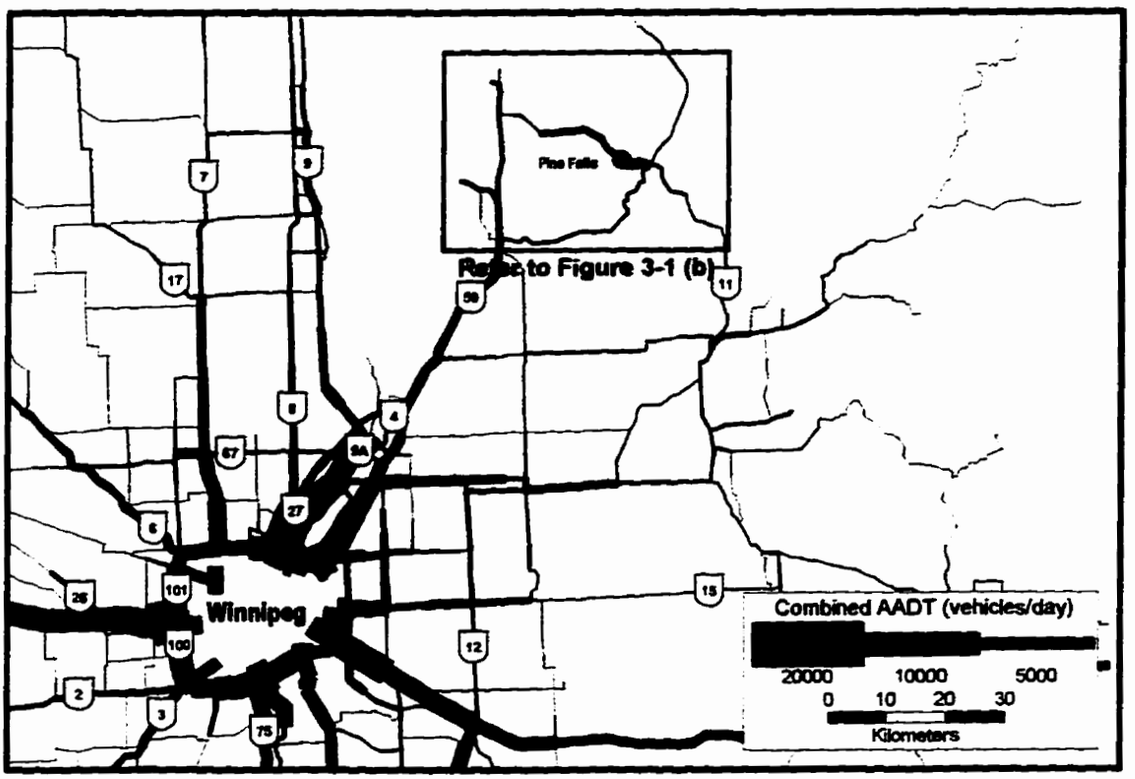
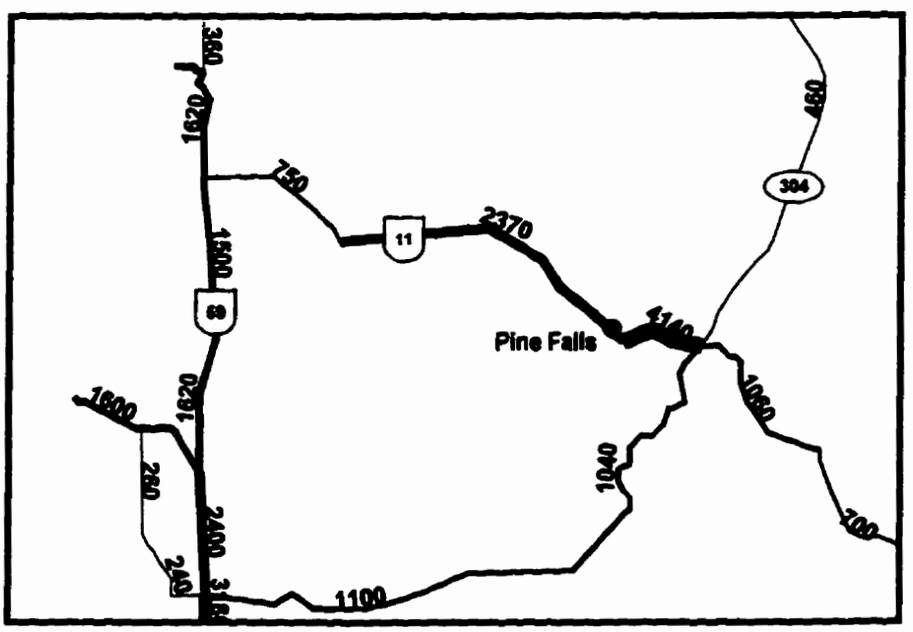


Figure 3-1 (b)

Combined AADTs (1995) for PTH 11



Source: University of Manitoba Transport Information Group *1997-03-29*

produces the same estimates, 750 and 2370 vehicles per day. This shows that the original AADTs have been correctly determined, and therefore no sources of error can be identified using this method.

Table 3-1

Actual Traffic Counts at Stations 119 and 659 on PTH 11

Stn	Dir'n	Start Date	End Date	Loop?	Count (vehicles)
119	C	95.05.30	95.06.01	N	1794
119	C	95.07.11	95.07.13	N	2391
659	C	95.05.31	95.06.02	N	6417
659	C	95.07.10	95.07.12	N	6272

Moving further to the east of PTH 11 finds that the traffic volume increases to 4140 vehicles, which represents a forty-three percent increase. This increase in traffic could be due to two things: (1) the location of the town of Pine Falls nearby, or (2) it could mean that AADT estimate for this link is of poor quality. In order to investigate whether there has been any error in the estimation process, the count station for this link is flagged, and the actual counts are retrieved. The data for Station 118, which is the control station for this link is shown in Table 3-2.

Table 3-2

Actual Traffic Counts for Station 118 on PTH 11

Stn	Dir'n	Start Date	End Date	Loop?	Count (vehicles)
118	C	95.05.31	95.06.02	N	12313
118	C	95.07.10	95.07.12	N	8104

Inspection of the actual traffic counts for Station 118 in Table 3-2 shows that although both counts were taken in the summer months approximately one month apart, the first count is significantly higher than the second count. The typical traffic flow pattern on this route is a high summer peak in the months of July and August, due to its proximity to the popular Lake Winnipeg beaches area. The higher traffic count in May and June does not fit the expected pattern for PTH 11. Based on this

information, it can be concluded that there is a problem with the actual traffic counts at Station 118, which is the source of the high AADT estimate at this location. The discrepancy in the raw traffic counts should be recorded, and a copy of this should be sent to MDHT to verify the count either by re-counting in the field or referring back to original count sheets.

This example shows how a route consistency checks allows any inconsistent AADT estimate to be re-considered in further detail to determine the cause of error, or provide explanations as to why the AADT estimate does not fit the pattern on that route. Although this method is manual and requires subjective human judgment, it does allow discontinuities in AADT estimates to be highlighted. The result is to produce better quality AADT estimates for provincial highways.

3.3 Comparison of Current Year AADT Estimates with Historical AADT Estimates

The AADT for any short-term count site that is reported at the end of a given year is an estimated value, and its true value is unknown. This poses a problem for analysis purposes because it does not allow one to determine whether an estimate reflects the true situation at any site, or the quality of that estimate.

One method of identifying possibly poor quality AADT estimates is by comparing current year AADT estimates with historical AADT estimates. Comparing estimates in this method allows sites which exhibit a significant difference in AADT between the given years to be flagged. AADT estimates can be affected by the estimation procedure and the representativeness of a short-term count site's assignment to a TPG and control station. On the other hand, some change in AADT is expected from year-to year due to population growth, the development of new communities, or the construction of a new highway which may redirect traffic to and from other existing

highways. This change is inevitable, however, in general, the traffic in most locations throughout the province are not significantly affected by these changes. As a result, any location which exhibits a significant change in AADT from one year to the next should be flagged and reasons for that occurrence must be provided. This allows potential errors or anomalies to be removed, and explanations for any significant change in AADT to be provided.

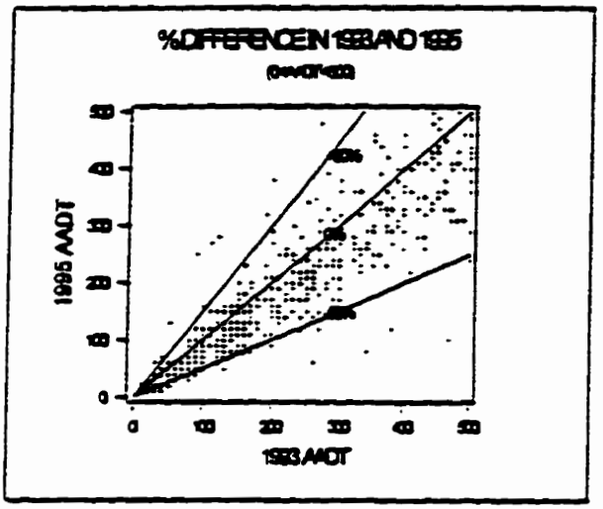
In order to conduct this comparison for 1995 AADT estimates, several graphs are plotted to show the 1995 and corresponding 1993 AADT estimate for each site, shown in Figures 3-2 (a) - (e). Each point on the graph represents a count station; the value on the x-axis shows the station's 1993 AADT and the y-axis shows the station's 1995 AADT estimate.

The graphs are separated into different ranges of AADT -- low volume sites and high volume sites. This is to account for the inherent traffic variation on roads with different traffic volumes. Lower volume roads have greater variabilities than higher volume roads, meaning that larger variations of traffic volume are expected on these roads [Ref. 1].

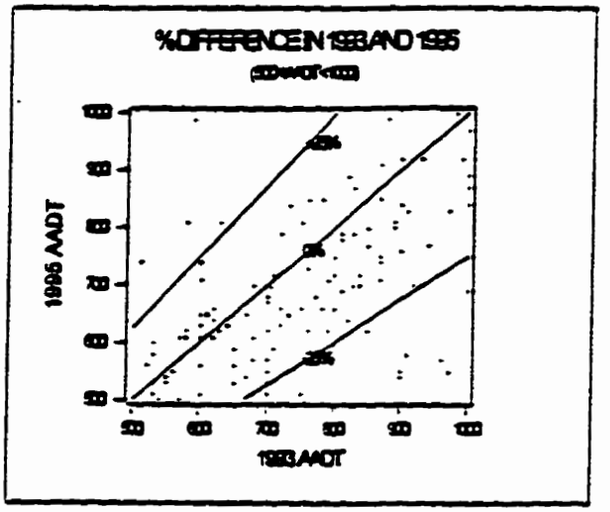
For example, a short-count site which was reported having an AADT in 1993 of 200 vehicles per day has an AADT in 1995 of 400 vehicles per day, and this represents a 100 percent increase in traffic volume. However, this large percent difference translates to a difference in the number of vehicles of only 200 vehicles, which is expected for a low volume road due to the nature of traffic variability on low volume roads. On the other hand, the same 100 percent increase in traffic on a higher volume road with an AADT of 5,000 vehicles per day represents a difference of 5000 vehicles per day. Such a large increase in traffic is not expected particularly if there have been no significant changes in land use, roadway development or other improvements in the region. Hence, on higher volume roads a greater percent difference between year-to-year estimates is of more importance than on lower volume roads.

Figure 3-2 (a) - (e)

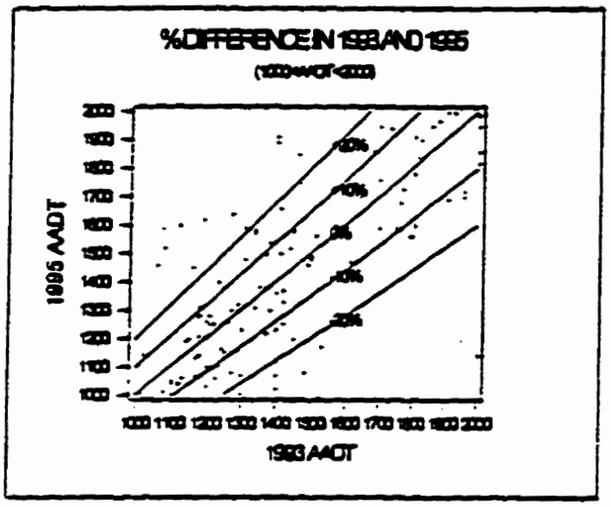
Comparison of 1995 and 1993 AADT Estimates



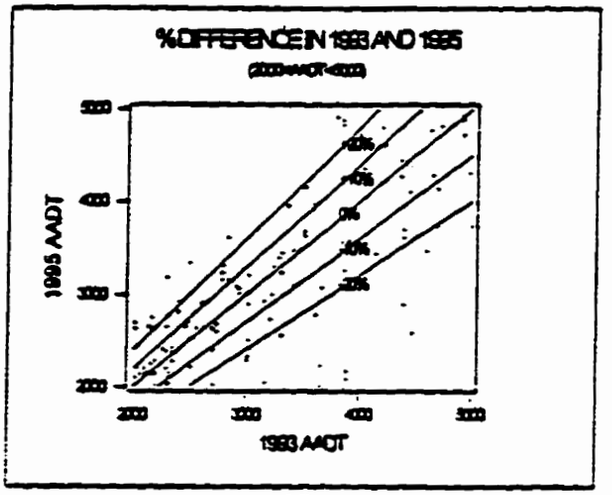
(a)



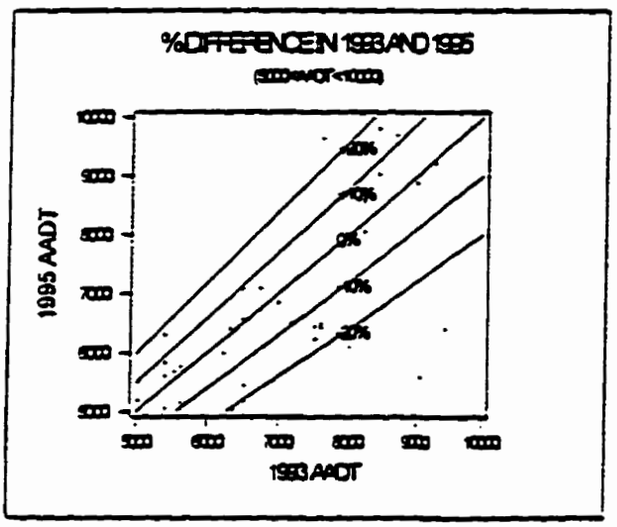
(b)



(c)



(d)



(e)

In order to compare equivalent sites in terms of the inherent variability, the sites are grouped into five different ranges of AADT estimates. Sites which have a 1995 AADT of less than 500 vehicles per day (low volume) are shown in Figure 3-2(a), and sites where the AADTs are between 5,000 and 10,000 vehicles per day (high volume) are shown in Figure 3-2(e). The other graphs (Figures 3-2 (b) - (c)) show AADT estimates that fall within the moderate range (between 500 vehicles per day and 5,000 vehicles per day).

Each graph also shows a series of percent difference lines. For example, the +50% difference line in Figure 3-2 (a) indicates the line where the 1995 estimates differ from the 1993 estimates by +50%. Similarly, the -50% difference line represents the line where the 1995 estimates differ from the 1993 estimates by -50%. If there is no difference in the 1995 estimate from the 1993 estimate, the points should fall on the 0% difference line as indicated in the same figure.

These figures along with the percent difference lines allows inconsistent estimates to be identified in a systematic and progressive way. After inconsistent estimates have been identified, these estimates can be evaluated in further detail to either accept or reject an estimate, and explanations as to why there is such a significant difference between the different years' estimates must be provided.

Example Application

This technique is used to analyze and compare the 1995 AADT estimates with 1993 AADT estimates. An example of a station which is identified as having a large difference in AADT between 1993 and 1995 is Station 205 (combined direction), located on PTH 9, north of the north junction with PTH 9A. The 1995 AADT estimate for this station is 3,470 vehicles per day and the 1993 AADT estimate was 4,600 vehicles per day, which represents a 25 percent decrease in AADT over the two years.

The next step is to check these estimates against each other and provide explanations as to which estimate is more appropriate based on the actual traffic counts and the average summer daily traffic (ASDT). This information is shown in Table 3-3 for Station 205.

The first row of count information shown in Table 3-3 corresponds to the count period when this station was first counted in 1995 (June 13 - 16, 1995). The second row of count information corresponds to the second period when this station was counted in 1995 (Sept. 18 - 20, 1995).

Table 3-3

Comparison of 1995 and 1993 AADT Estimates for Station 205 on PTH 9

Stn	Dir'n	93 AADT	95 AADT	Start Date	End Date	No. of Days	Loop?	Count	ASDT%	ASDT	ADT
205	C	4600	3470	95.06.13	95.06.16	3	N	12417	116	4025	4139
205	C	4600	3470	95.09.18	95.09.20	2	N	7338	116	4025	3669

The actual counts can be used as a basis of evaluating the 1995 estimate compared to the 1993 estimate. Since the counts were conducted during the summer months, the summer traffic volume is expected to be greater than the annual average. In 1995, the ASDT for this site is 116 percent of the AADT, which translates to 4,025 vehicles per day. Based on the two traffic counts, the average daily traffic (ADT) is calculated as the actual count divided by the number of days when the count was conducted, resulting in 4,139 and 3,669 vehicles per day respectively. These values are close (three-percent and nine-percent difference, respectively) to the summer traffic volume of 4,025 vehicles. These values are also greater than the estimated AADT for 1995 which is 3,470 vehicles per day. However, the AADT estimate for 1993, 4,600 vehicles per day, is greater than the summer traffic volume. This cannot be explained from the basic mathematical calculations.

Based on this analysis, it is concluded that 1993 AADT estimate for Station 205 is high.

3.4 **Intersection Balancing** [Ref. 3]

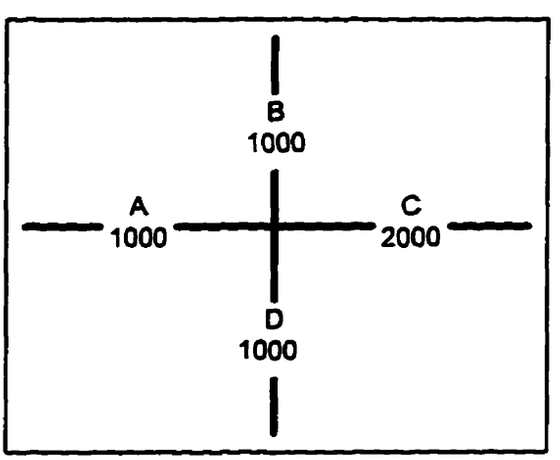
The sum of traffic entering an intersection must equal the sum of traffic leaving that intersection. The method of intersection balancing identifies intersections which do not balance. After identifying the imbalanced intersections, the AADT estimates on the individual highway links that make up that intersection are evaluated.

The evaluation considers the inherent traffic variability an intersection. Low volume intersections which are inherently more variable than high volume intersections are expected to have a greater degree of imbalance compared to higher volume intersections. Hence, this must also be taken into consideration during the evaluation process.

An example of an intersection which does not balance is shown in Figure 3-3.

Figure 3-3

Example of an "Imbalanced" Intersection



This example shows a four-leg intersection, labeled by A, B, C, and D and the corresponding AADT estimates on each of those links. If the AADT estimates for any two of the legs are added, it does not equal the sum of the AADT estimates of remaining two legs. Similarly, if the AADT estimates for any three legs of this intersection are summed, the resulting value does not equal the AADT estimate on the fourth leg. Based on the method of intersection balancing, the intersection is identified as being imbalanced, and the corresponding AADT estimates on each of the highway links A, B, C, and D are examined in further detail to determine the cause of the imbalance. An automated system which will facilitate more efficient checking of AADT estimates on provincial highway intersections is currently being developed [Ref. 3].

3.5 Other Techniques for Enhancing AADT Estimates

Other techniques which may be able to enhance AADT estimates are:

- Incorporating feedback from data users

  Traffic data users may be aware of specific system or locational characteristics which should be highlighted. For example, residents of the town of Steinbach may be more aware of local traffic conditions in their area such as the occurrence of a special event or an unusual weather condition, which may affect counts taken in that area during that time. The input which they can provide about these matters can be used to remove unusual counts from the database, which in turn results in a cleaner dataset.

  Identifying inconsistencies in AADT estimates through this method may be an effective method for improving its quality because it incorporates input about actual traffic conditions. Currently, users are able to phone, fax, mail or e-mail in any comments which they may have about specific traffic conditions to the MHTIS office. The knowledge gained through feedback from other users should be kept on a database for future reference.

- Utilizing an integrated count database

  The quality of AADT estimates on Manitoba's provincial highways may be improved by utilizing an integrated traffic count database. Currently, each province/jurisdiction conducts its own traffic counts on roads which lie in their

jurisdictions. Manitoba should consider integrating its traffic count database with those of neighbouring jurisdictions including the City of Winnipeg, Saskatchewan, Ontario, North Dakota and Minnesota to enhance the understanding of traffic movements in this region. The use of an integrated count database such as this may result in improved AADT estimates and/or reduced traffic monitoring costs since sites which have already been counted by one highway agency can be shared with other highway agencies, and need not be duplicated.

- Cordon counts

  Cordon counts are traffic counts which are taken on roads along jurisdictional boundaries by the respective officials. These counts can be used to improve the quality of AADT estimates on the related highways. For example, AADT estimates for the section of PTH 75 which lies just north of the Manitoba-U.S. border are produced at the MHTIS using the standard expansion method. However, the traffic count at this location is known in exact by the officials at U.S.-Canada Customs office. These exact counts should be used to check against estimated AADTs to determine how closely these two values relate to each other and to identify errors or inconsistencies. Similar counts for other highways should also be used as a method of evaluating AADT estimates on Manitoba's provincial highways.

Chapter 3 References

1. Clayton, Alan, Lucas, Brian. "Design, Development, and Implementation of a Traffic Monitoring System for Manitoba Highways and Transportation". University of Manitoba Transport Institute, April 1993.

2. "Traffic on Manitoba Highways 1995". University of Manitoba Transport Information Group, 1996.

3. Melchiorre, Marina. "Automated Quality-Control Evaluation of Traffic Estimates". Draft B.Sc. graduation project, University of Manitoba, 1997.

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1. American Association of State Highway and Transportation Officials. "Guidelines for Traffic Data Programs", 1992.

2. Missouri Highway and Transportation Department. "Traffic Monitoring". Presented at National Traffic Data Acquisition Conference, Albuquerque, 1996.

CHAPTER 4

Traffic Data Needs in Manitoba

This chapter describes the current AADT and other traffic data needs of traffic data users in Manitoba. Information for this chapter was obtained from a survey of traffic data needs that was conducted during the months of November 96 - January 97.

4.1 Background

One important part of the MHTIS is determining how well it is serving the needs of traffic data users. In Manitoba, AADT and other types of traffic data on provincial highways is required by the Manitoba Department of Highways and Transportation (MDHT), transportation engineering consulting firms, and the general public. Each of these data users may require different types, formats, and accuracies of traffic data to support their functions.

The most recent survey of traffic data needs was conducted in early 1992 before the implementation of the Manitoba Highway Traffic Information System (MHTIS). Since then, no work has been undertaken to review these data needs to provide an up-to-date account of traffic data needs in Manitoba.

This chapter reports and describes the current traffic data needs of the various traffic data users in Manitoba. These traffic data needs were obtained through a survey of data users conducted during the months of November 96 - January 97. The results of the survey are used to determine key areas of improvement and change which should be made to the current traffic monitoring system.

The objectives of this survey were to determine:

(1) the types of traffic data required by traffic data users to perform their functions.
(2) the importance, formats, and accuracy required of each type of traffic data.

(3) the importance of traffic data concerning low volume roads in their functions.
(4) the level of satisfaction with the current traffic monitoring program, and changes and improvements which can be made to enhance the traffic monitoring system in Manitoba.

4.2 Survey Methodology

The survey consisted of personal and telephone interviews with the major traffic data users in Manitoba. Four major groups of data users were surveyed: (1) The Manitoba Department of Highways and Transportation (MDHT); (2) Manitoba Department of Industry, Trade and Tourism; (3) Transportation Consulting Groups; (5) Other Traffic Data Users.

The traffic data requirements were obtained through personal and telephone interviews with staff members of MDHT, transportation consulting firms, and other users. The individuals who participated in this survey are acknowledged at the end of this chapter.

The types of data requested by the traffic data user was assessed according to three criteria: (1) its relative importance; (2) the frequency at which it is required; (3) the level of detail required. The following describes each of these criteria in further detail.

Importance: The importance of each type of data to each traffic data user is rated as either (1) essential to the data user's operations; (2) useful but not essential; (3) interesting but not often used; or (4) of no interest.

Frequency: The frequency at which the data is needed is described as either: (1) annual; (2) infrequent; (3) special-needs basis.

Detail: The level of detail required for the data are described as either (1) individual sites; (2) summarized by highway sections; (3) summarized by regions; (4) province-wide.

4.3 Survey Results

The results of the survey are presented in the following order:

- Section 4.3.1 presents the survey results of traffic data users within the Manitoba Department of Highways and Transportation;
- Section 4.3.2 presents the survey results of the Manitoba Department of Industry, Trade and Tourism;
- Section 4.3.3 presents the survey results of transportation consulting groups in Manitoba; and
- Section 4.3.4 presents the survey results of other traffic data users.

4.3.1 Manitoba Department of Highways and Transportation

4.3.1.1 Engineering and Technical Services Division

Highway Planning and Design Branch [Ref. 3]

Function

The Design Branch handles the conceptual, functional, and geometric designs for roadway projects in Manitoba. The Branch is responsible for coordinating activities from the Planning, Design and Access Management sections.

Data Requirements

- AADT - this is considered to be the most important of all the traffic data needed by the Branch.
- Intersection turning movement counts
- Percent Trucks
- Vehicle classifications
- Hourly traffic volumes, including peak hour volumes

Accuracy

An error range of ±10% in traffic data estimates is satisfactory for this Branch's purposes, however, final decisions are always made based on engineering judgment.

Low Volume Roads

Design work usually involves roads with AADT of greater than 500 vehicles per day. Less frequent counting on low volume roads is acceptable. It was indicated that there is no need to count on low volume roads more than once every three to five years.

Growth rates can be applied to determine the AADTs in years when these roads are not counted.

Changes and Improvements to the Current System

- Generally, this Branch feels that the current reporting procedure through the annual report *Traffic on Manitoba Highways* is satisfactory in meeting their data needs. However, the Branch prefers to have exact figures of average hourly and monthly traffic variations instead of graphs. This information is currently shown in graphical form in *Traffic on Manitoba Highways 1995*.
- Increased coverage of classification count sites in Manitoba. It was indicated that more sites should be classified according to the FHWA 13 vehicle classification scheme to provide a more accurate picture of truck traffic on Manitoba's provincial highways.
- The Branch frequently requires intersection and town counts to be done on a special request basis. These special counts should be indexed or recorded in a report so that the branch can refer to the locations of special counts which have already been done in order to avoid unnecessary duplication of counts.
- Finally, the Planning and Design Branch would like to obtain a large-scale traffic flow map of the province. This is a useful and efficient method to reference traffic volumes on individual highway sections. It is preferable that this map is included as part of *Traffic on Manitoba Highways*.

Programming Branch [Ref. 12, 13]

Function

The Programming Branch is responsible for four functions:

(1) Providing proposed annual highway construction programs for the Department. A program consists of a number of projects which require funding, for example a highway design project, highway construction project, or maintenance and resurfacing work. These projects are proposed by the various branches within the Department including the Construction and Maintenance Division, Highway Planning and Design Division, and regional offices. The Programming Branch is responsible for prioritizing these projects and submitting these for final approval by the Minister of Highways.
(2) Producing a highway inventory report which is an inventory and appraisal of existing conditions on Provincial Trunk Highways and Provincial Roads each year.
(3) Provide coordination for land acquisition.
(4) Provide coordination for utility reviews.

Data Requirements

- AADT - this statistic is considered essential and the most frequently used.
- Percent Trucks - this is also regarded as essential and is frequently used by the branch.
- Vehicle kilometers of travel
- Design hourly volumes

All of these statistics are required by highway sections for the entire province.

The Department is currently developing a new link-node system for subdividing the provincial highway network. This may result in a new control section map with a change in the way links are defined. Further work is required to develop a new inventory system.

Accuracy

Accurate traffic data is critical to this branch's operations. For example, when the branch is prioritizing two projects for maintenance, one in Dauphin and the other in Steinbach where both projects cost the same, the final decision as to which project is placed at a higher priority is based on the reported traffic volume estimate.

Decisions on projects which involve millions of dollars are based on traffic counts. This branch is responsible for setting the level of priority for each of these large-cost projects. Traffic data is what determines the final decision in almost all cases. Therefore, highly accurate traffic data is deemed to be extremely important.

Low Volume Roads

All roads are equally important to this branch's functions; traffic volumes are not used to differentiate between roads. All roads in the province must be listed in the annual inventory report produced by this branch, inventory such as traffic volumes, percent trucks, design hourly volumes, and projected traffic volumes for each control section are all listed in this report.

Changes and Improvements to the Current System

- Overall, the Programming Branch is confident with the estimates produced by UMTIG in *Traffic on Manitoba Highways*.
- The Programming Branch suggested that there should be more communication between traffic data users in this branch and UMTIG.
- This Branch indicated that a large-scale traffic flow map would be a highly useful format for presenting overall traffic volumes in the province, and they would like to see this produced as part of UMTIG's annual report.

- Transfer of data between the MHTIS and the current system - Currently, traffic information is broken down into control sections which do not necessarily match those of UMTIG's. A better way of integrating information between these two systems should be developed. The Computer Services branch is currently developing an improved control section map which will allow easier traffic data integration between the two systems.

Materials and Research Branch [Ref. 7, 8, 9]

Function

The Materials and Research Branch is responsible for pavement designs in the province. The Branch requires traffic data for pavement impact studies, pavement design, and the impacts of trucks on pavement deterioration.

Data Requirements

- AADT - required annually and seasonally
- Growth rates on AADT
- Percent trucks - required annually and seasonally
- Growth rates on percent trucks
- Vehicle classifications - the branch would like detailed information on the types of trucks which use provincial highways on an annual and seasonal basis
- Directional distribution of trucks
- Lane distribution of trucks
- Truck weight information - annually and seasonally

Truck data including classifications, weight data, and lane distributions are required to predict the number of ESALs (equivalent standard axle loads) that the pavement is expected to sustain. This information is used for pavement design and impact studies.

Overall, information pertaining to truck classifications and truck weights are most important to this branch. The Branch is particularly interested in knowing the types of trucks which use provincial highways, how these trucks are loaded, and the seasons in which the loading occurs. All of this data is considered essential for the Branch's functions.

Accuracy

The Branch believes that there are many variables involved in pavement design, each of which carries an inherent error. It is difficult to estimate how sensitive a design is based on the different variables (inputs). The Branch feels that for higher ESAL pavement designs, an accuracy of ±25% of traffic estimates is acceptable.

Low Volume Roads

Low volume roads are relevant to this branch's operations. The Branch considers all roads with an AADT of less than 300 vehicles per day to be low volume. For these roads, AADT estimates within ±30% of the actual traffic volume is acceptable.

Changes and Improvements to the Current System

- More data collection at more locations throughout the province is needed.
- More truck data particularly truck classifications, trucks weights and their distributions, and percent trucks. Currently all decisions requiring truck data are based on previous years' estimates if current year estimates are unavailable. Due to the changing fleet characteristics it is difficult to project the growth trends of truck traffic using previous years' data. It will be useful for the Branch if more current information on vehicle classifications and percent trucks is available.

Traffic Engineering Branch [Ref. 30]

Function

The Traffic Engineering Branch is responsible for providing the necessary traffic control devices and expertise to ensure safe and effective highway systems for the movement of people and goods in the province.

Data Requirements

Traffic data is essential for prioritizing Branch activities, and for the design and operation of various traffic control strategies and devices.

The types of traffic data required by this Branch includes:

- AADT - essential, required on an annual basis for province-wide highway sections.
- Seasonal, daily, and hourly variations of traffic - essential, required on an annual basis for province-wide highway sections.
- Intersection turning movements - essential, required on a special-needs basis for site-specific locations.
- Vehicle-kilometers of travel - essential.
- Percent Trucks - important.
- Vehicle weights - useful.

Accuracy

This Branch would like traffic data to be as accurate as possible, given the state of existing technology in traffic monitoring.

Low Volume Roads

This Branch does not require much traffic data on low volume roads. Roads are considered low volume if they have an AADT of less than 300 vehicles per day. In general, an accuracy level of ±20% is satisfactory to this Branch's functions.

Changes and Improvements

- *Traffic on Manitoba Highways* - It was indicated that improvements should be made to the sorting of count stations.

Northern Airports and Marines [Ref. 22]

This branch is responsible for designing, planning and maintaining aircraft landings and ferry services in northern Manitoba. This branch does not require traffic data for its functions.

4.3.1.2 Construction and Maintenance Division

Maintenance Management [Ref. 1 and 2]

Function

The Maintenance Management Branch coordinates maintenance activities for regional offices and for the province. The province is broken down into five regions, each of these regions is broken down into "beats". Each beat reports to the maintenance engineer of its regional office, which then reports to the head office. The head office is responsible for budgetary expenditures for each region, and monitors these expenditures according to allocated resources.

Maintenance activities are broken down into summer and winter activities. In 1997 the summer maintenance budget is approximately $26 million, and the winter budget is about $17 million. The head office oversees region's activities in terms of what portion of the budget has been spent, and what activity it has been spent on. The Branch also deals closely with the construction, research, contract and quality assurance divisions of the Department.

Data Requirements

- AADT data - AADT is used to assign roads to maintenance categories.
- Segment lengths
- Percent trucks
- Traffic growth rates
- Design hourly volume factors.

Low Volume Roads

In general, the Branch is concerned only with roads of AADT greater than 250 vehicles per day.

Accuracy

- No specific level of accuracy was provided.
- The Branch mainly bases decisions on engineering judgment and knowledge of specific locations to determine if the data is accurate enough for their purposes.
- The most important issue is that justification is provided for any activity.

Changes and Improvements to the Current System

- The Branch prefers a provincial highway map showing AADT estimates at point specific locations rather than for highway links.

Construction Management [Ref. 29]

Traffic data is not required by this Branch.

Contracts Branch [Ref. 18]

Functions

This Branch is responsible for traffic control for contracts for the construction of new roads. Traffic control includes all detours and traffic diversions.

Data Requirements

The following factors influence the types of traffic control devices that need to be implemented:

- AADT - different volumes of traffic require different traffic control devices to be implemented.

- Geometry of the road
- Topography
- Type of traffic which uses the road - percent trucks.

Low Volume Roads

All roads are equally important to this Branch.

Changes and Improvements to the Current System

The Branch obtains all of their traffic information from the Highway Planning and Design Branch for the designs of new highways and highway structures. No suggestions for improvement were provided.

Bridges and Structures Branch [Ref. 16]

Function

This Branch is responsible for the construction, maintenance, and design of bridges. Traffic data is needed for bridge ratings, which involves estimating an existing bridge's load-carrying capacity and the remaining life of a bridge structure.

Data Requirements

The most important types of data to this Branch are truck-related data, specifically:

- Truck weight data - essential for determining bridge ratings. The Branch would like to obtain gross vehicle weight and axle weight data, and the distributions of these weights.
- Percent Trucks.

Currently, the Branch obtains all truck data from the regional offices and the Highway Planning and Design Branch of MDHT.

AADT estimates are not important for bridge ratings.

Changes and Improvements to the Current System

No comments were provided.

4.3.1.3 Transportation Policy, Planning and Development Division

Transportation Systems Planning and Development Branch [Ref. 5]

Function

The function of this Branch is to strategically plan and optimize investments in provincial transportation systems [Ref. 5]. This is a relatively new Branch, being in operation for only two years. It is responsible for the long-term planning and development of provincial highway systems.

Data Requirements

- AADT data - essential, required province-wide.
- Percent trucks - essential, required province-wide.
- Growth rates - 3, 5, 10 and 20 years.
- Traffic mix and vehicle classifications - the Branch would like more information on the types of vehicles that use a particular highway. Detailed breakdowns of what types of trucks and cars (bicycles, small, medium, large cars, and pickup trucks) that use a highway are very useful. The Branch conducts many cost-benefit analyses and detailed breakdowns of traffic mix are required for input into the "MICROBENCOST" software, a cost-benefit analysis software for highway capitalization projects.
- Seasonal traffic variations, particularly summer recreational traffic volumes on provincial highways.
- Traffic volumes during spring restrictions period - the Branch is particularly interested in obtaining information on truck volumes during spring restriction periods.
- Design hourly volumes - 30th, 50th, 100th highest hours.
- Intersection volumes - particularly at intersections where the combined traffic volume is greater than or equal to 7000 vehicles per day.
- Traffic volumes within towns - the Branch would like to have more locations counted under the town counts program. A better method for expanding town counts into AADT will be very useful to this Branch.
- Vehicle-Kilometers of Travel - by highway section, province-wide.

Low Volume Roads

- This Branch requires more information concerning low volume roads throughout the province. The types of information which are considered useful for these roads includes AADTs, truck volumes, and seasonal traffic variations.
- Traffic estimates on low volume roads are required to be as accurate as possible.

Accuracy

Accurate traffic data is essential to this Branch's functions.

Changes and Improvements to the Current System

- Overall, this Branch is satisfied with the information that is currently being produced.
- More detailed vehicle classification information is needed.
- More intersection turning movement counts should be conducted, and a more accurate method for estimating traffic volumes within towns should be developed.
- Provincial vehicle-kilometers of travel data is useful, however, the Branch would like to obtain this information broken down by region, within towns, and also within the City of Winnipeg where possible.
- *Traffic on Manitoba Highways* - information shown in UMTIG's annual report is found to be satisfactory. However, it was indicated that improvements could be made with the sorting of count stations according to highway numbers and control sections.
- AADT traffic flow map - the Branch would like to see a copy of the traffic flow map included as part of *Traffic on Manitoba Highways* on an annual basis.
- Truck flow map.

4.3.1.4 Transportation Safety and Regulatory Services Division

Compliance and Regulatory Services Branch [Ref. 20, 21]

Functions

This Branch is responsible for enforcing weight and dimension regulations in the province through various scheduling and enforcement programs. This is a relatively new Branch, being in operation since April 1996.

Data Requirements

This Branch requires mostly truck-related data in their functions:

- Truck accident data is considered essential. This data is needed to determine accident locations, accident rates, and what types of trucks are involved in these accidents.
- Truck weight data is also considered essential. Currently, truck weights are monitored through static weigh scales in the province. The Branch feels that weight data from dynamic weigh scales are not reliable enough for their operations, and would like to see an improvement in this area.

- Truck classifications broken down into the FHWA scheme is very important for this Branch. It was indicated that there is a lack of computer capability to capture vehicle classification data in the province. More classification data will be very useful for this Branch's operations.
- Percent Trucks.
- AADT data is used mainly in conjunction with percent trucks figures to determine the levels of trucking activities on provincial highways and roads.

Changes and Improvements

In general, the Branch feels that more truck related data is needed in the province. The Branch is particularly interested in obtaining vehicle classification data and vehicle weight data. It was indicated that more research should be conducted to determine the best way of obtaining accurate vehicle weight data from WIM sites.

4.3.1.5 Regional Offices [Ref. 15]

Functions

Regional offices are responsible for administering the planning, survey, design and acquisition of R.O.W. for all regional projects, from inception to draft tender.

Data Requirements

- AADT
- Summer Daily Traffic (ASDT)
- Intersection turning movement counts
- Peak hourly and daily volumes
- Percent trucks
- Vehicle classifications and distributions
- Origin and destination data
- Weigh-in-motion data

Low Volume Roads

- Low volume roads tend to be more of a concern to local governments. There is always pressure to upgrade these roads to higher standard. AADT is used to justify whether or not an upgrade should be considered. In some cases, requests for upgrade are denied if traffic volumes are less than 300 vehicles per day. Any difference of 20 - 30 vehicles can make a difference in the decision.
- Highly accurate traffic estimates are needed for low volume roads.

Changes and Improvements to the Current System

- Computer access to traffic data, without the need for Internet.
- A large-scale traffic flow map.
- Concise data that will serve the needs of the District/Region.

4.3.2 Manitoba Department of Industry, Trade, and Tourism

Travel Manitoba [Ref. 4]

Function

The main function of Travel Manitoba is to promote tourism in Manitoba. Promotional material is produced by this Branch to encourage visitors into Manitoba. In order to produce this promotional material, the research analyst must determine the amounts and changes in tourist activity from a month-to-month and year-to-year basis. This performance is measured by using "performance indicators" such as traffic volumes entering the province, customs data, and tourist inquiries at visitor centers. The Branch is particularly interested in the growth or decline of tourist traffic entering the province, and one of the measures used to determine this is traffic volume data.

Data Requirements

The only summary traffic statistic which is required by this Branch is traffic volume data. Traffic volume data is needed in the form of daily and monthly traffic volumes. This data is used as an indicator of tourist activity into the province.

The Branch only requires traffic volumes for PTH #1 at the provincial boundaries (Stations 25 and 74) as an indicator of the amount of tourist activity entering the province. Directional distributions at these locations is essential.

Accuracy of Data

The Branch feels that if they are provided with more accurate traffic volumes they will be able to determine tourist activities to a better accuracy. It is preferred that traffic volumes are reported as accurately as possible.

Changes and Improvements to the Current System

Currently, UMTIG produces a report for Travel Manitoba on a monthly basis for traffic volumes at Stations 25 and 74 on the eastern and western provincial

boundaries. This report includes hourly traffic volumes for each month and a graph showing the cumulative traffic volume since the beginning of the year for each site.

This current reporting procedure is useful, however several changes can be made to which will assist the Branch in the analysis of the data. These include:

- A summary of traffic volume for each month
- A cumulative summary of traffic volumes from January 1st until the current reporting period (for example, the total traffic volume from January 1st until August 31st for 1996). Currently, the graph of cumulative volumes is not particularly helpful as it does not provide the analyst with precise volume figures.
- For each reporting period, show previous years' traffic volume for that same period. This is useful for identifying whether traffic has grown/declined compared to previous years.
- Conduct a license plate survey to determine the origins and destinations of traffic.

4.3.3 Transportation Consulting Groups

UMA Engineering [Ref. 6]

Functions

Transportation consultants provide engineering consulting services to different clients. Most of the work related to transportation projects involve consulting services for the Manitoba Department of Highways and Transportation. The types of projects undertaken by these consultants are diverse and include projects such as feasibility studies, functional design studies, and the design of pavements which all require traffic information.

Data Requirements

The type of traffic data required by the consulting firm depends on the project which is currently being investigated. Examples of the most important and frequently used traffic statistics required are:

- AADT at specific locations.
- Peak hour traffic volumes - this is needed particularly for the town areas such as Brandon and Portage La Prairie for specific projects such as traffic signal design.
- Intersection turning movement data - also required for traffic signal designs.
- Percent trucks - this is needed for pavement design work. *UMA Engineering* does not require detailed breakdowns of truck types into axle configurations, rather a percent trucks figure is sufficient for the design of pavements.

Low Volume Roads

More accurate traffic data is required for roads with higher traffic volumes, however, for lower volume roads, the allowable range of accuracy is larger. In all cases, the engineers also base their decisions on historical traffic volumes at the location under investigation in order to verify a growth or decline in traffic in the area.

Improvements to the Current System

Transportation consultants are often unaware of the types of traffic information which can be obtained through a traffic information system. It was indicated that more "advertising" of the system will allow them to know what types of information exists and are available to users.

Reid Crowther & Partners Ltd. [Ref. 10]

Functions

Transportation engineers at *Reid Crowther & Partners* conduct a variety of transportation consulting work, from conceptual design work to detailed design and construction of roads and highways in the province. Projects such as functional designs of roads, intersections designs, and traffic signal studies are conducted.

Data Requirements

- AADT estimates - this is viewed as being the single most important source of traffic volume information.
- Percent Trucks.
- Truck Classifications - more detailed information on truck classifications are required. In particular, large truck configurations from the 6-wheel trucks to B-trains and other unique configurations which may be present in Manitoba are considered highly useful.
- Intersection turning movement counts.
- Growth rates and past trends in traffic data are considered important in all of their proposals, design work, and construction. For projecting traffic volumes, the company also uses land use projections to determine growths in land use in the area under investigation.

Low Volume Roads

Reid Crowther & Partners performs studies of pavement improvements on low volume roads, such as determining whether a gravel road should be upgraded to an asphalt surfaced road. Roads which are considered for improvements must have an

AADT of greater than 1,000 vehicles per day. This criteria has been set up by the Manitoba Department of Highways and Transportation. Roads with less than 500 vehicles per day are considered to be less important because the traffic growth on these roads are viewed as being minimal.

Changes and Improvements to the Current System

More permanent counting stations should be installed in the province. Information at these sites can be used to develop expansion factors for short-term counts.

Dillon Consulting Engineers Planners - Environmental Scientists [Ref. 17]

Functions

Dillon conducts a variety of transportation related projects such as functional design studies, construction of provincial highways, traffic signalization studies, and level of service analysis for roadway projects in Manitoba.

Data Requirements

- AADT - considered to be essential
- Percent Trucks - this is used for pavement designs and level of service calculations. Detailed breakdowns of trucks into specific classes is not required, rather it is adequate if the traffic stream is broken down into cars and trucks.
- Intersection turning movement counts - *Dillon* is currently involved in a functional design study for PTH 6 from the Perimeter Highway to Warren, Manitoba. This is an example of a study which requires turning movement count data.
- Hourly traffic variations - these are used to determine the design hourly volumes.
- Seasonal traffic variations - this statistic is useful, but not required to perform the majority of projects.

Improvements to the Current System

The only comment that was provided was that the current traffic information system is viewed as providing more accurate traffic data compared to the old system.

DS-Lea Consultants Ltd. [Ref. 23, 24, 25]

Functions

DS-Lea conducts a variety of transportation-related projects in Manitoba. Currently, *DS-Lea* is conducting a project which involves warrants for traffic control devices for the Manitoba Department of Highways and Transportation.

Data Requirements

The following types of traffic data are required by this company:

- Intersection turning movement counts - essential, province-wide.
- Percent Trucks - essential, province-wide.
- Vehicle classification counts - essential, province-wide.
- Truck weight data - special-needs, individual sites as required.

Accuracy

Due to the high variability in traffic counts on a daily basis, an accuracy level of ±20 to 25% of traffic volume estimates is acceptable.

Changes and Improvements to the Current System

- Develop a method to expand intersection turning movement counts into an AADT. Confirm the factors currently used to expand a 14-hour count into a 24-hour count.
- Produce a map which shows locations which have been counted under the turning movement count program. This will allow more efficient reference to locations which have already been counted thus avoiding unnecessary duplication of count locations.

4.3.4 Other Traffic Data Users

The City of Winnipeg Streets and Transportation Department [Ref. 11]

Provincial highway traffic data is not used by this department. The Department obtains all of their traffic data from traffic counts done in The City of Winnipeg.

The types of traffic data needed by this Department include peak hour traffic volumes and average daily traffic. This information is used for transportation modeling projects.

Police [Ref. 26]

In Manitoba the RCMP requires AADT information for allocating resources. AADT estimates and accident rates are used to review existing programs and to allocate resources to roads or regions in the province. This statistic is needed on a special-needs basis for site-specific locations.

Businesses [Ref. 26, 28]

Businesses use AADT estimates for conducting feasibility studies, determining suitable locations for setting up a business, service stations, or advertising signs. Potential businesses also often require truck classification data. This information is useful for determining whether the location is suitable for setting up restaurants, recreational vehicle sales businesses, and gas stations.

4.4 Summary of Expressed Data Needs

This section summarizes the results of the traffic data needs survey. Tables 4-1 through 4-6 on pages 59-67 summarize the information in tabular form.

1. Data Requirements

- The most important data type requested by traffic data users is Annual Average Daily Traffic (AADT). 81 percent of traffic data users surveyed use AADT data in their functions. Out of these, 44 percent indicated that AADT is essential in their functions.

- The second most important statistic is percent trucks. 62 percent of users surveyed use percent trucks data in their functions. Out of these, 80 percent indicated that percent trucks data is essential.

- The third most important traffic statistic is vehicle classification data. 44 percent of users surveyed indicated that vehicle classification data is used in their branches. Out of these, 43 percent indicated that vehicle classification data is essential in their functions and would like to see more classification data collected and reported. For most users, classifications of vehicles according to the FHWA 13 vehicle classification scheme is found to be most useful, with the exception of the Transportation System Planning and Development Branch which would like more detailed breakdowns of vehicles.

- Intersection turning movement counts are useful to one-quarter of all users surveyed. These counts are mostly required for specific locations in the province and on a special-request basis.

- Variations in AADT such as seasonal, day-of-week, and hourly variations are found to be important to most Branches and external users.

2. Low Volume Roads

Out of all users surveyed, about one-quarter require traffic statistics on low volume roads. In general, the lowest volume roads which are of concern to these traffic data users are roads with AADTs of greater than 300 vehicles per day.

Most Branches indicated that AADT on low volume roads need not be monitored on a frequent basis. It is sufficient for their functions if AADT estimates on these roads are provided once every five years.

Most users indicated that they could tolerate greater variability when dealing with low volume roads, and less variability when dealing with high volume roads. This suggests that lower volume roads should be counted less frequently. Currently short-term counts are conducted where the AADT is greater than 200 vehicles per day once every two years. Sites where the AADT is less than 200 vehicles per day are counted less frequently, typically once every four years. Less frequent counting on low volume roads will reduce traffic monitoring costs in terms of counting, processing, and summarizing of traffic statistics on these roads.

3. Accuracy

Users strongly emphasized the importance of accurate traffic data. All indicated that accurate traffic data is required for good decision-making. In general it is difficult for most of the Branches to quantify the level of accuracy required of traffic data. A few Branches indicated that an error of ±10 percent of the traffic estimate is adequate, however, little work has been done to determine the sensitivity of decisions to data inputs.

4. Changes and Improvements to the Current System

The main suggestions for change and improvement which users would like to see in the current system are:

- Production and distribution of a provincial traffic flow map. Approximately 40 percent of all traffic data users indicated that they would like to see a large-scale traffic flow map included as part of the annual report, *Traffic on Manitoba Highways* on an annual basis.

- Collection and reporting of more vehicle classification information (38 percent).

- Truck weight data is important for the Materials and Research Branch, Compliance and Regulatory Services Branch, and Bridges and Structures Branch. These users feel that there is a lack of truck weight data in the province. Increased coverage of truck weight collection locations will be very useful. Several traffic data users also expressed an interest in receiving *Truck Traffic on Manitoba Highways* on an annual basis.

- Intersection turning movement counts should be reported in further detail. Users which require this data would like to obtain peak hour volumes and factors in addition to the current reporting method. Further, the factor used to expand a 14-hour count into a 24-hour estimate (1.3) should be confirmed to ensure that they are representative of the location which they are being applied to.

- Overall, traffic data users indicated that they were satisfied with the traffic data that is currently being produced by UMTIG. Some of these users also indicated that current traffic statistics produced by UMTIG are more accurate compared to the previous system.

4.5 Additional Facts and Figures

The University of Manitoba Transport Information Group receives many requests for traffic data from traffic data users in Manitoba and in other jurisdictions. The following shows some figures on the usage of this system:

- From the period January 1995 until December 1996, UMTIG received 205 requests for traffic information from staff members of the Manitoba Department of Highways and Transportation.

- In this same period, UMTIG received 227 traffic data requests from external users including engineering consulting groups, Travel Manitoba, Manitoba Bureau of Statistics, businesses, and the general public.

- The MHTIS Internet site has been accessed 3,597 times from December 20, 1995 until December 16, 1996.

Table 4-1 Engineering and Technical Services Division

Type of Traffic Data	Highway Planning and Design Branch	Programming Branch
AADT		
Importance:	Essential	Essential
Frequency:	Annual	Annual
Detail:	Highway sections, individual sites	Highway sections, province-wide
Seasonal traffic variations		
Importance:	Essential	Not used
Frequency:	Annual	
Detail:	Highway sections, individual sites	
Day-of-week traffic variations		
Importance:	Essential	Not used
Frequency:	Annual	
Detail:	Highway sections, individual sites	
Hourly traffic variations		
Importance:	Essential	Essential
Frequency:	Annual	Annual
Detail:	Highway sections, individual sites	Highway sections, province-wide
Directional Distribution of Traffic		
Importance:	Not used	Not used
Frequency:		
Detail:		
Intersection Turning Movements		
Importance:	Essential	Not used
Frequency:	Annual	
Detail:	Special-needs	
Vehicle-Kilometers of Travel Data		
Importance:	Not used	Essential
Frequency:		Annual
Detail:		Highway sections, province-wide
Percent Trucks		
Importance:	Essential	Essential
Frequency:	Annual	Annual
Detail:	Highway sections, individual sites	Highway sections, province-wide
Vehicle Classifications		
Importance:	Interesting	Not used
Frequency:	Special-needs	
Detail:	Individual sites	
No. of classes:	FHWA scheme	
Vehicle Weights		
Importance:	Not used	Not used
Frequency:		
Detail:		
Other	-	-

Table 4-1 Engineering and Technical Services Division (continued)

Type of Traffic Data	Traffic Engineering Branch	Materials and Research Branch
AADT		
Importance:	Essential	Essential
Frequency:	Annual	Annual
Detail:	Highway sections, province-wide	Highway sections
Seasonal traffic variations		
Importance:	Essential	Essential
Frequency:	Semi-annual	Annual
Detail:	Highway sections, province-wide	Highway sections, province-wide
Day-of-week traffic variations		
Importance:	Essential	Not used
Frequency:	Semi-annual	
Detail:	Highway sections, province-wide	
Hourly traffic variations		
Importance:	Essential	Not used
Frequency:	Semi-annual	
Detail:	Highway sections, province-wide	
Directional Distribution of Traffic		
Importance:	Useful	Essential
Frequency:	Semi-annual	Annual
Detail:	Highway sections	Highway sections, individual sites
Intersection Turning Movements		
Importance:	Essential	Not used
Frequency:	Special-needs	
Detail:	Individual sites	
Vehicle-Kilometers of Travel Data		
Importance:	Essential	Not used
Frequency:	Annual	
Detail:	Highway sections, province-wide	
Percent Trucks		
Importance:	Important	Essential
Frequency:	Annual	Annual
Detail:	Highway sections, individual sites	Highway sections
Vehicle Classifications		
Importance:	Not used	Essential
Frequency:		Annual
Detail:		Highway sections, province-wide
No. of classes:		As detailed as possible
Vehicle Weights		
Importance:	Useful	Essential
Frequency:		Annual
Detail:		Individual sites, province-wide
Other	-	Growth rates of Percent Trucks

Table 4-2 Construction and Maintenance Division

Type of Traffic Data	Maintenance Management Branch	Construction Management Branch
AADT Importance: Frequency: Detail:	 Essential Annual Highway sections, province-wide	Not used
Seasonal traffic variations Importance: Frequency: Detail:	Not used	Not used
Day-of-week traffic variations Importance: Frequency: Detail:	Not used	Not used
Hourly traffic variations Importance: Frequency: Detail:	 Essential Annual Highway sections	Not used
Directional Distribution of Traffic Importance: Frequency: Detail:	Not used	Not used
Intersection Turning Movements Importance: Frequency: Detail:	Not used	Not used
Vehicle-Kilometers of Travel Data Importance: Frequency: Detail:	 Useful Annual Highway sections	Not used
Percent Trucks Importance: Frequency: Detail:	 Essential Annual Highway sections, province-wide	Not used
Vehicle Classifications Importance: Frequency: Detail: No. of classes:	Not used	Not used
Vehicle Weights Importance: Frequency: Detail:	Not used	Not used
Other	-	-

Table 4-2 Construction and Maintenance Division (continued)

Type of Traffic Data	Bridges and Structures Branch	Contracts Branch
AADT		
Importance:	Useful	Essential
Frequency:	Special-needs	Annual
Detail:	Individual sites	Highway sections, special-needs
Seasonal traffic variations		
Importance:	Not used	Useful
Frequency:		Annual
Detail:		Highway sections, special-needs
Day-of-week traffic variations		
Importance:	Not used	Useful
Frequency:		Annual
Detail:		Highway sections, special-needs
Hourly traffic variations		
Importance:	Not used	Useful
Frequency:		Annual
Detail:		Highway sections, special-needs
Directional Distribution of Traffic		
Importance:	Not used	Not used
Frequency:		
Detail:		
Intersection Turning Movements		
Importance:	Not used	Not used
Frequency:		
Detail:		
Vehicle-Kilometers of Travel Data		
Importance:	Not used	Not used
Frequency:		
Detail:		
Percent Trucks		
Importance:	Important	Essential
Frequency:	Special-needs	Annual
Detail:	Individual sites	Highway sections, special-needs
Vehicle Classifications		
Importance:	Useful	Useful
Frequency:	Special-needs	Annual
Detail:	Individual sites	Individual sites
No. of classes:		-
Vehicle Weights		
Importance:	Important	Not used
Frequency:	Special-needs	
Detail:	Individual sites	
Other		
	-	-

Table 4-3 Transportation Policy Planning and Development Division

Type of Traffic Data	Transportation Systems Planning and Development Branch
AADT	
Importance:	Essential
Frequency:	Annual
Detail:	Province-wide, highway sections
Seasonal traffic variations	
Importance:	Essential
Frequency:	Annual
Detail:	Highway sections
Day-of-week traffic variations	
Importance:	Not used
Frequency:	
Detail:	
Hourly traffic variations	
Importance:	Useful
Frequency:	Annual
Detail:	Highway sections
Directional Distribution of Traffic	
Importance:	Not used
Frequency:	
Detail:	
Intersection Turning Movements	
Importance:	Essential
Frequency:	Special-needs, required for locations where AADT >7000 veh/day
Detail:	Individual sites
Vehicle-Kilometers of Travel Data	
Importance:	Essential
Frequency:	Annual
Detail:	Province-wide
Percent Trucks	
Importance:	Essential
Frequency:	Annual
Detail:	Province-wide
Vehicle Classifications	
Importance:	Essential
Frequency:	Annual
Detail:	Province-wide
No. of classes:	As detailed as possible
Vehicle Weights	
Importance:	Not used
Frequency:	
Detail:	
Other	Growth rates on Percent Trucks Design hourly volumes - 30, 50, 100 highest hours More town counts coverage

Table 4-4 Transportation Safety and Regulatory Services Division

Type of Traffic Data	Transport Compliance Branch
AADT	
Importance:	Important
Frequency:	Annual
Detail:	Individual sites, province-wide
Seasonal traffic variations	
Importance:	Useful
Frequency:	Annual
Detail:	Individual sites
Day-of-week traffic variations	
Importance:	Not used
Frequency:	
Detail:	
Hourly traffic variations	
Importance:	Not used
Frequency:	
Detail:	
Directional Distribution of Traffic	
Importance:	Useful
Frequency:	Annual
Detail:	Individual sites
Intersection Turning Movements	
Importance:	Not used
Frequency:	
Detail:	
Vehicle-Kilometers of Travel Data	
Importance:	Not used
Frequency:	
Detail:	
Percent Trucks	
Importance:	Essential
Frequency:	Annual
Detail:	Province-wide
Vehicle Classifications	
Importance:	Essential
Frequency:	Annual
Detail:	Individual sites
No. of classes:	FHWA 13 Class
Vehicle Weights	
Importance:	Essential
Frequency:	Annual, special-needs
Detail:	Individual sites
Other	
	-

Table 4-5 Regional Offices

Type of Traffic Data	Planning, Design and Materials and Research Branches
AADT	
Importance:	Essential
Frequency:	Annual
Detail:	Highway sections
Seasonal traffic variations	
Importance:	Essential
Frequency:	Annual
Detail:	Highway sections
Day-of-week traffic variations	
Importance:	Essential
Frequency:	Annual
Detail:	Highway sections
Hourly traffic variations	
Importance:	Essential
Frequency:	Annual
Detail:	Highway sections
Directional Distribution of Traffic	
Importance:	Not used
Frequency:	
Detail:	
Intersection Turning Movements	
Importance:	Essential
Frequency:	Special-needs
Detail:	Individual sites
Vehicle-Kilometers of Travel Data	
Importance:	Not used
Frequency:	
Detail:	
Percent Trucks	
Importance:	Essential
Frequency:	Annual
Detail:	Highway sections
Vehicle Classifications	
Importance:	Important
Frequency:	Annual
Detail:	Individual sites
No. of classes:	-
Vehicle Weights	
Importance:	Important
Frequency:	Annual
Detail:	Highway sections
Other	-

Table 4-6 External Traffic Data Users

Type of Traffic Data	Travel Manitoba	Engineering Consulting Firms	The City of Winnipeg Streets and Transportation Department
AADT Importance: Frequency: Detail:	Useful Annual Individual sites - Stations 25 and 74 only	Essential Special-needs Individual sites	Not used
Seasonal traffic variations Importance: Frequency: Detail:	Essential Annual Individual sites	Useful Special-needs Individual sites	Not used
Day-of-week traffic variations Importance: Frequency: Detail:	Essential Special-needs Individual sites	Not used	Not used
Hourly traffic variations Importance: Frequency: Detail:	Not used	Essential Special-needs Individual sites	Not used
Directional Distribution of Traffic Importance: Frequency: Detail:	Essential Special-needs Individual sites	Not used	Not used
Intersection Turning Movements Importance: Frequency: Detail:	Not used	Essential Special-needs Individual sites	Not used
Vehicle-Kilometers of Travel Data Importance: Frequency: Detail:	Not used	Not used	Not used
Percent Trucks Importance: Frequency: Detail:	Not used	Essential Special-needs Highway sections	Not used
Vehicle Classifications Importance: Frequency: Detail: No. of classes:	Not used	Not used	Not used
Vehicle Weights Importance: Frequency: Detail:	Not used	Not used	Not used
Other	-	-	-

Table 4-6 External Traffic Data Users (continued)

Type of Traffic Data	Police	Businesses
AADT		
Importance:	Important	Useful
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
Seasonal traffic variations		
Importance:	Important	Useful
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
Day-of-week traffic variations		
Importance:	Useful	Useful
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
Hourly traffic variations		
Importance:	Useful	Useful
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
Directional Distribution of Traffic		
Importance:	Useful	Important
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
Intersection Turning Movements		
Importance:	Not used	Useful
Frequency:		Special-needs
Detail:		Individual sites
Vehicle-Kilometers of Travel Data		
Importance:	Not used	Not used
Frequency:		
Detail:		
Percent Trucks		
Importance:	Important	Useful
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
Vehicle Classifications		
Importance:	Important	Useful
Frequency:	Special-needs	Special-needs
Detail:	Highway sections	Individual sites
No. of classes:	-	
Vehicle Weights		
Importance:	Not used	Not used
Frequency:		
Detail:		
Other		
	-	-

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2. Mr. Brett Wareham. Methods Engineer. Construction and Maintenance Division, Manitoba Department of Highways and Transportation. Phone No: 945-3896. Personal interview on November 13, 1996.

3. Mr. Eric Christiansen, P.Eng. Senior Functional Design Engineer. Design Branch, Manitoba Department of Highways and Transportation. Phone No: 945-0236. Personal interview on November 13, 1996.

4. Ms. Statia Elliot. Research and Policy Analyst. Travel Manitoba, Manitoba Department of Industry, Trade and Tourism. Phone No: 945-2402. Personal interview on November 14, 1996.

5. Mr. David Duncan, P.Eng. Senior Transportation Planning Consultant. Transportation System Planning and Development Branch, Manitoba Department of Highways and Transportation. Phone No: 945-3646. Personal Interview on November 21, 96.

6. Mr. Derek Durant, P.Eng. Transportation Project Engineer. Transportation Division, UMA Engineering Ltd. Phone No: 284-0580. Personal interview on: November 26, 1996.

7. Mr. Ray Van Cauwenberghe, P.Eng. Director. Materials and Research Branch, Manitoba Department of Highways and Transportation. Phone No: 945-1934. Personal interview on: November 27, 1996.

8. Mr. Said Kass, P.Eng. Senior Pavements and Geotechnical Engineer. Materials and Research Branch, Manitoba Department of Highways and Transportation. Phone No: 945-8982. Personal interview on: November 27, 1996.

9. Mr. Stan Hildebrand, P.Eng. Pavement Design Engineer. Materials and Research Branch, Manitoba Department of Highways and Transportation. Phone No: 945-2410. Personal interview on: November 27, 1996.

10. Mr. Todd Smith, P.Eng. Reid Crowther & Partners Ltd. 850 Pembina Highway, Winnipeg, MB R3M 2M7. Telephone interview on December 10, 1996.

11. Mr. Doug Hurl, P.Eng. Transportation Systems Planner. Transportation Systems Planning Branch, The City of Winnipeg Streets and Transportation Department,

100 Main Street, Winnipeg, MB R3C 1A4. Phone No: 986-5207. Telephone interview on: December 10, 1996.

12. Mr. Trevor Curtis, P.Eng. Senior Programming Engineer. Programming Branch. Manitoba Department of Highways and Transportation. Phone No: 945-3679. Personal interview on: December 11, 1996.

13. Mr. Don Bodnaruk, C.E.T. Programming Technologist. Programming Branch. Manitoba Department of Highways and Transportation. Phone No: 945-7111. Personal interview on December 11, 1996.

14. Mr. Chuck Lund. Technical Services Engineer. Dauphin Regional Office, Manitoba Department of Highways and Transportation. Phone No: 622-2261.

15. Mr. Brian Little. Regional Design Engineer. Southwestern Region (Brandon, MB). Manitoba Department of Highways and Transportation. Phone No: 726-6819.

16. Mr. Walter Saltzberg, P.Eng. Director. Bridges and Structures Branch. Manitoba Department of Highways and Transportation. Phone No: 945-5058. Personal interview on: December 13, 1996.

17. Mr. Bill Kavanaugh. Transportation Engineer. Dillon Consulting Engineers Planners - Environmental Scientists, 6 Donald Street, Winnipeg, MB. Phone No: 453-2301. Telephone interview on December 10, 1996.

18. Mr. Gerald Tencha, P.Eng. Contracts Engineer. Contracts Branch, Manitoba Department of Highways and Transportation. Phone No: 945-3776. Telephone interview on December 10, 1996.

19. Mr. Rolie Savoie, P.Eng. Transportation Policy and Service Development Branch, Manitoba Department of Highways and Transportation. Phone No: 945-8617.

20. Mr. Greg Catteeuw. Director. Compliance and Regulatory Services Branch, Manitoba Department of Highways and Transportation. Phone No: 945-3898. Personal interview on December 12, 1996.

21. Mr. Dwight Solon. Manager. Compliance Services Branch, Manitoba Department of Highways and Transportation. Phone No: 945-1966. Personal interview on December 12, 1996.

22. Mr. Dave Salby. Director. Northern Airports and Marines Branch, Manitoba Department of Highways and Transportation. Phone No: 945-3421. Telephone interview on December 11, 1996.

23. Mr. Richard Tebinka, P.Eng. DS-Lea Consultants Ltd., Winnipeg, MB. Phone No: 943-3178. Personal interview on : December 13, 1996.

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CHAPTER 5
Traffic Pattern Groups

This chapter develops new traffic pattern groups (TPGs) for the study region (Manitoba and Saskatchewan) and evaluates how the new TPGs affect the AADT estimates for short-counts in Manitoba.

5.1 Introduction

TPGs are used to expand short-counts into AADT estimates. Approximately one-third of Manitoba's short-count sites are expanded using this method. The quality of the AADT estimate depends on the quality of the TPG to which the short-count site is assigned. A TPG which does not reflect the actual traffic pattern at the short-count site to which it is assigned will result in AADT estimates which are inaccurate.

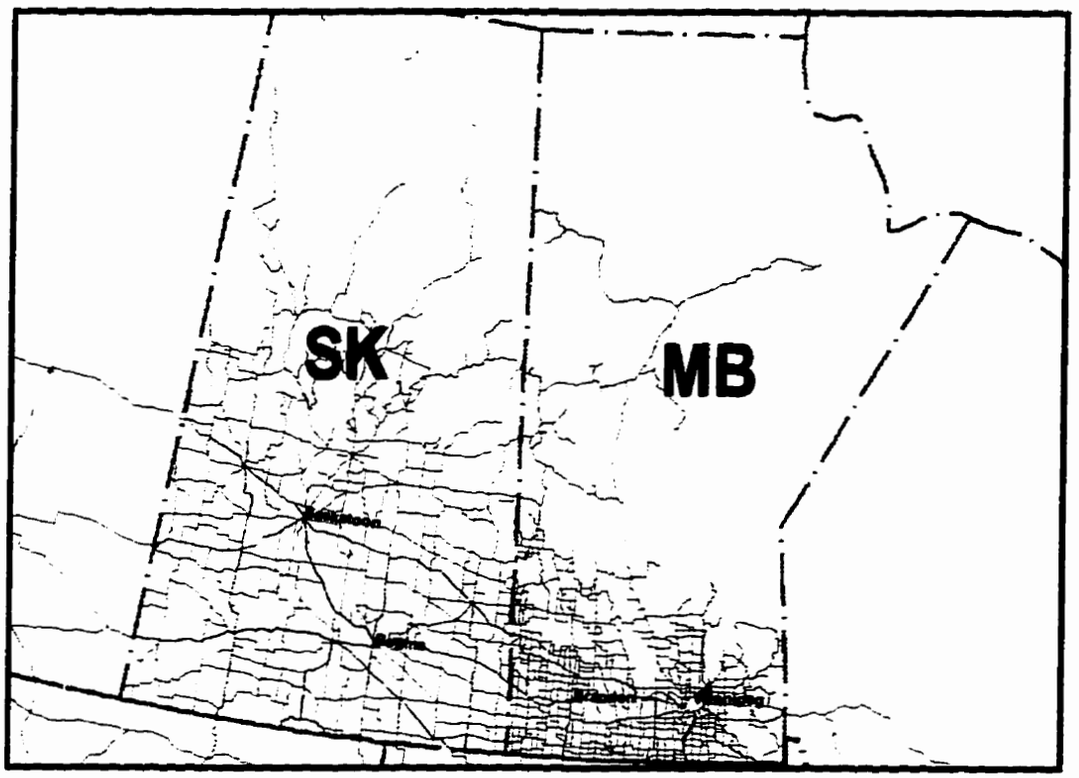
To date, Manitoba's TPGs have been developed by using permanent counter data from Manitoba. This chapter investigates whether TPGs can be strengthened based on traffic patterns for an expanded region, consisting of Manitoba and Saskatchewan.

This region was selected because Manitoba and Saskatchewan share many highways at the provincial border, and the traffic patterns on these and many other highways in the region could be similar. The traffic flow on these highways is controlled by the activity systems and transportation systems in this region, and not by the political boundary that separates the two provinces.

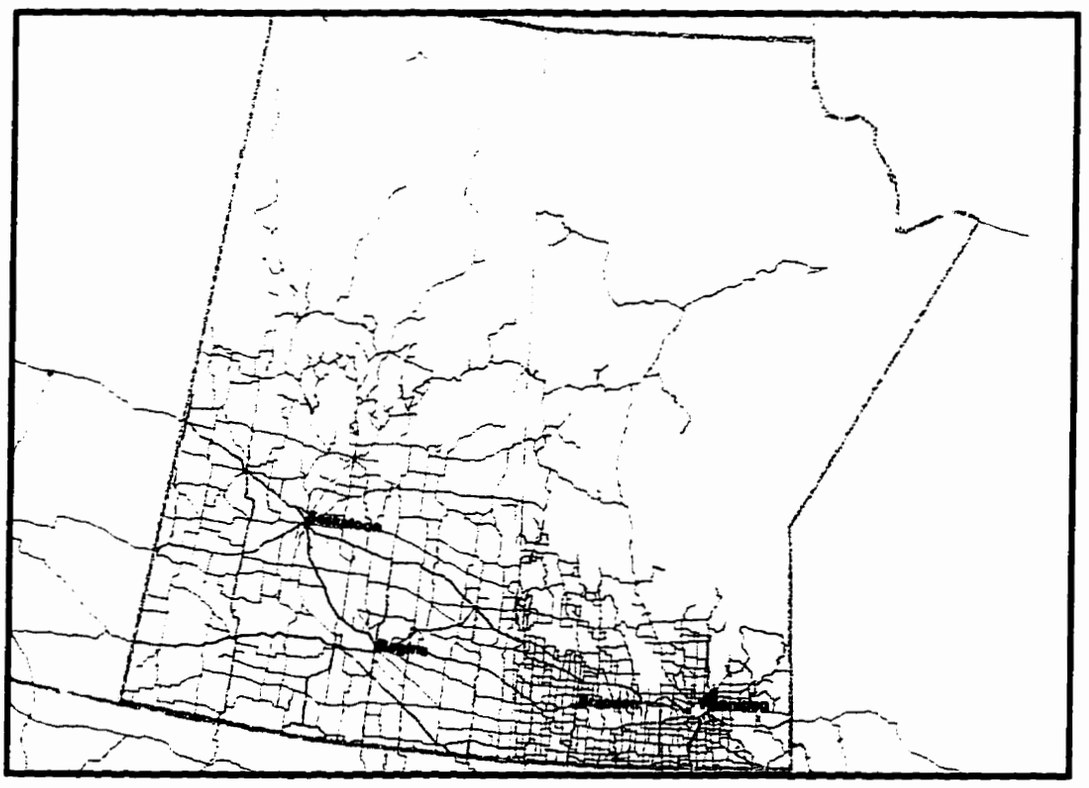
For example, the TransCanada highway adjacent to Regina, Saskatchewan could be similar to the TransCanada highway adjacent to Winnipeg, Manitoba. This research develops TPGs in the region based on the premise that the traffic patterns in the

Figure 5-1

The Study Region



(a)



Source: University of Manitoba Transport Information Group

(b)

1997-03-29

region are independent of the provincial boundaries. Figure 5-1 (b) shows the provincial highway network in the study region, distinct from the current highway networks which are separated by a political boundary (Figure 5-1 (a)).

5.2 Traffic Monitoring in the Study Region

Traffic on Manitoba's provincial highways is monitored by the Manitoba Department of Highways and Transportation, and traffic on Saskatchewan's provincial highways is monitored by the Saskatchewan Department of Highways and Transportation.

There are many similarities in traffic monitoring practices in the two jurisdictions. However, traffic data is not exchanged between the two provinces to either (1) enhance existing AADT data, or (2) reduce traffic monitoring costs.

5.3 Comparison of Traffic Monitoring Practices in the Study Region

Traffic on the 18,000 kilometers of Manitoba's provincial highways is monitored using permanent counters and short-term counts. There are currently 57 permanent counters located throughout Manitoba, and 2,013 sites are counted under the short-term count program. Out of the 57 permanent counters, 15 are AVC/WIM stations which are used to monitor vehicle classifications and weights in the province.

Traffic on Saskatchewan's 26,000 kilometers of provincial highways is monitored by using automatic traffic recorders (ATRs) and short-term counts. The ATRs are the same as Manitoba's permanent counters which are used for continuous traffic monitoring; there are currently 40 ATR locations throughout Saskatchewan. For purposes of this research, permanent counting stations in Manitoba and ATRs in Saskatchewan are referred to as permanent counters in both provinces. Short-term counts are conducted using a sampling procedure; in 1994, Saskatchewan Highways conducted 800 short-term counts throughout the province [Ref. 3]. In addition to

ATRs and short-term counts, Saskatchewan Highways also operates 10 AVC sites to monitor truck traffic on provincial highways. Figure 5-2 shows the locations of permanent counters in the region.

5.4 Existing Traffic Patterns

The existing highway traffic patterns in the region are shown in Figure 5-3. In this map, each symbol and colour-coded station represents an existing TPG in Manitoba and Saskatchewan.

Manitoba's provincial highway network is classified into six TPGs [Ref. 11]:

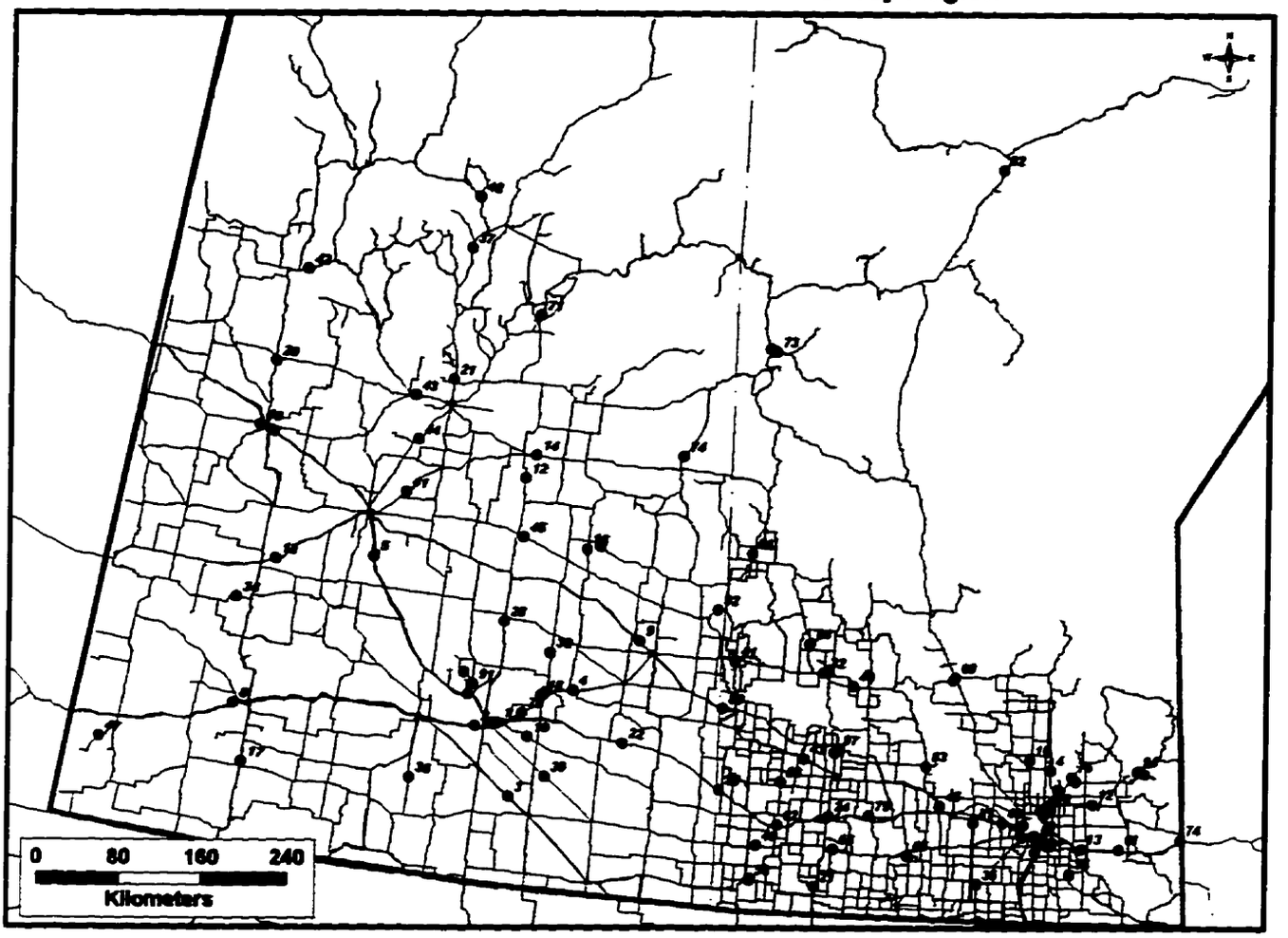
- Urban Commuter (UC) - high morning and afternoon peaks with little seasonal variation.
- Rural Commuter (RC) - daily peaking different from Urban Commuter Group, little seasonal variation.
- Trunk (T) - steady traffic through the day and through the year.
- Trunk-Seasonal (TS) - steady traffic through the day but significantly more traffic in summer than in winter.
- Rural Commuter Seasonal (RCS) - daily peaking similar to Rural Commuter Group, significantly higher in summer than in winter.
- Resort (RES) - extreme seasonal variation.

Saskatchewan's provincial highway network is also classified into six TPGs [Ref. 3]:

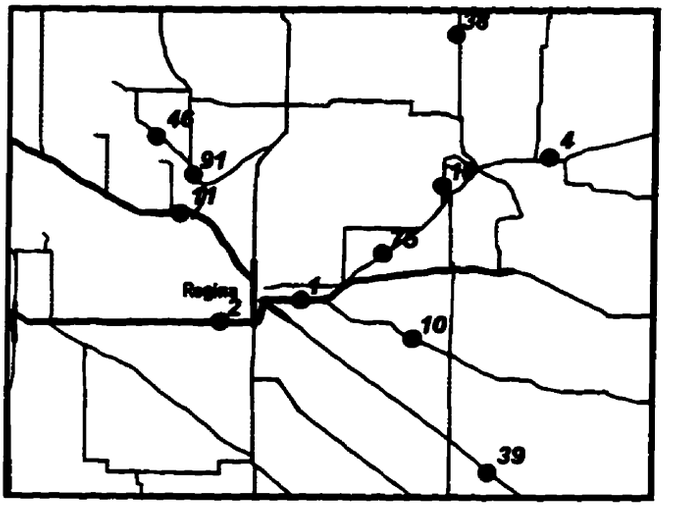
- Regional Commuter Rural Highways (ADT over 2000) (REG) - roads which carry mainly commuter traffic.
- Long Distance Rural Highways (ADT over 2000) (LDR) - roads that are generally used for long-distance commuter traffic.
- Rural Highways (ADT>600) (R>600) - roads that bring commuter traffic to and from smaller towns.
- Rural Highways (ADT<600) (R<600) - these roads exhibit the same characteristics as the previous Rural Highways group, except the majority of the roads in this group are collector roads which carry lower volumes of traffic.
- Rural Recreational Highways (RR) - these roads mainly serve a rural area, and also carry significant recreational traffic during the summer months.
- Resort Highways (RES) - these roads are mainly used for recreational purposes.

Figure 5-2

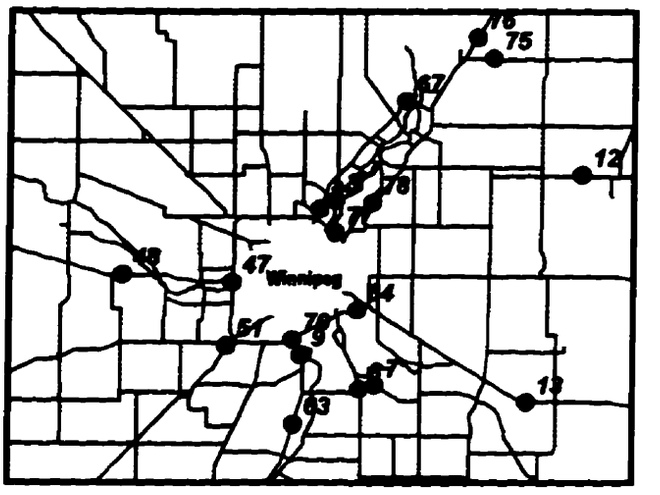
Permanent Counter Locations in the Study Region



Enlargement of Regina



Enlargement of Winnipeg

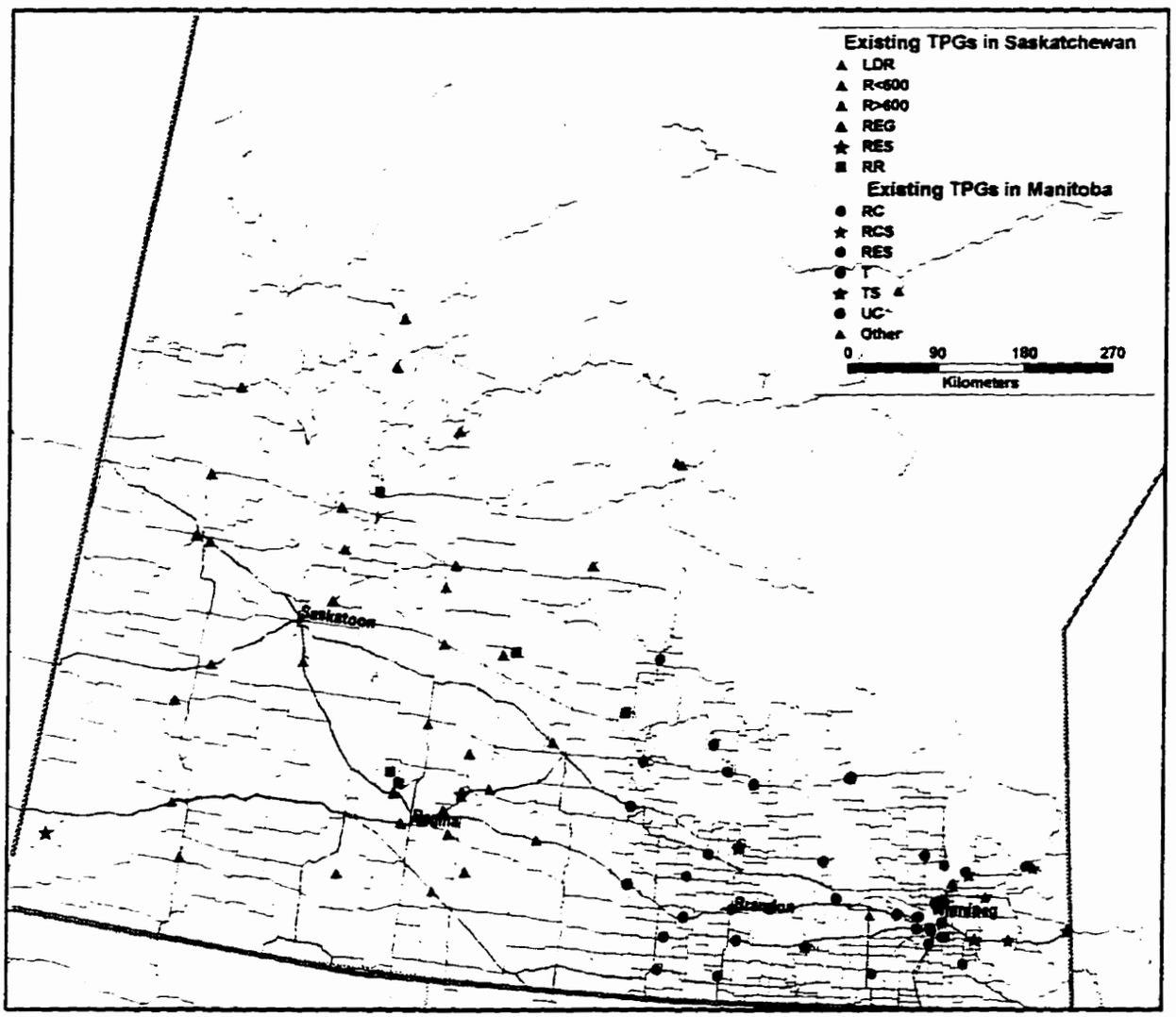


Source: University of Manitoba Transport Information Group

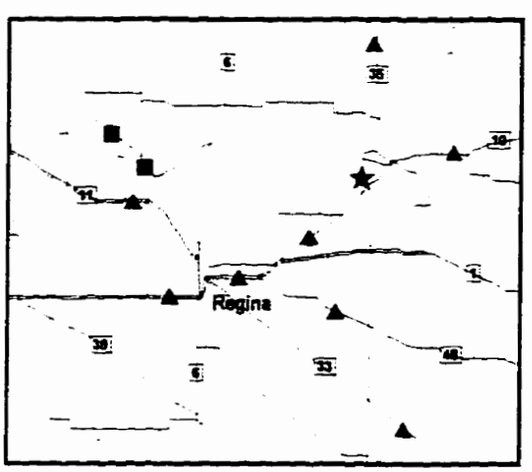
1997-03-29

Figure 5-3

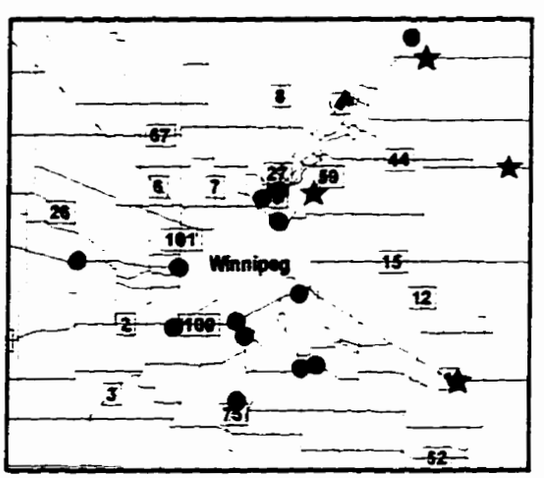
Existing Traffic Patterns in the Study Region



Enlargement of Regina



Enlargement of Winnipeg



Source: University of Manitoba Transport Information Group

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5.5 Comparison of Existing Traffic Patterns in the Study Region

- The Urban Commuter Group in Manitoba is similar to the Regional Commuter Group in Saskatchewan. Both groups have low seasonal variation and carry heavy commuter traffic to and from major urban centers such as Winnipeg and Regina.

- The Trunk Group in Manitoba and Long Distance Rural Highways Group in Saskatchewan consist of highways which mainly carry long-distance through-traffic. These roads are located away from population centers and recreational destinations, and serve mainly longer-trip purposes.

- The Rural Commuter Seasonal and Rural Recreational Highways Groups consist of highways which carry both commuter traffic to nearby towns and significant recreational traffic during the summer months.

- Resort Highways in both Manitoba and Saskatchewan carry mainly recreational traffic. Summer peaks are very high compared to the rest of the year.

5.6 Developing the New Traffic Pattern Groups

The traffic patterns on highways in the region are examined to develop TPGs. These patterns are based on the seasonal and hourly traffic variations at permanent counter sites from the year 1995. Permanent counter data from Manitoba was obtained from UMTIG through the MHTIS, and ATR data from Saskatchewan was obtained from Saskatchewan Department of Highways and Transportation. The data from each permanent counter was summarized into seasonal (monthly) and average hourly traffic volumes.

The procedure for developing TPGs is as follows:

1. Select the permanent counters for the analysis.
2. Develop groups based on the seasonal variations at each permanent counter site.
3. Further define the seasonal groups by sub-dividing each group based on the average weekday and weekend hourly traffic patterns at each permanent counter.

5.6.1 Cluster Analysis

Cluster analysis is used to form the TPGs. The purpose of cluster analysis is to identify similar objects from the characteristics they possess [Ref. 1]. This technique is used to identify and classify objects or variables so that each object is very similar to others in its cluster.

In the field of transportation engineering, cluster analysis has been used to group permanent counter data based on their seasonal traffic patterns. Albright [Ref. 4] used cluster analysis on permanent counters in New Mexico to group counters with similar seasonal traffic patterns. The resulting groups were then used for expanding short-term counts into AADT. Albright also notes that several other states including New York, New Jersey and Louisiana also applied cluster analysis to their permanent counter locations in order to identify seasonal traffic variation patterns on state highways.

The *Traffic Monitoring Guide* (TMG) [Ref. 2] describes and recommends the use of cluster analysis to identify highway patterns based on state permanent counter data. The TMG indicates that the application of these methods to a number of State programs in the U.S. has produced very reasonable results. In most cases, the patterns of variation that stand out the most are those of rural, urban, and recreational areas. However, the TMG also indicates that the major weakness of this procedure is the lack of theoretical guidelines for establishing the optimal number of groups.

In this analysis, permanent counters with similar seasonal traffic variation patterns are grouped using the CLUSTER procedure of the Statistical Analysis Software (SAS) [Ref. 5, 6]. This procedure uses Ward's minimum variance method of hierarchical grouping, which involves calculating the distance between two clusters using analysis of variance (ANOVA) [Ref. 8, 12]. The ANOVA sum-of-squares is summed over all the variables (in the case of the seasonal grouping analysis there are 12 variables, one

for each month of the year), and the two objects with the least within-cluster sum-of-squares is joined to form a new cluster. This process is repeated until only one cluster remains.

This grouping method was developed by Ward [Ref. 10] in 1963 and was first applied to traffic counter grouping by Sharma and Werner [Ref. 8] in 1981. In this method, counters are grouped based on their twelve monthly factors. The twelve monthly factors are defined as the monthly average daily traffic (MADT) divided by the AADT at the site, normalizing the traffic flows at each site. This allows the twelve monthly factors to be compared for different sites.

5.6.2 Permanent Counter Selection Criteria

This research uses permanent counter data from Manitoba and Saskatchewan for the year 1995. For purposes of this research, permanent counters were selected based on the following two criteria:

1. The data set at the permanent counter site must be complete.

Permanent counter data are vulnerable to equipment malfunctions and errors. As a result, there may be missing data in any permanent counter data set. For this analysis, permanent counters are selected if they contain data for at least two consecutive weeks for each month in the data year. This allows continuous data from at least half of each month to be analyzed.

2. Missing data must not be imputed

This criteria follows from the principle of truth-in-data [Ref. 9]. Permanent counter raw data is screened to remove errors and anomalies (refer to Chapter 2 for an explanation of traffic data screening methods), but none of the data has been imputed or patched in any way.

Based on these criteria, 49 permanent counters from Manitoba and 34 automatic traffic recorders from Saskatchewan -- a total of 83 sites were used in the analysis. These sites are listed in Table 5-1.

Table 5-1

List of Permanent Counters Analyzed

MANITOBA			SASKATCHEWAN		
PCS No.	Hwy. No.	Location	ATR No.	Hwy. No.	Location
1	8	1.4 KM S. OF P.R. #321	1	11	1.5 KM. W. OF JCT. #48
3	9	1.7 KM S. OF P.T.H. #27	2	1	8.0 KM. W. OF JCT. #6
4	9	SOUTH OF P.T.H. 17	3	39	3.0 KM. SE. OF YELLOW GRASS
7	210	EAST OF P.T.H. #59	4	10	6.5 KM. E. OF BALCARRES
8	59	N. OF N. JCT. P.R. #210	5	11	5.0 KM. S. OF ROAD TO DUNDURN
9	75	1.1 KM N. OF P.R. #247	8	1	0.5 KM. W. OF JCT. #32
12	44	3.7 KM E. OF P.R. #215	9	16	1.5 KM. NW. OF ORCADIA
13	1	5.8 KM E. OF P.T.H. #12	10	48	3.0 KM. SE. OF DAVIN
14	12	3.7 KM S. OF P.R. #303	11	11	5.0 KM. E. OF JCT. #54
16	7	3.7 KM N. OF P.T.H. #17	13	7	8.0 KM. E. OF JCT. #4
21	10	1.6 KM N. OF P.R. #448	15	49	8.0 KM. E. OF JCT. #38
24	10	1.3 KM N. OF P.T.H. #1	16	38	8.0 KM. S. OF JCT. #49
25	1	WEST OF P.T.H. #41	17	4	1.5 KM. N. OF JCT. #13
28	21	3.2 KM N. OF P.T.H. #24	18	210	8.1 KM. N. OF JCT. HWY. #10
32	5	4.0 KM E. OF E. JCT. P.R. #274	20	4	1.5 KM. S. OF GLASLYN
40	2	2.4 KM E. OF P.T.H. #83	21	2	1.5 KM. N. OF JCT. HWY. #355
41	5	3.2 KM N. OF P.R. #583	22	1	5 KM. E. OF GRENFELL
43	16	3.2 KM E. OF E. JCT. P.R. #354	28	6	1.5 KM. S. OF JCT. #15
46	16	2.4 KM N. OF P.T.H. #1	34	44	6.0 KM. W. OF WARTIME
47	100	0.8 KM S. OF P.T.H. #1	36	36	2.0 KM. N. OF GALILEE
48	1	4.0 KM E. OF P.R. #332	38	38	N OF LIPTON
49	5	1.6 KM E. OF P.T.H. #20	39	33	SE OF FRANCIS
51	3	0.3 KM S.W. OF P.T.H. #2	40	40	1.0 KM. W. OF JCT. #29
56	3	3.2 KM E. OF N. JCT. P.T.H. #83	41	41	NE OF ABERDEEN
58	34	0.8 KM S. OF P.R. #449	42	55	SW OF GREEN LAKE
59	325	WEST OF P.T.H. #6	43	3	W OF PRINCE ALBERT
60	6	S. OF S. JCT. P.R. #325	44	11	NE OF ROSTHERN
63	75	5.1 KM SOUTH OF P. R. #210	45	5	E OF WATSON
65	1	WEST OF MACGREGOR	46	322	1.6 KM. NW OF SILTON
66	2	EAST OF NESBITT	71	106	MILE 75 OF HANSON LAKE ROAD
67	4	WEST OF SELKIRK BR.	74	9	10.5 KM. N. OF HUDSON BAY
68	320	CONNECTING RTE - SELKIRK BR. TO PR 320	75	10	10.0 KM. NE. OF JCT. #1
70	100	W. END OF RED RIV. BRIDGE	91	20	NW OF CRAVEN
72	10	SOUTH OF P.R. #287	92	57	SW OF DUCK MOUNTAIN PARK
73	287	EAST OF P.T.H. #10			
74	1	WEST OF ONTARIO BDRY.			
75	317	EAST OF P.T.H. #59			
76	59	NORTH OF P.R. #317			
77	101	1.1 KM W. OF P.T.H. #59			
78	59	SOUTH OF BIRDS HILL PARK ENTRANCE			
79	1	4.3 KM W. OF P.T.H. #5			
80	16	0.8 KM. E. OF SASK. BDRY.			
81	13	2 MILES S. OF OAKVILLE			
83	50	1.3 KM S. OF PR 265			
84	10	3.8 KM S OF S JCT. #10A (ETHELBERT)			
93	313	EAST OF P.R. #315			
94	315	NORTH OF P.R. #313			
96	10	SOUTH OF P.R. #357			
97	357	EAST OF P.T.H. #10			
Total Number of MB Sites = 49			Total Number of SK sites = 34		
Total Number of Sites Analyzed = 83					

5.6.3 Analysis of Seasonal Traffic Patterns

At each of the 83 permanent counter sites, the 12 monthly factors were used as input values into the CLUSTER procedure in SAS. The SAS software produced numbers of groups ranging from 83 groups (each site was considered as a separate group) to one group (all sites were grouped together into a single group). The output of the analysis from the SAS program are given in Appendix E.

The resulting groups are analyzed in terms of the semi-partial R^2 at each level of the grouping process. The semi-partial R^2 is an indication of the change in the R^2 statistic at each level of the grouping process. Each time two stations are grouped together, the R^2 value becomes less than it was compared to the previous step due to the greater error associated with joining two sites which are not the same [Ref. 5]. This can also be viewed as the marginal cost of reducing the number of groups by one. The semi-partial R^2 measures the decrease in the proportion of variance accounted for resulting from joining two clusters [Ref. 6].

Figure 5-4 shows a graph of the semi-partial R^2 in the grouping process, from 83 groups to one group. From this figure, it can be seen that the semi-partial R^2 is greatest when the number of groups equals one, and least when the number of groups is 83. The optimum number of groups is selected at the point when the gains in the semi-partial R^2 values become negligible (the "knee of the curve"). From this graph, it appears that the optimum number of counter groups lies somewhere between five and nine because a substantially large increase in error is observed before five groups, and there is little change in semi-partial R^2 after nine groups.

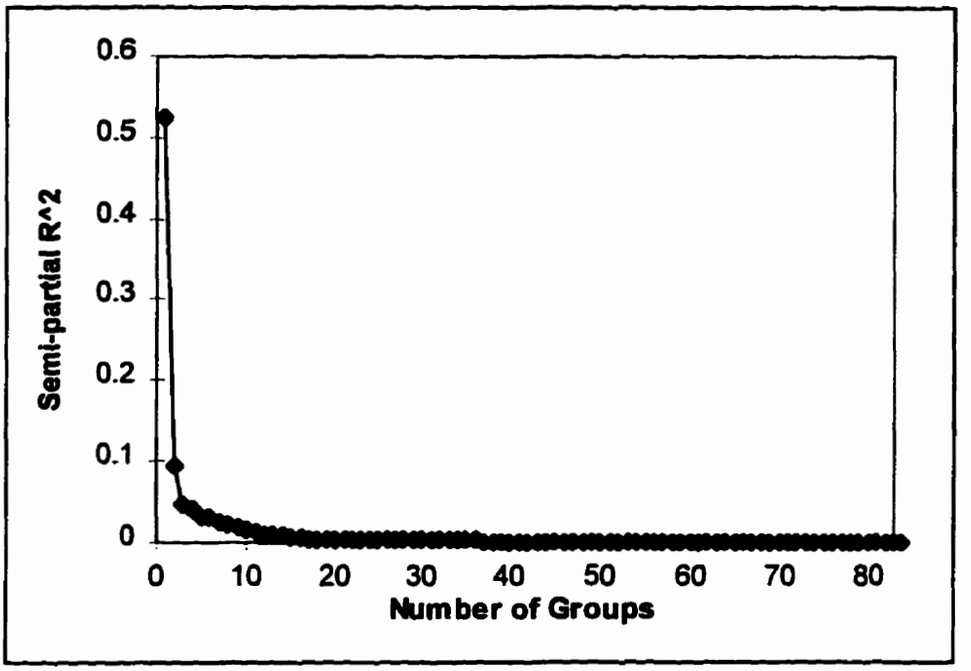
5.6.4 Determination of Optimum Number of Groups

The optimum number of seasonal counter groups was determined by comparing the mean monthly factors of each group using the Tukey multiple comparison of means

test. This test compares the two samples (groups) based on the hypothesis that all of the group means are equal to each other. The test compares the group means of a number of groups and the resulting hypothesis is either accepted or rejected. The Tukey multiple comparison of means was conducted using *Minitab* [Ref. 7] for numbers of groups (n) ranging from nine to five at a 95% confidence level.

Figure 5-4

Semi-partial R^2 in the Seasonal Grouping Process



The significance of difference in counter group means was established by comparing the monthly factors of each month of the year. The various group contrasts differed significantly from each other for a number of months at the 95% confidence level. Previous research has shown that counter groups should be considered different if the group means differ for three or more months out of the year based on the 95% confidence level [Ref. 8]. This is used as the basis for determining the optimum number of groups in this research.

Based on the Tukey multiple comparison of means, the optimum number of seasonal groups was determined to be five. Table 5-2 summarizes the differences in group means for the five groups. As shown in this table, further consolidation of groups into less than five groups results in group means which differ for greater than three months, which in turn results in inappropriate groupings.

Table 5-2

Tukey Multiple Comparison of Means for Optimum Number of Seasonal Groups

This table shows the results of the Tukey multiple comparison of means test for the mean monthly factors. It shows the number of months which differ when two groups are joined together based on the Tukey test. For example when GI and G2 are joined, 6 out of the 12 months were found to be significantly different. Similarly, when G1 and G3 are joined, it was found that 10 out of the 12 months were different, and so on. In this analysis, groups are considered to be inappropriate for joining together if at least 3 out of the 12 months are different. This table shows that all of the groups differ from each other by more than 3 months and hence, should not be joined together.

Group	G1	G2	G3	G4	G5
G1	-	6	10	11	11
G2	6	-	6	9	10
G3	10	6	-	4	8
G4	11	9	4	-	4
G5	11	10	8	4	-

5.6.5 Results of the Seasonal Grouping Analysis

The five major groups resulting from the seasonal grouping analysis are:

- **Seasonal Group 1** counters exhibit the lowest seasonal variation compared to the other seasonal groups. These counters lie on highway sections which are adjacent to population centers such as Winnipeg, Brandon, and Regina, and consists of mainly commuter type traffic.

- **Seasonal Group 2** counters have moderately high seasonal variation, and are located on major highways such as the TransCanada Highway, PTH 75 in Manitoba, the Yellowhead Highway #16, and Highways 5, 7, and 11 in Saskatchewan all of which serve longer trip distances.

  These routes connect major urban centers which are separated over longer distances. Examples include PTH 1 west of Winnipeg, and PTH 75, south of Winnipeg.

Similarly, in Saskatchewan, Highway #11 is a major arterial highway which connects Regina with Saskatoon, two major urban centers. This same highway runs northeast from Saskatoon to the town of Prince Albert which also exhibits the same characteristics.

- **Seasonal Group 3** counters exhibit moderately high seasonal variations similar to counters in Seasonal Group 2. However, all of the counters in this group are located on routes which also serve largely recreational destinations. This recreational nature of the routes creates a large proportion of summer traffic.

  For example, Station 12 in Manitoba located on PTH 44 exhibits a large proportion of summer traffic. PTH 44 is a route which is connected to the Whiteshell Provincial Park region, a largely recreational destination which attracts heavy summer traffic. Because this counter is located on a section which is farther away from the Park with many intersecting routes and small towns in between, it also carries a significant proportion of through-traffic.

- **Seasonal Group 4** counters have very high seasonal variations and are all located close to recreational destinations. For example, Station 74 in Manitoba located on PTH 1 is located on a route which carries major recreational traffic to the Whiteshell Park and northwestern Ontario. It also carries a significant amount of long distance traffic to and from Winnipeg, in addition to TransCanada summer travel.

- **Seasonal Group 5** consists of roads which carry heavy recreational traffic. This is shown by the very high summer traffic volumes compared to the rest of the year. Permanent counting sites that belong to this group include Stations 4, 76, and 94 in Manitoba, and Stations 18, 91 and 92 in Saskatchewan. All of these stations are located on routes which serve largely recreational destinations.

Figure 5-5 summarizes the seasonal variation patterns of these five groups. The y-axis shows the ratio of MADT to AADT, a high ratio represents a high traffic volume for the corresponding month. Most of the groups show a higher peak during the summer months, however, Seasonal Groups 4 and 5 exhibit significantly higher summer traffic volumes compared to the other groups. Seasonal Group 1 has the least seasonal variation, and Seasonal Group 2 and 3 have moderate seasonal rise.

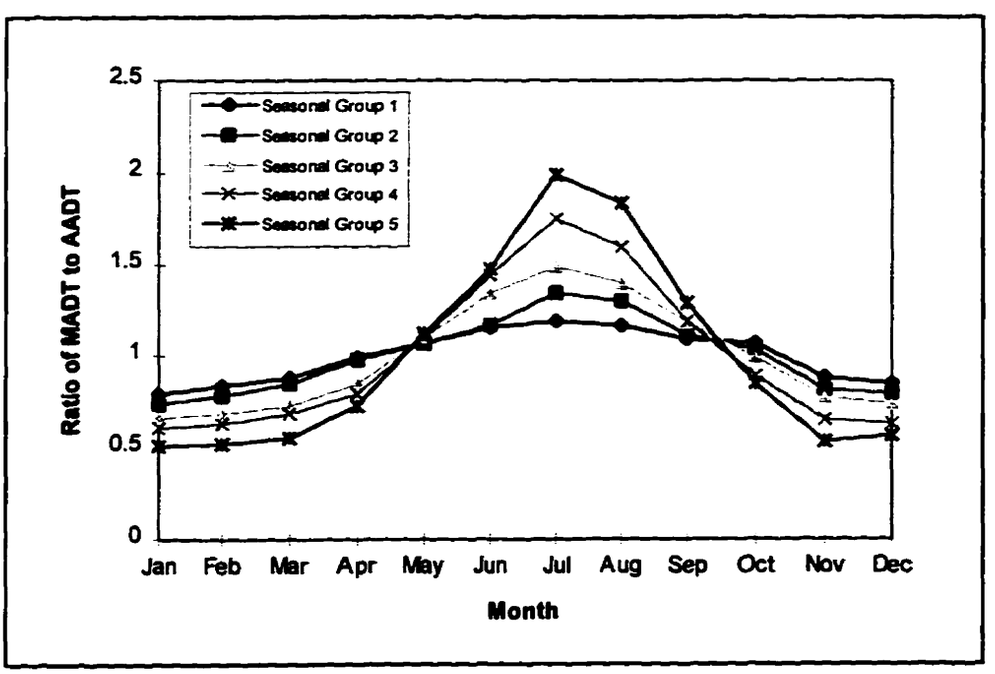
Figure 5-5 indicates another important characteristic of provincial highway traffic patterns. All of the five seasonal groups intersect each other at two points during the

year -- May and September -- and the corresponding ratio of MADT to AADT at these times is approximately one. This indicates that a short-count which is conducted in May or in September is close to the annual average compared to counts which are done during other times of the year. This characteristic of highway patterns is true for all the five groups.

The five seasonal groups account for 98 percent of the counters in the study region (81 out of 83). The remaining two counters, Station 71 (located in Saskatchewan on Highway 106, mile 75 of Hanson Lake Road) and Station 74 (located in Saskatchewan on Highway 9, north of Hudson Bay) have distinctly different patterns from the other five seasonal groups; therefore, these two counters were left ungrouped. Appendix A shows the seasonal traffic patterns of these stations.

Figure 5-5

Graphs of Seasonal Traffic Variation Patterns



5.6.6 Analysis of Average Hourly Traffic Patterns

Each of the five seasonal groups were further subdivided in terms of the average hourly patterns within each seasonal group. This is done to further define the traffic patterns in terms of hourly traffic variations.

The permanent counter data for the 81 sites (excluding the two sites which were ungrouped) were summarized into average hourly values for weekdays and weekends. Weekdays are from Monday to Friday and weekends are from Saturday to Sunday. Appendix B shows the average hourly traffic patterns for weekdays and weekends for these sites. The average hourly values were standardized by taking the ratio of the hourly volume to the AADT. These values were then used as input variables into the CLUSTER procedure in SAS, similar to the analysis of seasonal patterns.

5.6.7 Results of the Average Hourly Analysis

The analysis of the average hourly traffic patterns for each seasonal group produced the following results (shown graphically in Figure 5-6):

- Hourly Patterns for Seasonal Group 1

  Permanent counters in Seasonal Group 1 can be sub-divided into two groups of hourly patterns: (1) counters which exhibit high morning and afternoon peaking characteristics, with roughly equal volumes during the two peak times; (2) counters which exhibit higher afternoon peaks compared to morning peaks. In both cases, weekday traffic volume is much higher than the weekend traffic volume.

  Counters in the first hourly group with roughly equal morning and afternoon peaks tend to be located closer to major urban centers including Winnipeg and Regina. Counters in the second group are located near smaller population centers such ass Roblin and Dauphin in Manitoba, and Yorkton and Prince Albert in Saskatchewan.

- Hourly Patterns for Seasonal Group 2

  Seasonal Group 2 counters exhibit steady traffic throughout the weekday and weekend. The weekday and weekend patterns are similar, with no well-defined peaks in this group.

- Hourly Patterns for Seasonal Group 3

  Counters in this group exhibit high weekend traffic volumes compared to weekday traffic volumes. Two main groups of hourly patterns are observed for Seasonal Group 1: (1) weekday traffic which has high morning and afternoon peaks, similar to the hourly patterns in Seasonal Group 1, indicating a commuter-seasonal pattern; and (2) steadily increasing traffic throughout the weekday and weekend similar to Seasonal Group 2. The first type can be found on routes that lie adjacent to towns and that lead to major recreational destinations. The second type of hourly pattern can be found on routes that lead mainly to recreational destinations.

- Hourly Patterns for Seasonal Group 4

  Seasonal Group 4 counters exhibit significantly higher weekend traffic volumes compared to weekday traffic volumes because they are located on highly recreational routes. There is steady traffic flow throughout the weekend.

- Hourly Patterns for Seasonal Group 5

  The hourly patterns for roads in this group are the same as those in Seasonal Group 4. Weekend traffic is peaks on Saturdays and Sundays, and is generally greater than weekday traffic.

5.7 Summary of the New Traffic Pattern Groups

Based on the analysis of seasonal and average hourly traffic variations at permanent counters in Manitoba and Saskatchewan, seven major TPGs are developed. These groups are named Prairie Groups, because of the prairie region (Manitoba and Saskatchewan) in which they are located. Table 5-3 describes the Prairie Groups by their seasonal and average hourly traffic variation patterns, and comments on the general geographic locations of the sites. Table 5-4 lists the permanent counters which belongs to each of these groups. Figures 5-7 to 5-13 show the locations of

permanent counter sites which have been assigned to each group. Individual seasonal and average hourly patterns at each permanent counter are shown in Appendix A and Appendix B.

Table 5-3

Summary of the New TPGs Developed from the Study Region

TPG	Seasonal Pattern	Hourly Pattern	Geographic Characteristics
Prairie Group 1	Flat seasonal pattern.	High morning and afternoon peaks during the weekdays.	These routes are located in and around major urban centers like Winnipeg and Regina.
Prairie Group 2	Moderately high summer peak.	Similar pattern of steady traffic increases throughout the weekday and weekend.	These routes are not located adjacent to population centers. Rather, they serve longer-trip purposes.
Prairie Group 3	High summer peak.	Steady traffic throughout the day, but weekend traffic volumes tend to be greater than weekdays.	These routes are similar to Prairie Group 2, but also connect to recreational destinations.
Prairie Group 4	Flat seasonal pattern, similar to Prairie Group 1.	Weekday afternoon peaks are higher than weekday morning peaks.	These routes lie adjacent to rural population centers such as Dauphin, Minnedosa, and Roblin in Manitoba, and Yorkton in Saskatchewan.
Prairie Group 5	High summer peak.	Same as Prairie Group 4, with steady increasing traffic throughout the day on weekends.	These routes are similar to the Prairie Group 4, but are also used for recreational purposes since they lead to recreational destinations.
Prairie Group 6	Very high summer peak.	Very high weekend traffic volumes compared to weekday traffic volumes.	These routes connect to mainly recreational destinations which attract a high proportion of summer traffic. For example, the TransCanada highway near the Whiteshell Provincial Park, Riding Mountain National Park, and the beaches of Lake Winnipeg.
Prairie Group 7	Moderately high summer peak.	Similar to Prairie Group 1, with high morning and afternoon peaks.	These routes are located near population centers in Northern Manitoba such as The Pas and Thompson (Region 5, north of the intersection of PTH 6 and PTH 60). These routes also connect to the Clearwater Lake Prov. Park, a major recreational destination during the summer months in northern Manitoba.

Figure 5-6
Average Hourly Traffic Patterns (Weekdays and Weekends)

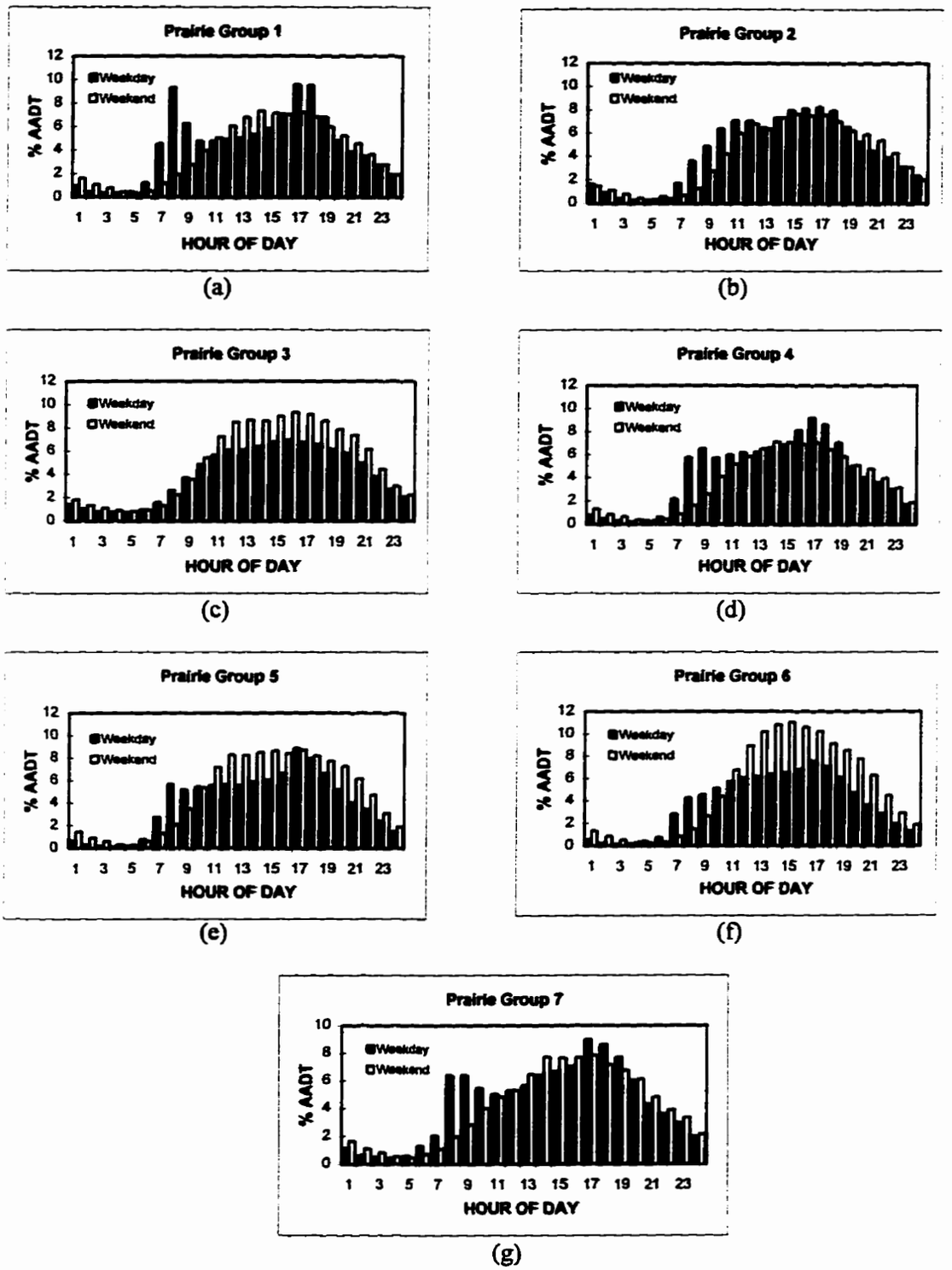


Table 5-4

List of Permanent Counters in the New TPGs

Prairie Group 1

MB Sites = 9
SK Sites = 2

Site No.	Province	Highway	Location
1	MB	8	1.4 KM S. OF P.R. #321
3	MB	9	1.7 KM S. OF P.T.H. #27
7	MB	210	EAST OF P.T.H. #59
8	MB	59	N. OF N. JCT. P.R. #210
9	MB	75	1.1 KM N. OF P.R. #247
47	MB	100	0.8 KM S. OF P.T.H. #1
51	MB	3	0.3 KM S.W. OF P.T.H. #2
70	MB	100	W. END OF RED RIV. BRIDGE
77	MB	101	1.1 KM W. OF P.T.H. #59
1	SK	1	1.5 KM W. OF JCT. #48
2	SK	1	8.0 KM W. OF JCT. #6

Prairie Group 2

MB Sites = 17
SK Sites = 13

Site No.	Province	Highway	Location
16	MB	7	3.7 KM N. OF P.T.H. #17
25	MB	1	WEST OF P.T.H. #41
40	MB	2	2.4 KM E. OF P.T.H. #83
43	MB	16	3.2 KM E. OF E. JCT. P.R. 354
46	MB	16	2.4 KM N. OF P.T.H. #1
48	MB	1	4.0 KM E. OF P.R. #332
49	MB	5	1.6 KM E. OF P.T.H. #20
60	MB	6	S. OF S. JCT. P.R. #325
63	MB	75	5.1 KM S. OF P. R. #210
66	MB	2	EAST OF NESBITT
67	MB	4	WEST OF SELKIRK BRIDGE
68	MB	320	CONNECTING RTE. SELKIRK BR. TO P.R. #320
79	MB	1	4.3 KM W. OF P.T.H. #5
80	MB	16	0.8 KM E. OF SASK. BDRY.
81	MB	13	2 MILES S. OF OAKVILLE
83	MB	50	1.3 KM S. OF P.R. #265
84	MB	10	3.8 KM S. OF S. JCT. #10A (ETHELBERT)
5	SK	11	5.0 KM S. OF ROAD TO DUNDURN
8	SK	1	0.5 KM W. OF JCT. #32
9	SK	16	1.5 KM N.W. OF ORCADIA
11	SK	11	5.0 KM E. OF JCT. #54
13	SK	7	8.0 KM E. OF JCT. #4
20	SK	4	1.5 KM S. OF GLASLYN
22	SK	1	5 KM E. OF GRENFELL
28	SK	6	1.5 KM S. OF JCT. #15
38	SK	38	NORTH OF LIPTON
41	SK	41	N.E. OF ABERDEEN
44	SK	11	N.E. OF ROSTHERN
45	SK	5	E. OF WATSON
75	SK	10	10.0 KM NE OF JCT. #1

Prairie Group 3

MB Sites = 4
SK Sites = 0

Site No.	Province	Highway	Location
13	MB	1	5.8 KM E. OF P.T.H. #12
65	MB	1	WEST OF MACGREGOR
74	MB	1	WEST OF ONTARIO BDRY.
75	MB	317	EAST OF P.T.H. #59

Prairie Group 4

MB Sites = 8
SK Sites =12

Site No.	Province	Highway	Location
14	MB	12	3.7 KM S. OF P.R. #303
24	MB	10	1.3 KM N. OF P.T.H. #1
28	MB	21	3.2 KM N. OF P.T.H. #24
32	MB	5	4.0 KM E. OF E. JCT. P.R. #274
41	MB	83	3.2 KM N. OF P.R. #583
56	MB	3	3.2 KM E. OF N. JCT. P.T.H. #83
58	MB	34	0.8 KM S. OF P.R. #449
59	MB	325	WEST OF P.T.H. #6
3	SK	39	3.0 KM S.E. OF YELLOW GRASS
4	SK	10	6.5 KM E. OF BALCARRES
10	SK	48	3.0 KM S.E. OF DAVIN
15	SK	49	8.0 KM E OF JCT. #38
16	SK	38	8.0 KM S OF JCT. #49
17	SK	4	1.5 KM N OF JCT. #13
34	SK	44	6.0 KM W OF WARTIME
36	SK	36	2.0 KM N OF GALILEE
39	SK	33	SE OF FRANCIS
40	SK	40	1.0 KM W OF JCT. #29
42	SK	55	S.W. OF GREEN LAKE
43	SK	3	W. OF PRINCE ALBERT

Prairie Group 5

MB Sites = 6
SK Sites = 1

Site No.	Province	Highway	Location
12	MB	44	3.7 KM E. OF P.R. #215
21	MB	10	1.6 KM N. OF P.R. #448
78	MB	59	SOUTH OF BIRDS' HILL PARK ENTRANCE
93	MB	313	EAST OF P.R. #315
96	MB	10	SOUTH OF P.R. #357
97	MB	357	EAST OF PTH 10
21	SK	2	1.5 KM N OF JCT. HWY. #355

Prairie Group 6

MB Sites = 3
SK Sites = 4

Site No.	Province	Highway	Location
4	MB	9	SOUTH OF PTH 17
76	MB	59	NORTH OF P.R. #317
94	MB	315	NORTH OF P.R. #313
18	SK	210	8.1 KM N OF JCT. HWY. #10
46	SK	322	1.6 KM NW OF SILTON
91	SK	20	NW OF CRAVEN
92	SK	57	SW OF DUCK MOUNTAIN PARK

Prairie Group 7

MB Sites = 2
SK Sites = 0

Site No.	Province	Highway	Location
72	MB	10	SOUTH OF P.R. #287
73	MB	287	EAST OF P.T.H. #10

Ungrouped Sites

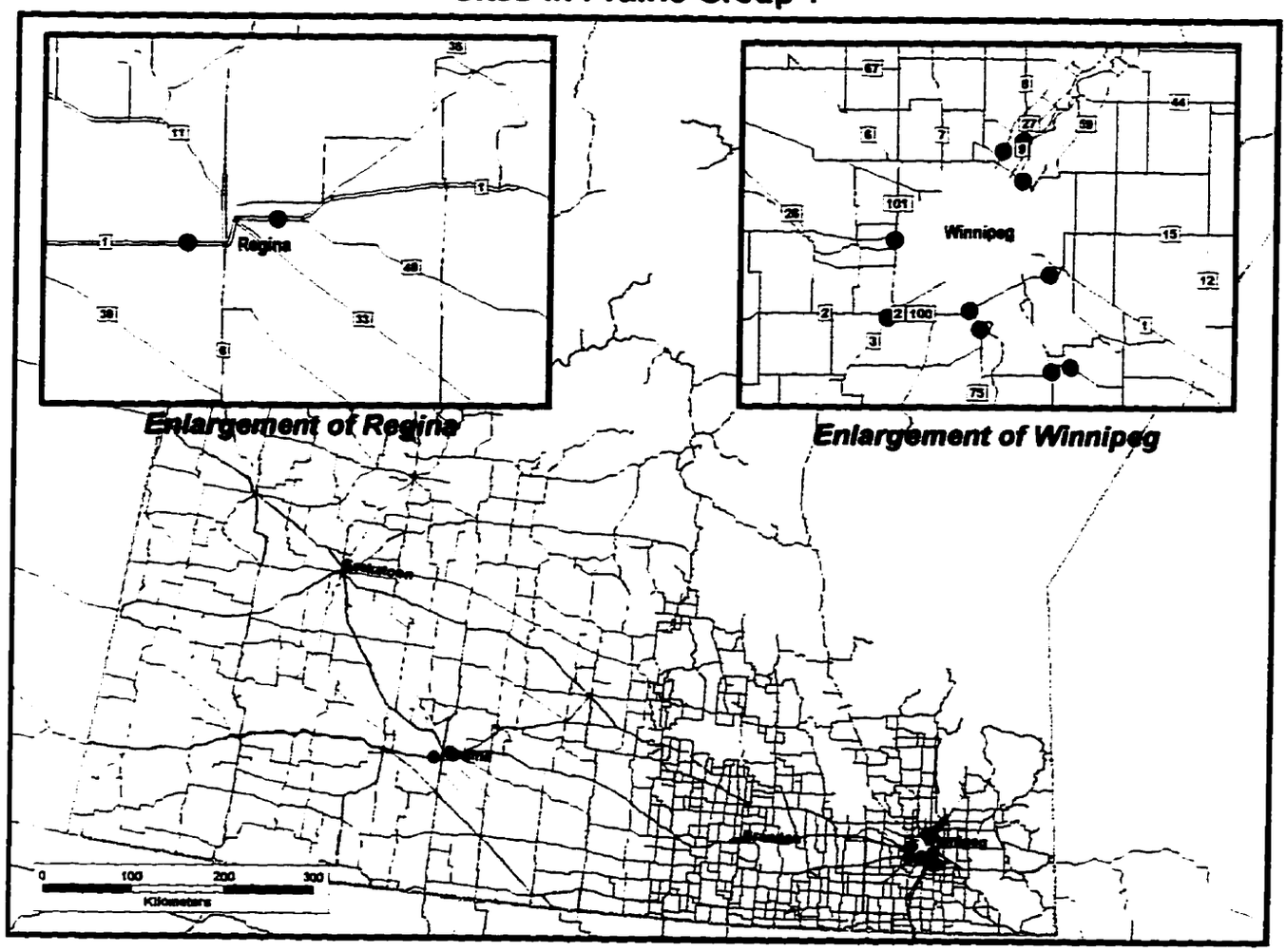
SK Sites = 2

Site No.	Province	Highway	Location
71	SK	106	MILE 75 OF HANSON LAKE ROAD
74	SK	9	10.5 KM N OF HUDSON BAY

Number of Manitoba Sites = 49
Number of Saskatchewan Sites = 34
Total Number of Sites Analyzed = 83

Figure 5-7

Sites in Prairie Group 1



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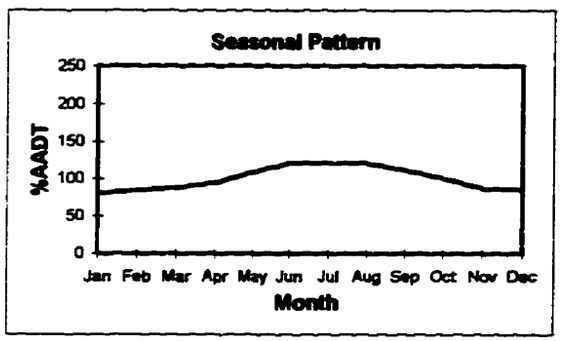


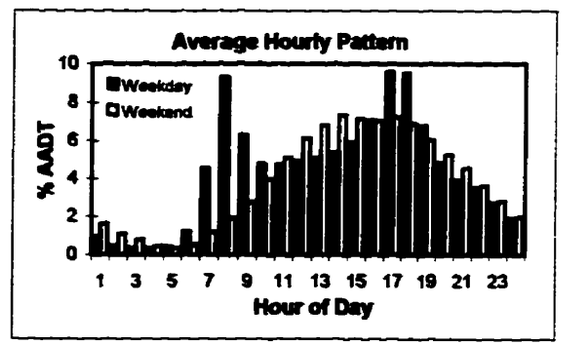
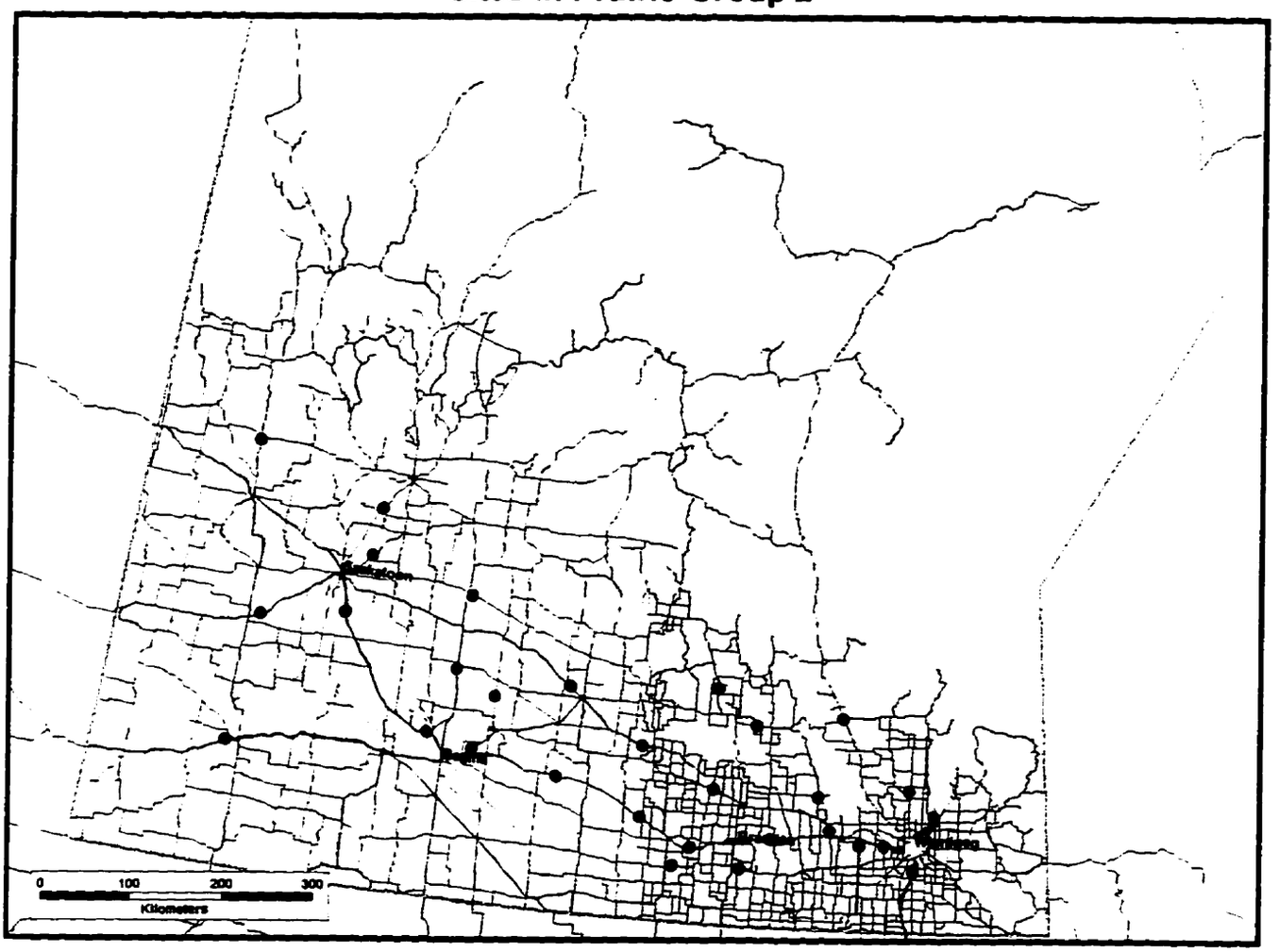


Figure 5-8

Sites in Prairie Group 2



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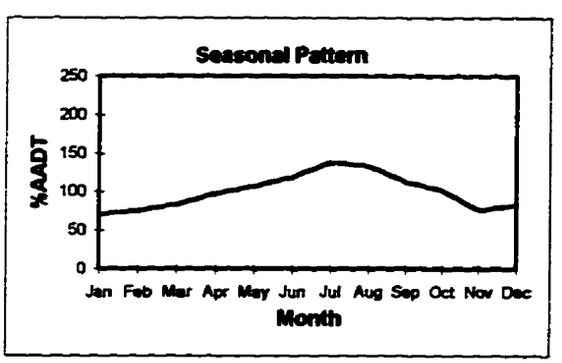


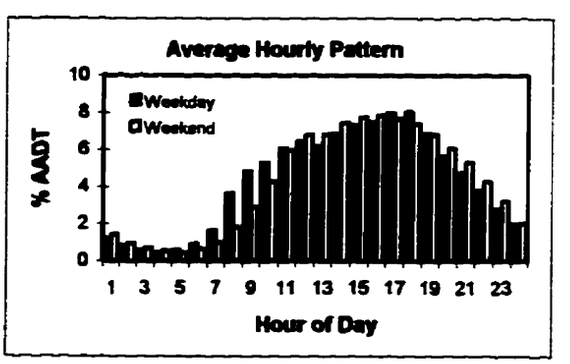
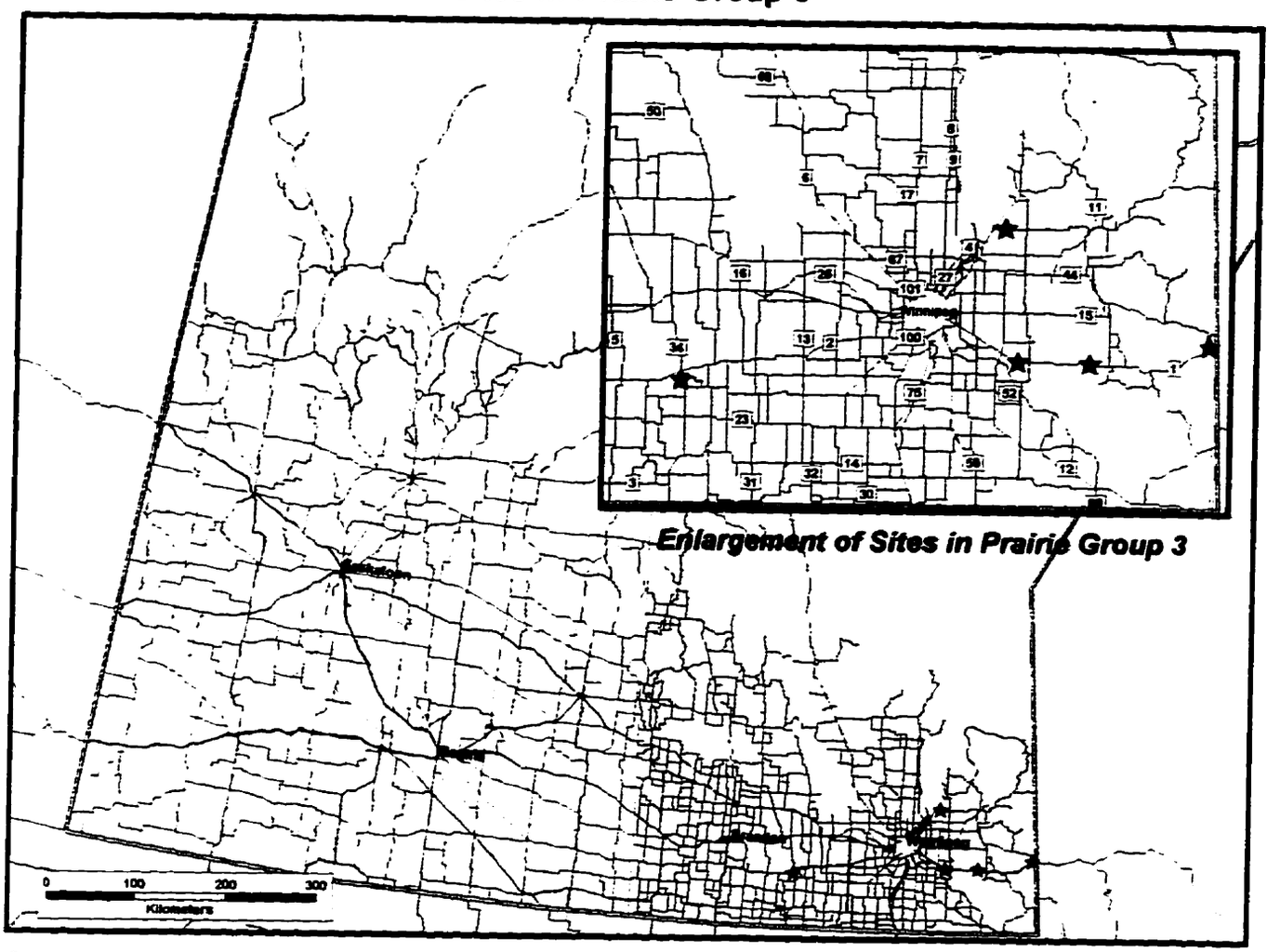


Figure 5-9

Sites in Prairie Group 3



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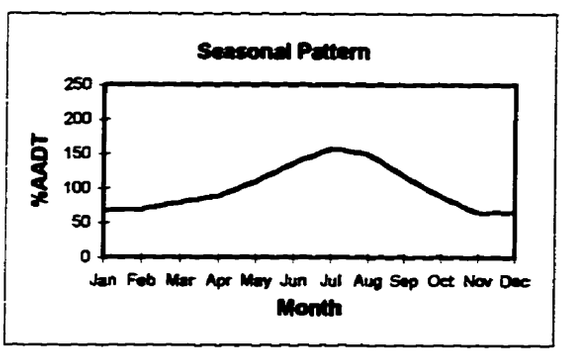


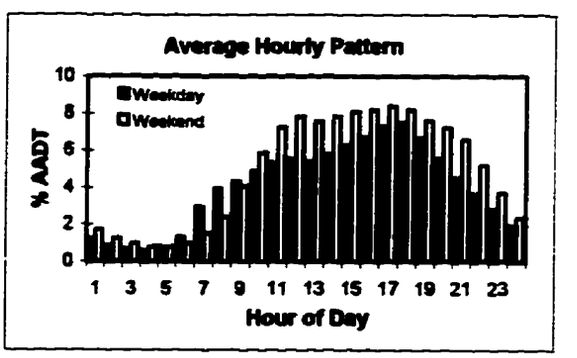
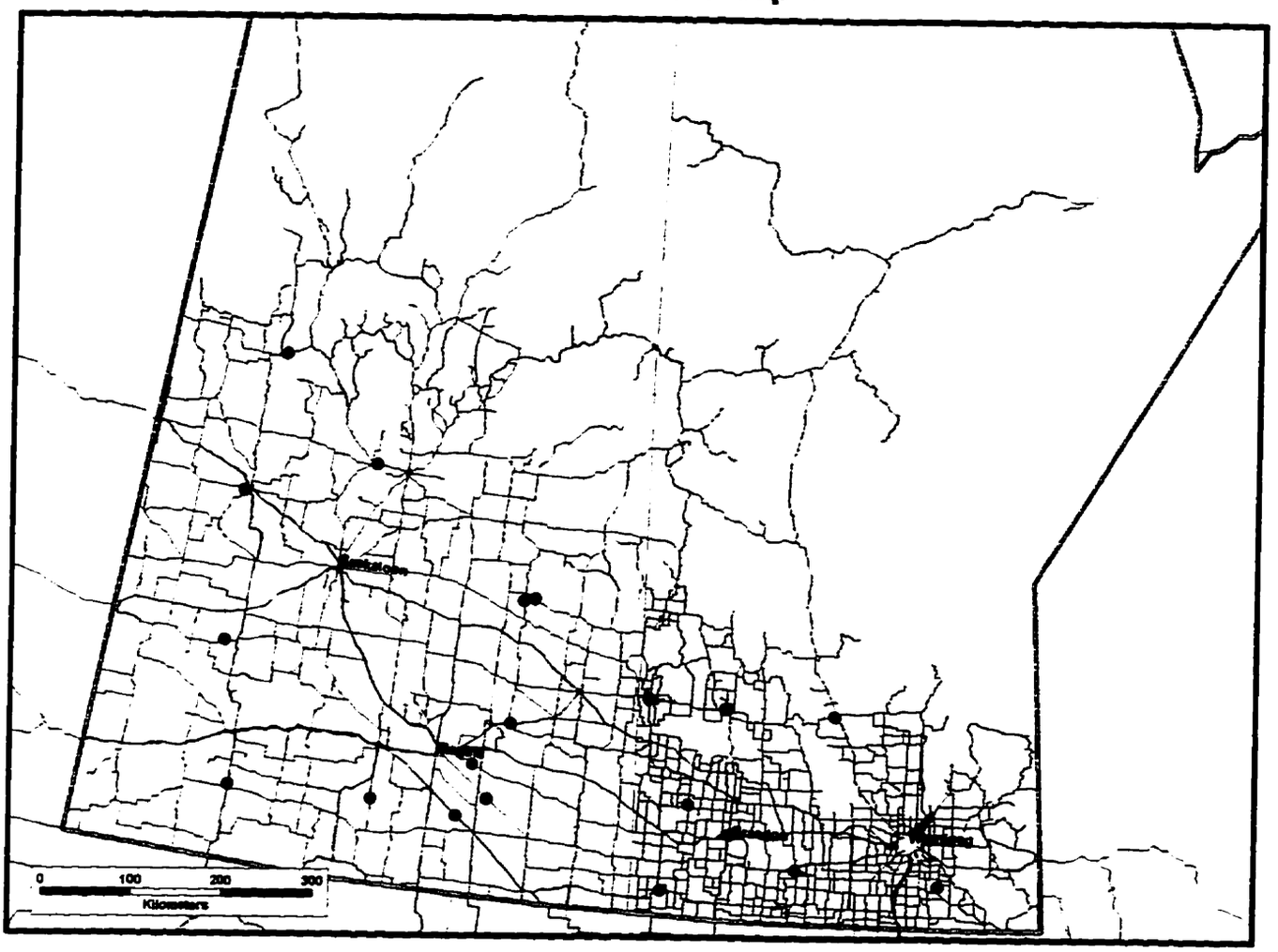


Figure 5-10

Sites in Prairie Group 4



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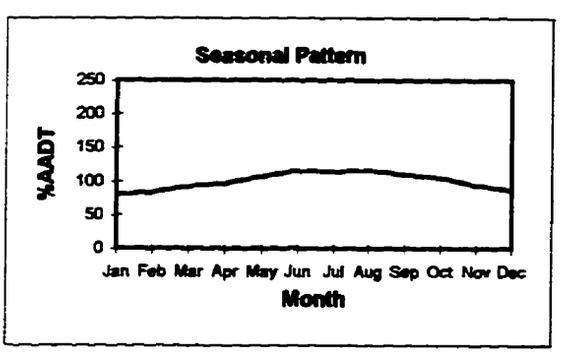


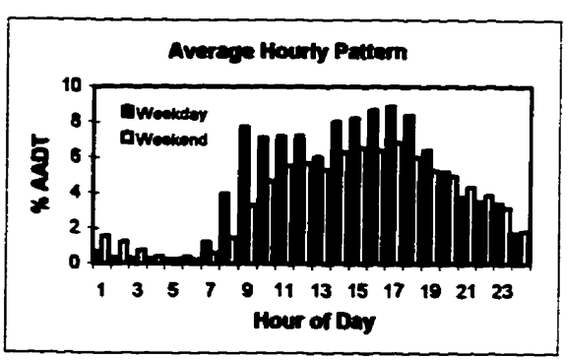
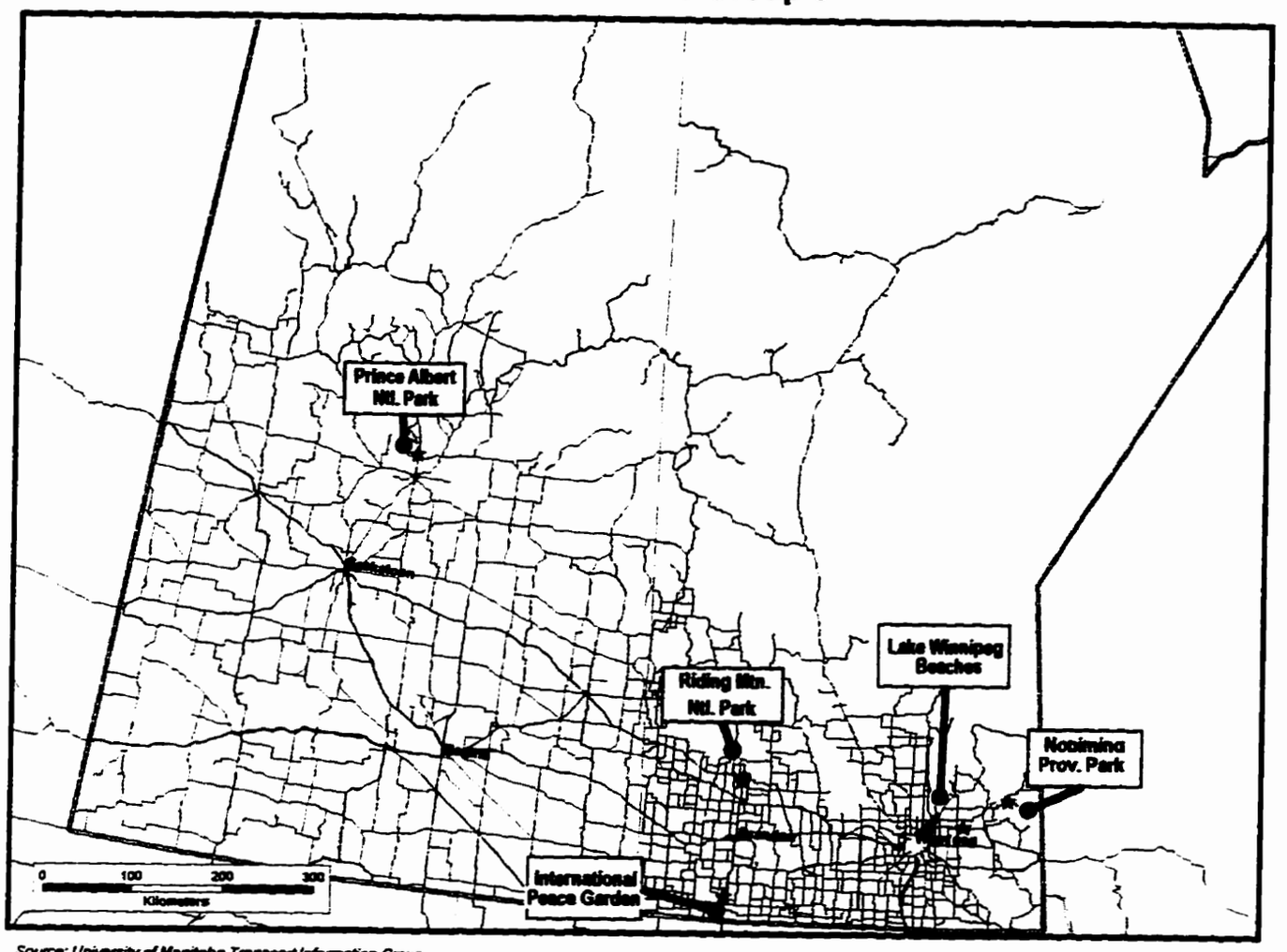


Figure 5-11

Sites in Prairie Group 5



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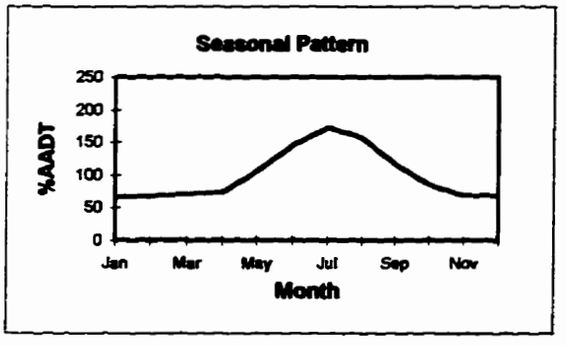


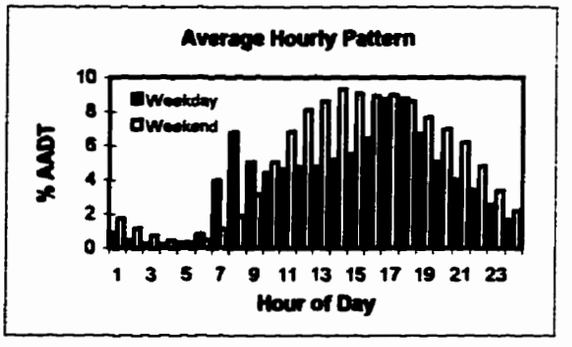
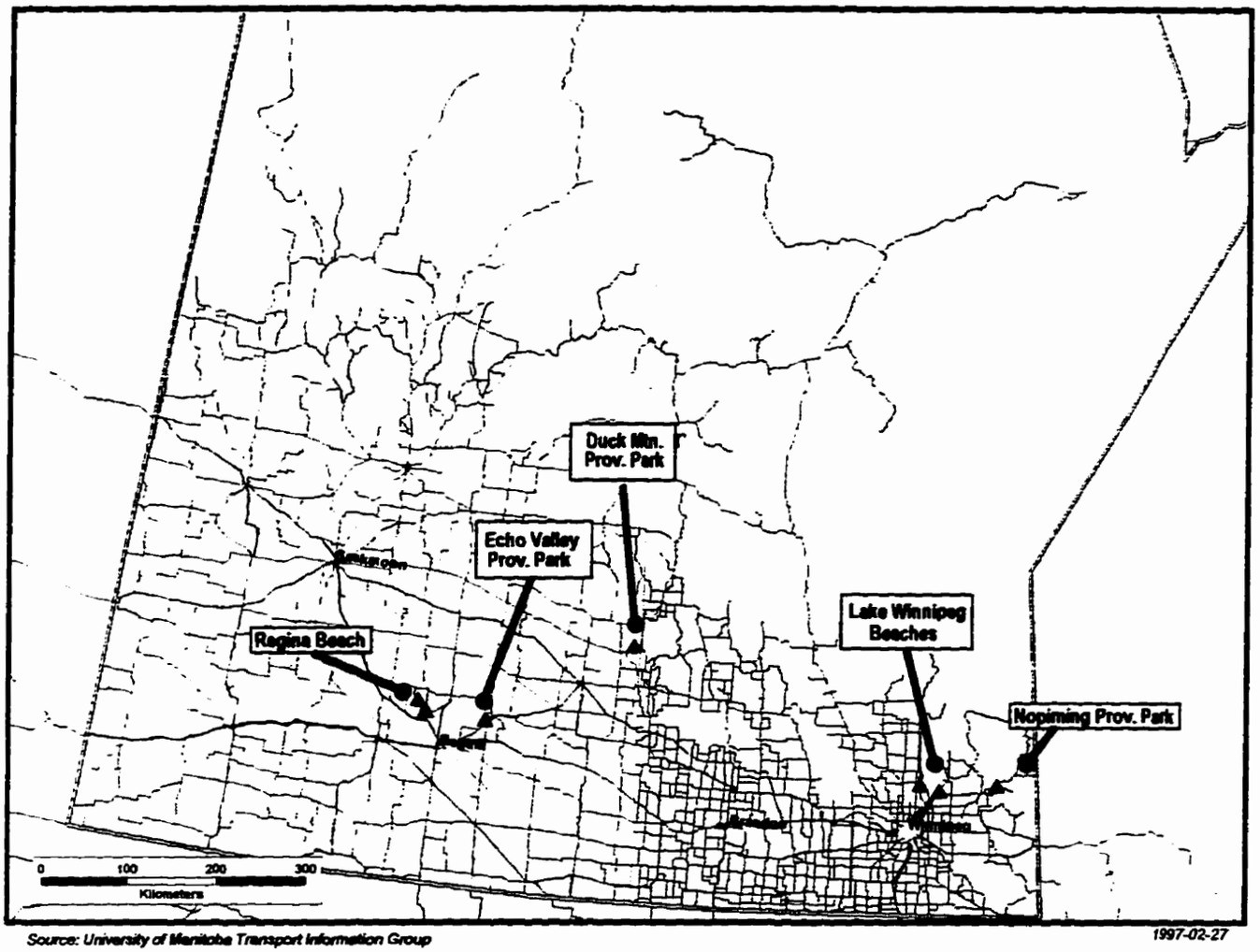


Figure 5-12

Sites in Prairie Group 6



Source: University of Manitoba Transport Information Group

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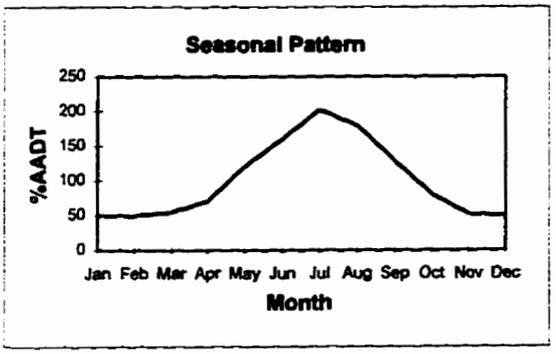


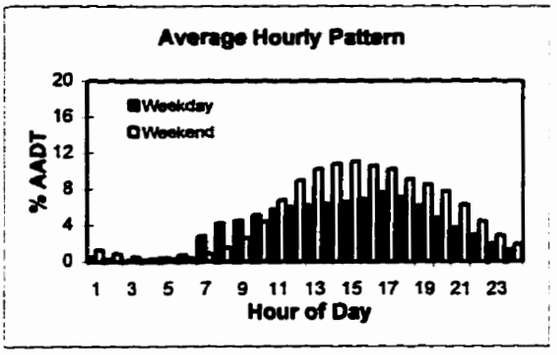
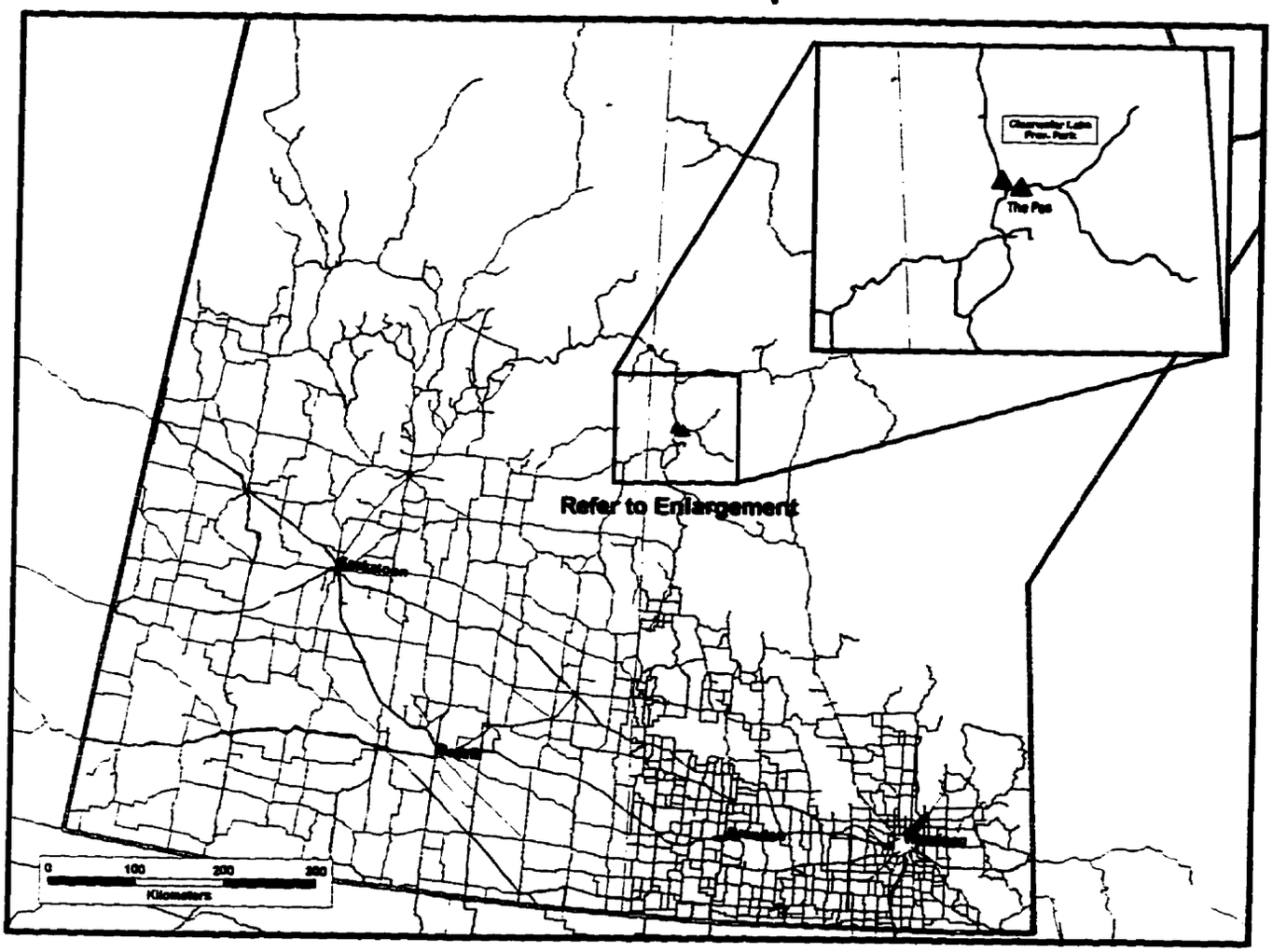


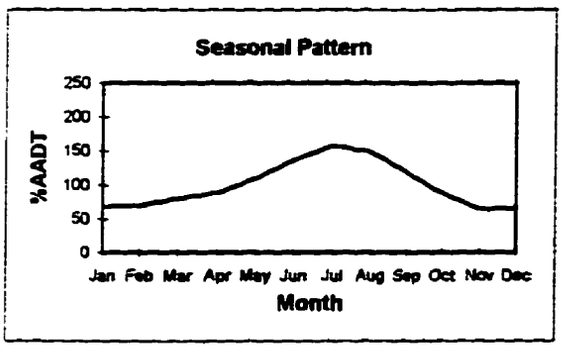
Figure 5-13

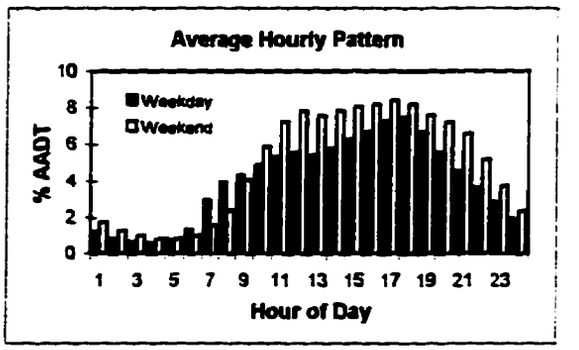
Sites in Prairie Group 7



Source: University of Manitoba Transport Information Group

1997-02-27





5.8 Similarities in Highway Traffic Patterns in the Study Region

The previous section demonstrated that many of Manitoba's and Saskatchewan's highways exhibit similar traffic patterns and can be grouped together into TPGs.

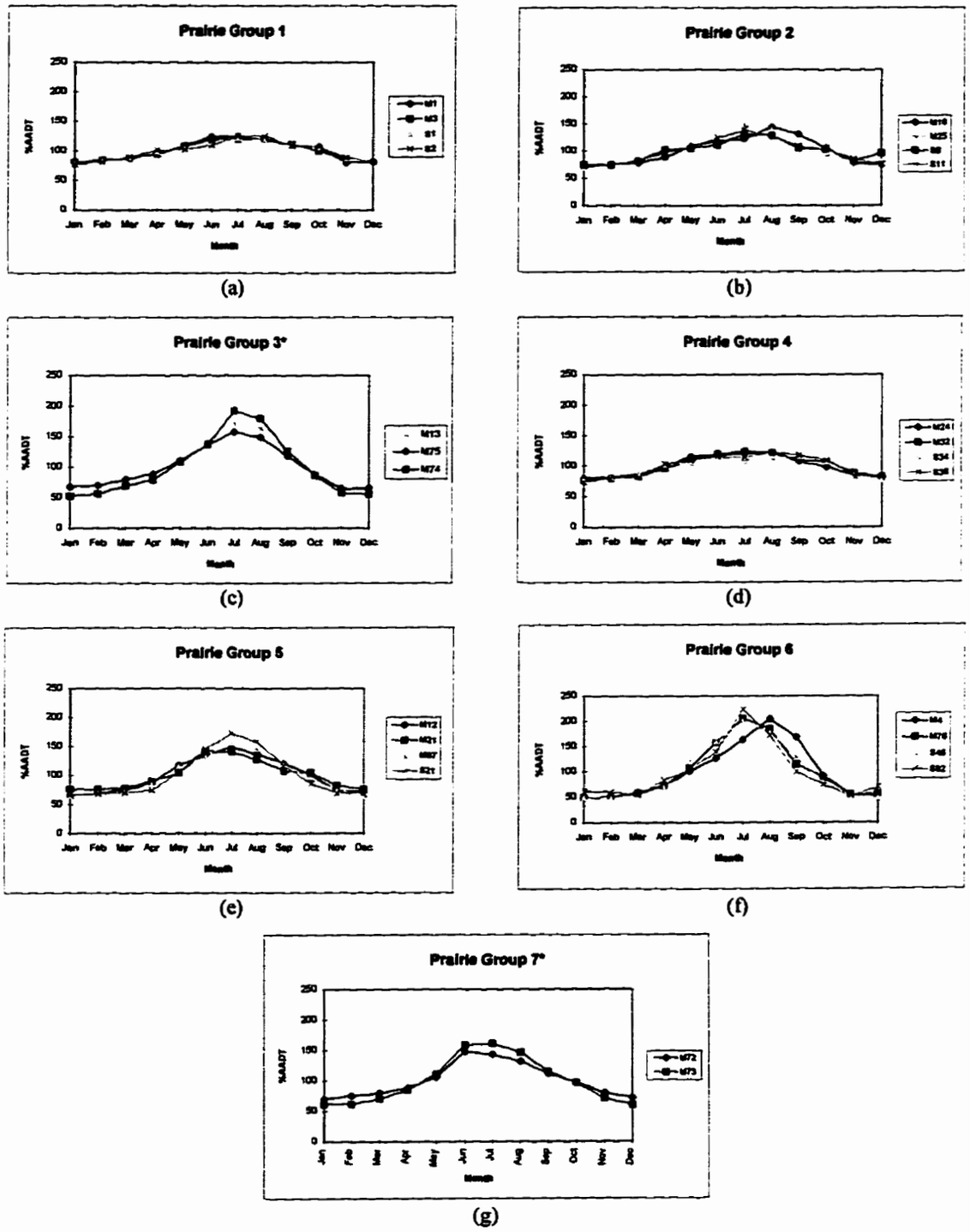
The similarities in seasonal traffic patterns at many of Manitoba's and Saskatchewan's sites are shown in more detail by several graphs. Figures 5-14 (a)-(e) shows typical sites in Manitoba and Saskatchewan which exhibit similar seasonal traffic patterns. As shown in Figure 5-14 (a), all four of the sites in Prairie Group 1 exhibit very similar seasonal patterns, and all four of these sites are located near Winnipeg or Regina.

The sites which belong to Prairie Group 2 are shown in Figure 5-14 (b). All four of the sites also show close resemblance to one another. These sites are all located on major highways not adjacent to major population centers or recreational destinations.

Likewise, Manitoba and Saskatchewan sites within the other groups including Prairie Groups 4, 5, and 6 also exhibit very similar patterns to one another (Prairie Groups 3 and 7 consist only of Manitoba-based sites).

Figure 5-14 (a) - (e)

Seasonal Traffic Patterns at Typical Manitoba and Saskatchewan Sites



*Prairie Groups 3 and 7 consist of Manitoba-based permanent counters only.
Note: Stations labeled with "M" indicate a Manitoba-based site, and stations labeled with "S" indicate a Saskatchewan-based site.

5.9 Evaluation of AADT Estimates

The next step is to investigate how the new TPGs affect the AADT estimates for short-term counts in Manitoba. The evaluation is carried out by comparing the estimated AADT for a short-term count obtained from using the new TPG with the estimated AADT obtained from using the existing TPG in Manitoba. The estimated AADTs from the two methods are compared to the actual AADT to determine which estimate is more accurate. The next section describes the method of evaluation followed by an example application.

5.9.1 Method of Evaluation

The method of evaluation is based on using existing permanent counter data to develop sample short-counts [Ref. 1]. First, a permanent counter was temporarily removed from a known TPG in order to develop experimental samples of short counts; this permanent counter is referred to as a "sample permanent counter", or "sample PCS" [Ref. 1]. Next, the short-count is expanded to AADT using the new TPG and the old TPG. Since the actual AADT at the sample PCS is known, the two AADT estimates from the old and new TPGs are compared to the actual AADT to determine which method produces more accurate estimates. This procedure was repeated for all sample PCSs in Manitoba for each TPG.

This procedure is summarized in the following steps:

(1) generate short-counts from existing permanent counter data;
(2) estimate AADT from these short-counts using (i) the new TPGs and (ii) the current Manitoba-based TPGs;
(3) compare the resulting AADTs with the actual AADT, and
(4) discuss results.

5.9.2 Example Application

The method of evaluation is shown by an example. In this example, Station 16 is selected as the sample PCS. Station 16 is located on PTH 7 and belongs to Prairie Group 2 (refer to Table 5-4 for a list of permanent counters and their TPGs). Two randomly selected short-count periods were obtained from the sample PCS, July 5 and 6, 1995 (Monday and Tuesday) and August 28 and 29, 1995 (Wednesday and Thursday). The traffic volume counts during these periods are 3,810 vehicles and 4,574 vehicles, respectively.

Based on this information, the AADT at this location is estimated using the following relationship:

$$\frac{Vol_{STC}}{AADT_{STC}} = \frac{\sum_{i=1}^{n} \frac{Vol_i}{AADT_i}}{n}$$

where Vol_{STC} = the observed short-term count traffic volume
$AADT_{STC}$ = the estimated AADT from the short-term count site
Vol_i = the observed traffic volume at site "i" in the traffic pattern group
$AADT_i$ = the AADT at site "i" in the traffic pattern group
n = the number of sites in the traffic pattern group.

Table 5-5 shows the estimated AADTs for sample PCS 16 based on the two short-count periods.

Table 5-5

Comparison of Actual and Estimated AADT at Sample PCS 16 in Manitoba

Count period	Volume	Estimated AADT (Old)	Estimated AADT (New)
July 5 and 6, 1995	3810	1400	1460
August 28 and 29, 1995	4574	1840	1820
Estimated AADT		**1620**	**1640**

Table 5-5 shows that there is only a slight difference in AADT estimates between the two methods. However, since the sample PCS is in fact a permanent counting station, its actual AADT is known from the continuously recorded traffic data at the site. The actual AADT at Station 16 is 1760 vehicles per day. The analysis shows that the AADT (New) is closer to the actual AADT than the AADT (Old). This example indicates that the use of the new TPGs results in a better quality AADT estimate compared to the existing TPG.

5.10 Results of Evaluation

Similar evaluations were carried out for all sample PCSs in Manitoba in each of the new TPGs. The same short-count period was selected for all sample PCSs. Tables 5-6 (a) - (g) show the results of the evaluation for each TPG. Each table shows the site which was sampled, the actual AADT of that site, the estimated AADTs using the new (NEW) and the existing (OLD) TPGs, and the percent difference between the estimated and actual AADTs. The last column shows the method which produces the more accurate AADT estimate, based on the percent difference. A lower percent difference indicates that the estimated AADT is closer to the true value.

These results are also shown in graphical form in Figures 5-15 (a) - (f) for Prairie Groups 1 to 6. Prairie Group 7 is not shown in the graphs because both sites in this group were previously not assigned to any TPG, and therefore no comparison to the previous method can be made. Each graph in Figure 5-15 shows the actual and estimated AADTs using the old and new TPGs. The 45-degree line on each graph represents the line where the estimated AADT is equal to the actual AADT.

Table 5-6 (a)

Comparison of Actual and Estimated AADTs for Prairie Group 1

Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
1	9820	7360	-25.0%	7550	-23.1%	New
3	8780	7160	-18.4%	7320	-16.6%	New
7	760	790	4.0%	800	5.3%	Old
8	4690	3880	-17.3%	3980	-15.1%	New
9	6880	7100	3.2%	6950	1.0%	New
47	22020	18870	-14.3%	19310	-12.3%	New
51	3610	4100	13.6%	3950	9.4%	New
70	14720	14440	-1.9%	14960	1.6%	New
77	11350	14690	29.4%	15190	33.8%	Old

Table 5-6 (b)

Comparison of Actual and Estimated AADTs for Prairie Group 2

Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
16	1760	1620	-8.0%	1640	-6.8%	New
25	2790	3080	10.4%	3120	11.8%	Old
40	750	730	-2.7%	750	0%	New
43	1580	1190	-24.7%	1220	-22.8%	New
46	3070	2760	-10.1%	2810	-8.5%	New
48	9900	9370	-5.4%	9530	-3.7%	New
49	1670	1480	-11.4%	1510	-9.6%	New
60	1280	1090	-14.8%	1150	-10.2%	New
63	4580	4700	2.6%	4900	7%	Old
66	1310	1100	-16.0%	1250	-4.6%	New
67	2060	2350	14.1%	2200	6.8%	New
68	900	860	-4.4%	880	-2.2%	New
79	5180	4850	-6.4%	4930	-4.8%	New
80	1210	1480	22.3%	1490	23.1%	Old
81	880	780	-11.4%	840	-4.5%	New
83	780	760	-2.6%	720	-7.7%	Old
84	620	750	21.0%	710	14.5%	New

Table 5-6 (c)

Comparison of Actual and Estimated AADTs for Prairie Group 3

Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
13	5480	5700	4.0%	5700	4.0%	No difference
65	4920	4850	-1.4%	4850	-1.4%	No difference
74	3600	3850	6.9%	3850	6.9%	No difference
75	940	800	-14.9%	800	-14.9%	No difference

Table 5-6 (d)

Comparison of Actual and Estimated AADTs for Prairie Group 4

Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
14	2870	2750	-4.2%	2930	2.1%	New
24	4570	4630	1.3%	4900	7.2%	Old
28	1090	1370	25.7%	1430	31.2%	Old
32	2650	2780	4.9%	2930	10.6%	Old
41	1110	1100	-0.9%	1140	2.7%	Old
56	760	820	7.9%	780	2.6%	New
58	630	520	-17.5%	560	-11.1%	New
59	690	620	-10.1%	650	-5.8%	New

Table 5-6 (e)

Comparison of Actual and Estimated AADTs for Prairie Group 5

Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
12	2960	2730	-7.8%	3070	3.7%	New
21	1120	970	-13.4%	990	-11.6%	New
78	8730	7330	-16.0%	7410	-15.1%	New
93	200	250	25.0%	260	30.0%	Old
96	1580	1680	6.3%	1680	6.3%	No Difference
97	410	480	17.1%	480	17.1%	No Difference

Table 5-6 (f)

Comparison of Actual and Estimated AADTs for Prairie Group 6

Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
4	1920	2340	21.9%	2500	30.2%	Old
76	3350	2960	-11.6%	3330	-0.6%	New
94	690	650	-5.8%	730	5.8%	No Difference

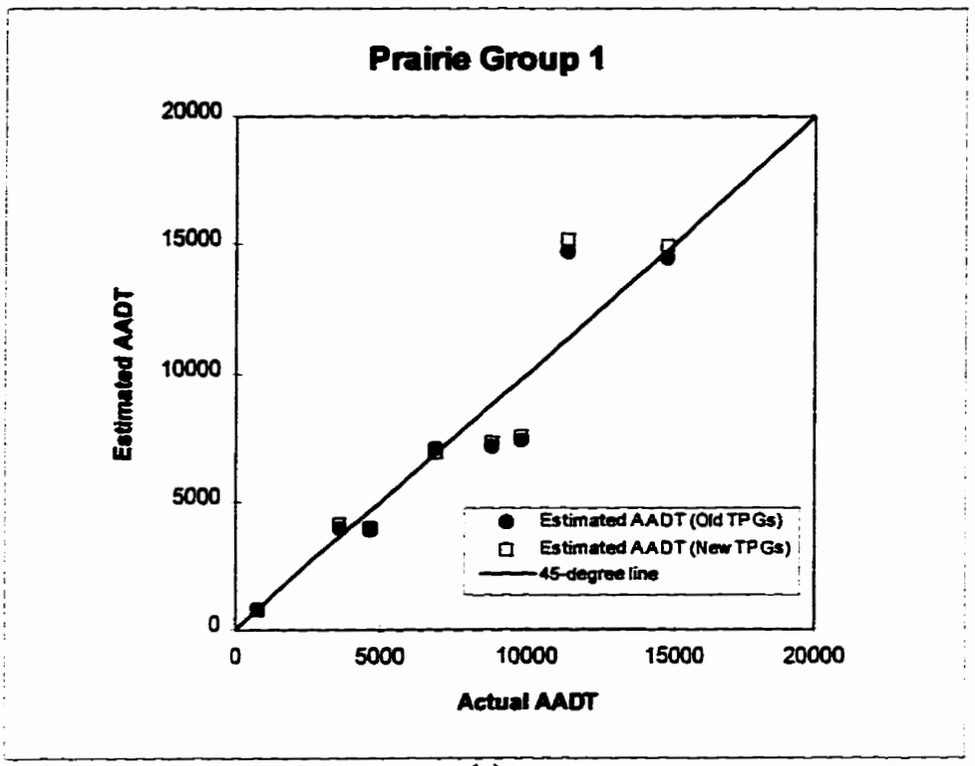
Table 5-6 (g)

Comparison of Actual and Estimated AADTs for Prairie Group 7

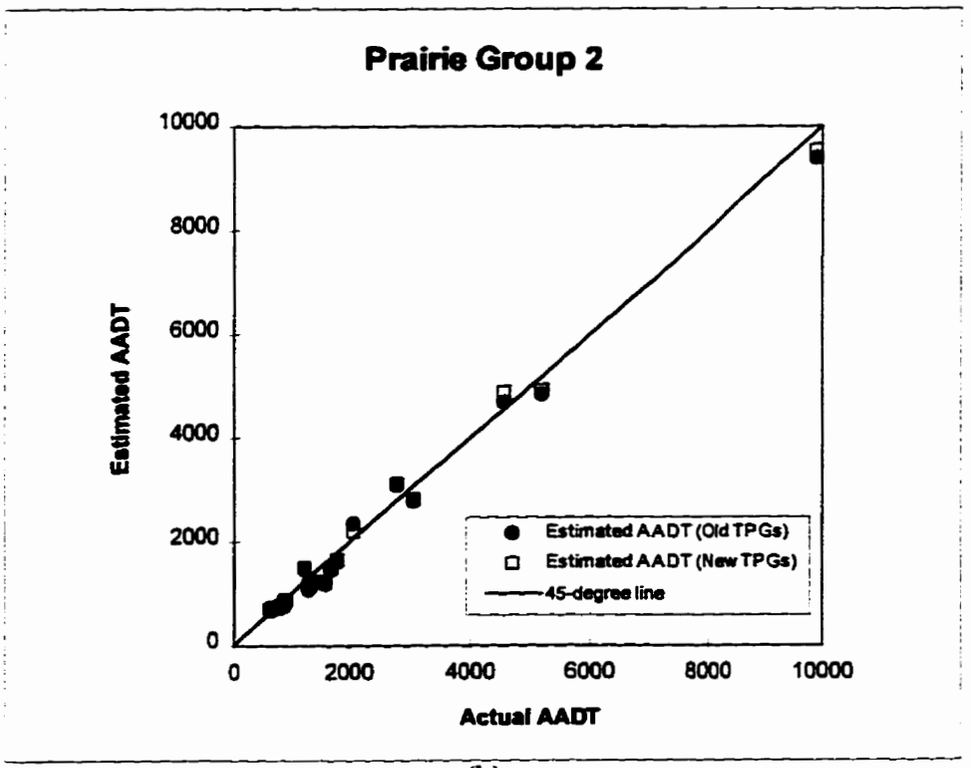
Sample site	Actual AADT	Estimated AADT (OLD)	%Difference (OLD)	Estimated AADT (NEW)	%Difference (NEW)	Enhanced Method
72	1620	Not assigned	-	1510	-6.8%	-
73	880	Not assigned	-	980	11.4%	-

Figure 5-15

Graphical Comparison of Actual and Estimated AADTs for Different TPGs

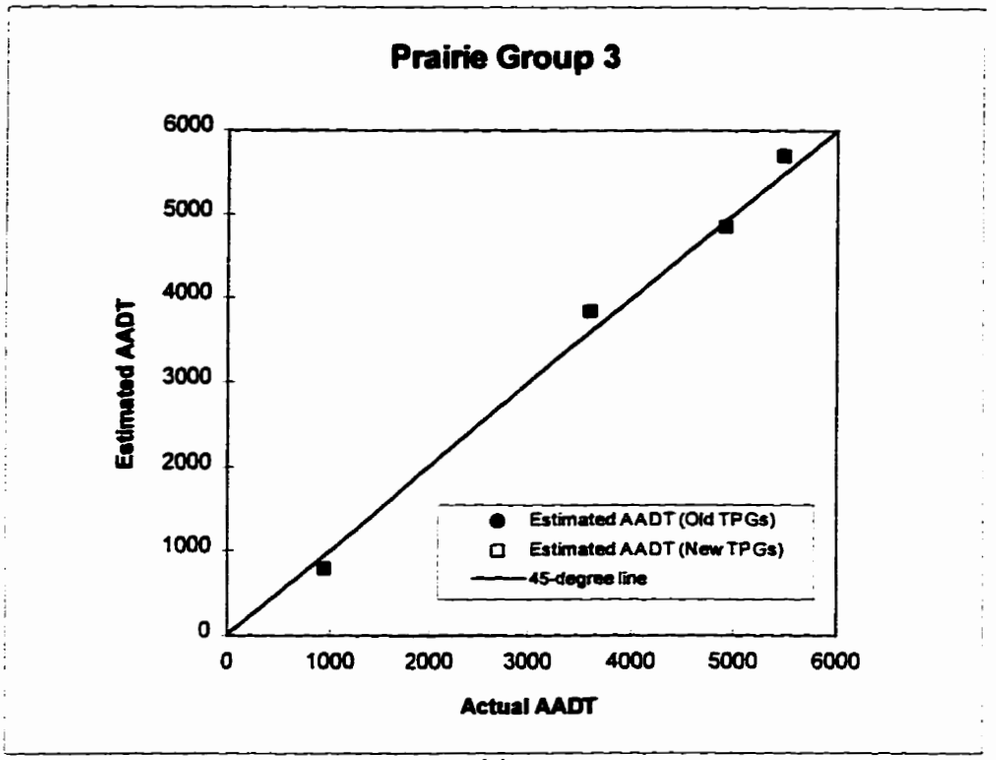


(a)

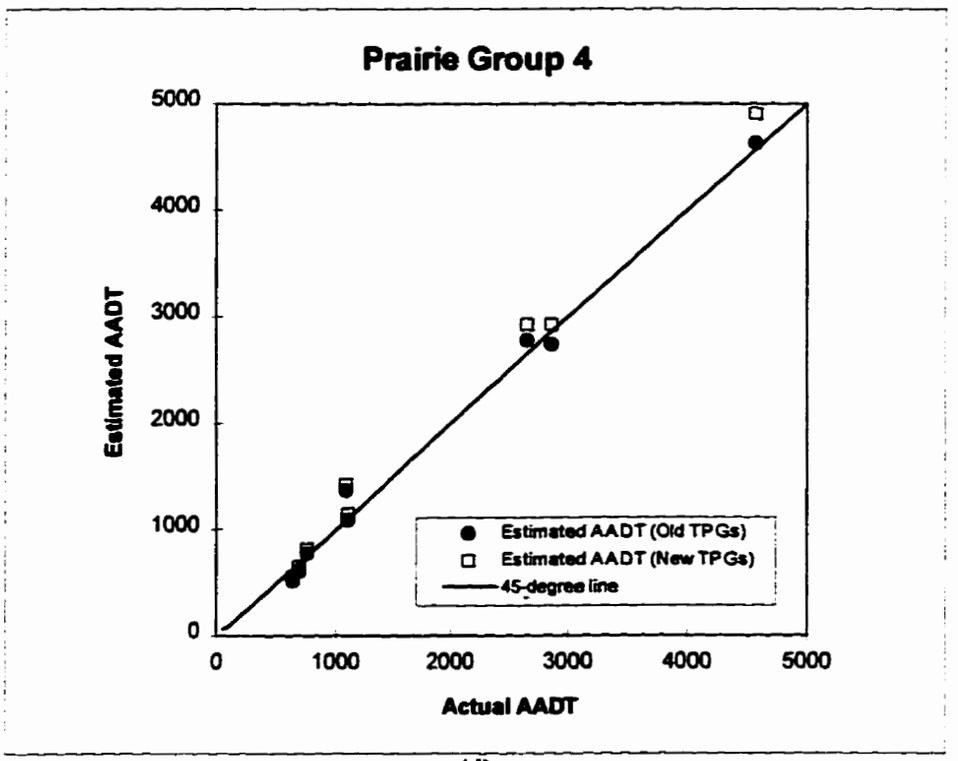


(b)

Figure 5-15 (continued)

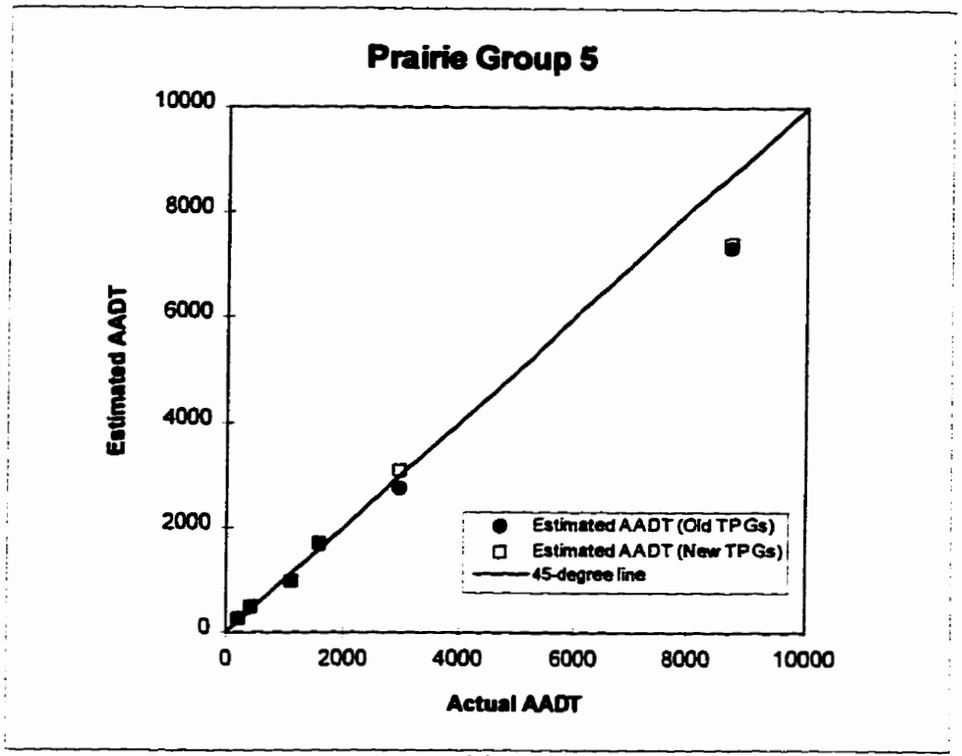


(c)

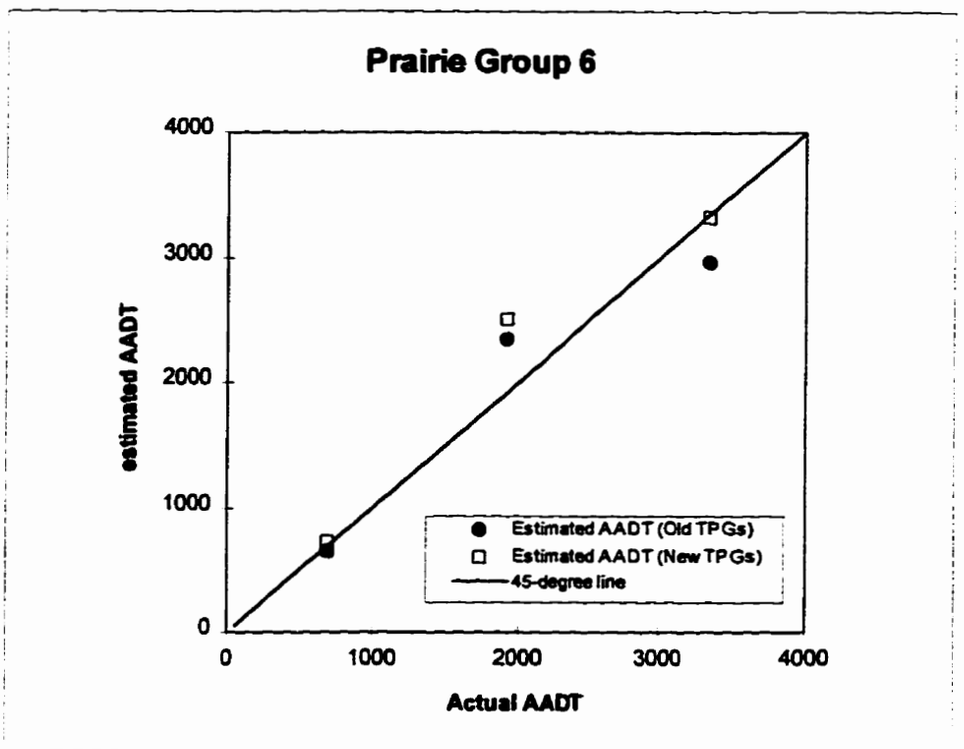


(d)

Figure 5-15 (continued)



(e)



(f)

5.11 Discussion of Results

The following summarizes the results of the analysis:

- 78 percent of the sites in Prairie Group 1 showed better AADT estimates when the new TPGs were used; the remaining 22 percent showed better AADT estimates when the old TPGs were used.
- 76 percent of the sites in Prairie Group 2 showed better AADT estimates when the new TPGs were used; the remaining 24 percent showed better AADT estimates when the old TPGs were used.
- All four of the sites in Prairie Group 3 showed no difference in the estimates for both methods.
- 50 percent of the sites in Prairie Group 4 showed better AADT estimates when the new TPGs were used; the remaining 50 percent were better when the old TPGs were used.
- In Prairie Group 5, 50 percent of the sites showed better AADT estimates using the new TPGs; 17 percent were better when the old TPGs were used, and the remaining 33 percent showed no difference in the two methods.
- In Prairie Group 6, 33 percent of the sites showed better AADT estimates when the new TPGs were used; 33 percent showed better AADT estimates when the old TPGs were used, and 33 percent showed no difference.
- The sites in Prairie Group 7 were not assigned to any TPG previously, so no comparison can be made for these sites.

Overall, the AADT estimates for 60 percent of the sites improved when the new TPGs are used for expansion, 25 percent of the sites improved when the old TPGs are used, and the remaining 15 percent showed no difference in the two methods. All of the sites in Prairie Group 3 showed no difference because the new and old TPGs in which they have been assigned consist of the same permanent counters, meaning that there is no change in the pattern in these groups from the old and new methods.

The graphical representation of estimated AADTs in Figures 5-15 (a) - (f) show that both the new and old TPGs produce similar estimates, hence, many of the data points overlap. However, based on the estimates from Tables 5-6 (a) - (g) it can be concluded that the AADT for the majority of the sample sites improved when the new TPGs are used.

The advantage of this method is that it simulates actual short-counts in Manitoba, and the evaluation of the new and old TPGs can be conducted based on these actual counts.

A shortcoming of this method is that the selection of the sample short-count is based on random sampling, and in this analysis only two short-count periods were selected for each sample permanent counter to simulate actual field counts. The AADT estimates can vary if a different short-count was selected for another period. Further analysis is required to analyze all possible short-count periods and to determine the effect of these count periods on the resulting AADT estimates.

In addition, due to the nature of low volume roads and the number of these roads in the province, the results of this method can vary particularly if the estimate is for a low volume road. The analysis is best suited for higher volume roads.

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CHAPTER 6

New Methodology for Assigning Short-Term Count Sites to TPGs and Control Stations

This chapter develops a new procedure for assigning Manitoba's short-term count sites to appropriate traffic pattern groups (TPGs) and control stations.

6.1 Introduction

Short-term counts are expanded to AADT estimates using a control station or a TPG. In order to do this, the short-count site must first be assigned to a control station and a TPG which are most appropriate for that short-count site. The problem with this assignment process is that unlike permanent counters, the traffic patterns at short-count sites are unknown. The short-count is typically counted for a period of 48-hours twice during a given year, and based on these counts it can be difficult to determine the traffic pattern at that site.

This chapter develops a transparent procedure for assigning Manitoba's short-count sites to appropriate TPGs and control stations.

6.2 The Current Method

The current method for assigning short-count sites to TPGs and control stations involves identifying the short-count location on a map and relating this site to a control station and a TPG which are "believed to be" most representative of the short-count site. This procedure is based only on subjective human judgment which can result in inconsistent assignments. In addition, this method is not transparent and the reason for selecting a particular TPG or control station for a short-count site is not

recorded. As a result, poor quality AADT estimates may be produced at those sites which were assigned to an inappropriate TPG and/or control station.

Other highway agencies [Ref. 6, 7] have expressed similar concerns regarding the assignments of the existing short-count sites in their jurisdictions. Highway agencies indicated that this is an area in which much of the uncertainty in AADT estimates on provincial highways arises. These highway agencies also indicated that it is difficult to justify the current assignments since the procedure of assigning short-counts to more appropriate TPGs was conducted many years ago and was not documented. It was indicated that a thorough review of short-term count assignments to pattern groups should be conducted to confirm the current assignments.

6.3 Review of Literature

There has been little research in the area of determining the most appropriate TPG and control station for a short-count. The main contributors of research in this area have been by Dr. S. Sharma and researchers from the University of Regina, and Dr. Gary Davis and researchers from the University of Minnesota. The existing literature by these individuals indicates that in order to produce reliable and accurate estimates of AADT from short-count sites, large amounts of data are required.

Sharma and Allipuram [Ref. 2] developed a method for determining the TPG which best fits the pattern of traffic counts taken at a short-term count site using Minnesota data. In this method, short-count sites are assigned to the most appropriate TPG based on an index of assignment effectiveness (IAE). An IAE of 100 percent indicates that the short-count site was assigned to the correct traffic pattern group, and an IAE of 0 percent means that the assignment is poor. This method is systematic, however it requires large amounts of short-term count data to be effective in determining which TPG is most appropriate for a short-count site. The study found

that two or more one-week duration counts would be needed to give an assignment effectiveness of greater than 90 percent.

Similar conclusions were drawn by Davis (1996) [Ref. 4] who found that two full-week counts (i.e. 14 days) from two different but well-chosen months are needed to reliably identify the TPG to which a short-count belongs. Davis also found that three sets of five-day duration counts (i.e. 15 days) consisting entirely of weekdays gave unreliable results.

In these studies, it was found that in order to produce reliable and accurate estimates of AADT from short-count sites, large amounts of data are required. Based on this literature review, the current short-count program in Manitoba which is typically of two 48-hour duration counts is not appropriate for determining what is the best TPG which fits the pattern at the short-count site. More short-counts during different times of the year to provide a seasonally balanced traffic volume sample would be required to determine the actual traffic pattern at any short-count site [Ref. 2]. As a result, the assignment of short-count sites to TPGs and control stations has to be based on other characteristics of the short-count site. This chapter develops a new "transparent" methodology for assigning short-count sites to TPGs and control stations.

6.4 Development of a New Assignment Methodology

The proposed method of assignment is based on the geographic characteristics of the highway on which the short-count site is located, and does not utilize data that has been collected from the short-count site.

To develop the new method, the geographic characteristics of permanent counting stations and the traffic patterns at these sites are first examined. The analysis in Chapter 5 found that many permanent counters in the same TPG exhibit similar geographic characteristics. For example, PTH 1 (TransCanada highway) which runs

west of Winnipeg, through Regina, and further west across Canada exhibits moderately higher summer traffic compared to winter traffic, and a steady increasing hourly pattern which is relatively the same for both weekdays and weekends. This pattern can be found along the sections of PTH 1 which do not lie adjacent to population centers. The sections of highways which lie adjacent to population centers are characterized by relatively flat seasonal patterns, and high morning and afternoon peaking characteristics. Highways which lead to mainly recreational destinations are characterized by very high summer peaks, and weekend traffic volumes which are higher than weekday traffic volumes. Similarly, the patterns on other highways can also be characterized by their geographic locations. Table 5-3 in Chapter 5 describes the geographic characteristics of the permanent counting stations in each of the TPGs. This finding was also shown by Lucas (1996) who indicated that many of Manitoba's permanent counters which are located on similar geographic locations exhibit the same traffic pattern. Hence, knowledge of the geographic characteristics of a site are useful in determining the most appropriate TPG and control station for a short-count site.

Based on these site characteristics, the proposed method is developed by applying the same knowledge about short-count site locations to determine the most likely traffic pattern which can be observed at that site. This method involves identifying the short-count site on a map and determining its geographic location, such as its proximity to population centers, recreational destinations, or whether it lies on a route that serves longer trip purposes, for example PTH 1.

Once the geographic characteristics of a site has been determined, the method guides the user through several steps in order to select the most appropriate TPG and control station for that short-count site.

The proposed method is best shown by a flowchart, which can guide a user through the entire assignment process. These flowcharts are shown in Figures 6-1 (a) and (b), the steps are summarized below:

1. Identify the short-count site on a provincial highway map.
2. Determine its location relative to activity areas such as the City of Winnipeg, other population centers (Dauphin, Roblin), and recreational destinations (Whiteshell Provincial Park, beach areas, Riding Mountain National Park).
3. Determine if the short-count site is located on a route that leads to one or more of these activity areas by referring to the highway map.
4. Determine if there are any major intersections that lie between the short-count site and the activity area. (This procedure assumes that traffic patterns can change at an intersection since traffic can either enter or exit from the highway at this location, therefore creating a different traffic pattern).
5. Based on the above information, assign the short-count site to the indicated TPG and select the control station which lies closest to the short-count site that also exhibits the same traffic pattern.

This method can be shown by an example. Consider short-count Station 1165 located on Highway 17, 2.4 kilometers east of PTH 7 as shown in Figure 6-2. In order to select the most appropriate TPG for this site, the user begins by referring to Flowchart 1 shown in Figure 6-1 (a). The steps in the assignment process are described below:

1. Is the STC located on a route which leads directly to PTH 100/101 (the perimeter highway surrounding Winnipeg)? --- *No.*
2. Is the STC located on a route that is directly connected to another route which leads to PTH 100/101? --- *No.*
3. Go to Chart 2.
4. Locate population centers (other than the City of Winnipeg) that lie closest to the STC location --- *in this case, the town of Teulon, Manitoba is located closest to the short-count site.*
5. Is the STC located on a route that leads directly to one or more of the above population centers? --- *Yes.*
6. Is there an intersection between the STC location and the population center? - *No.*
7. Is the STC located on a route that also leads to a recreational destination? --- *Yes.*
8. Based on the answers which were provided, the flowchart identifies the most appropriate TPG for Station 1165 to be Prairie Group 5.
9. To select the control station for Station 1165, four immediate choices are apparent - Stations 16, 4, 75 and 76, as shown on the map. Since the short-count site has already been assigned to Prairie Group 5 and none of the four permanent counters exhibit this pattern, no control station is assigned to this site.

Figure 6-1 (a)

Flowchart 1 for Assigning Short-Count Sites to TPGs and Control Stations

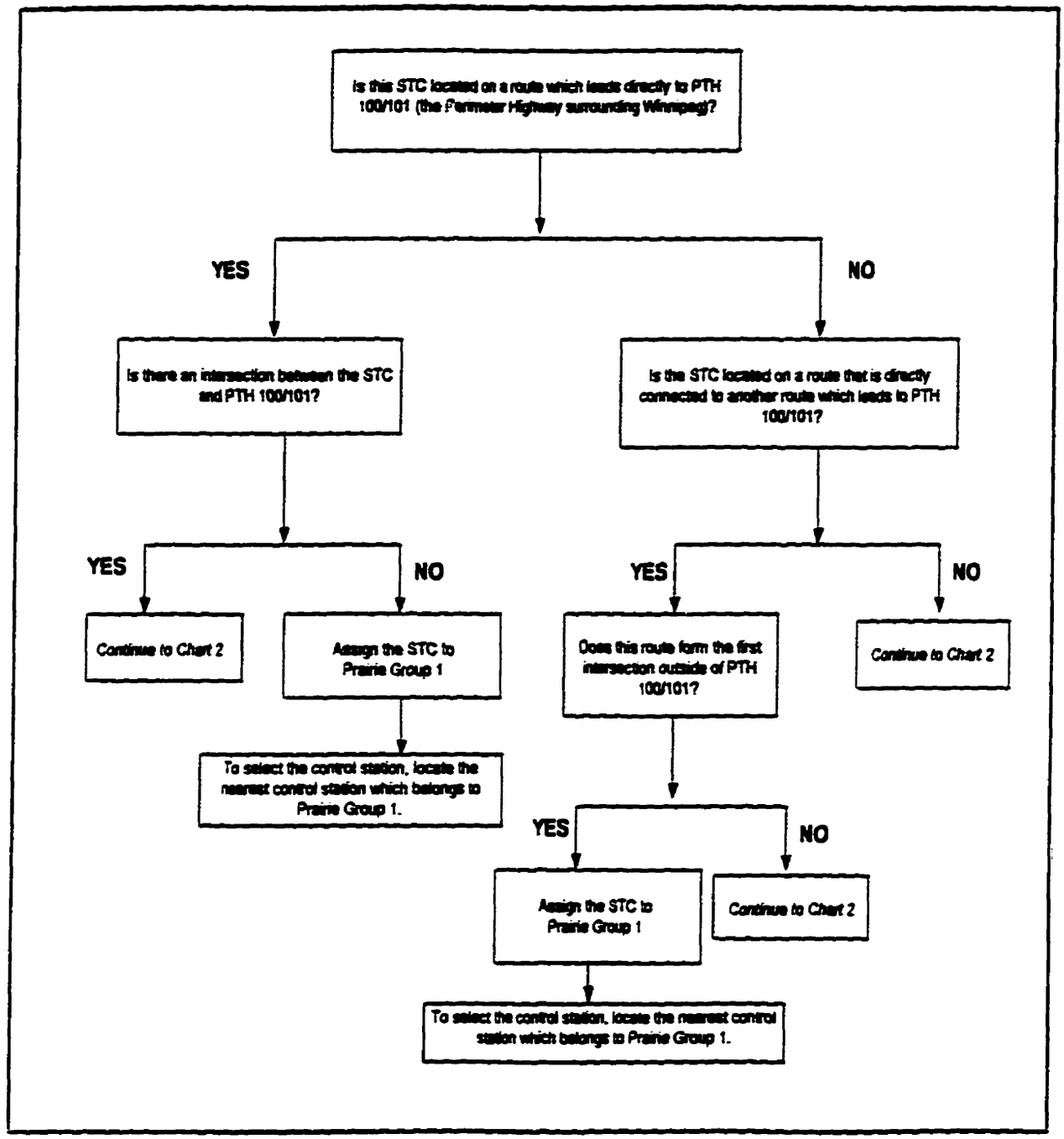


Figure 6-1 (b)

Flowchart 2 for Assigning Short-Count Sites to Appropriate TPGs and Control Stations

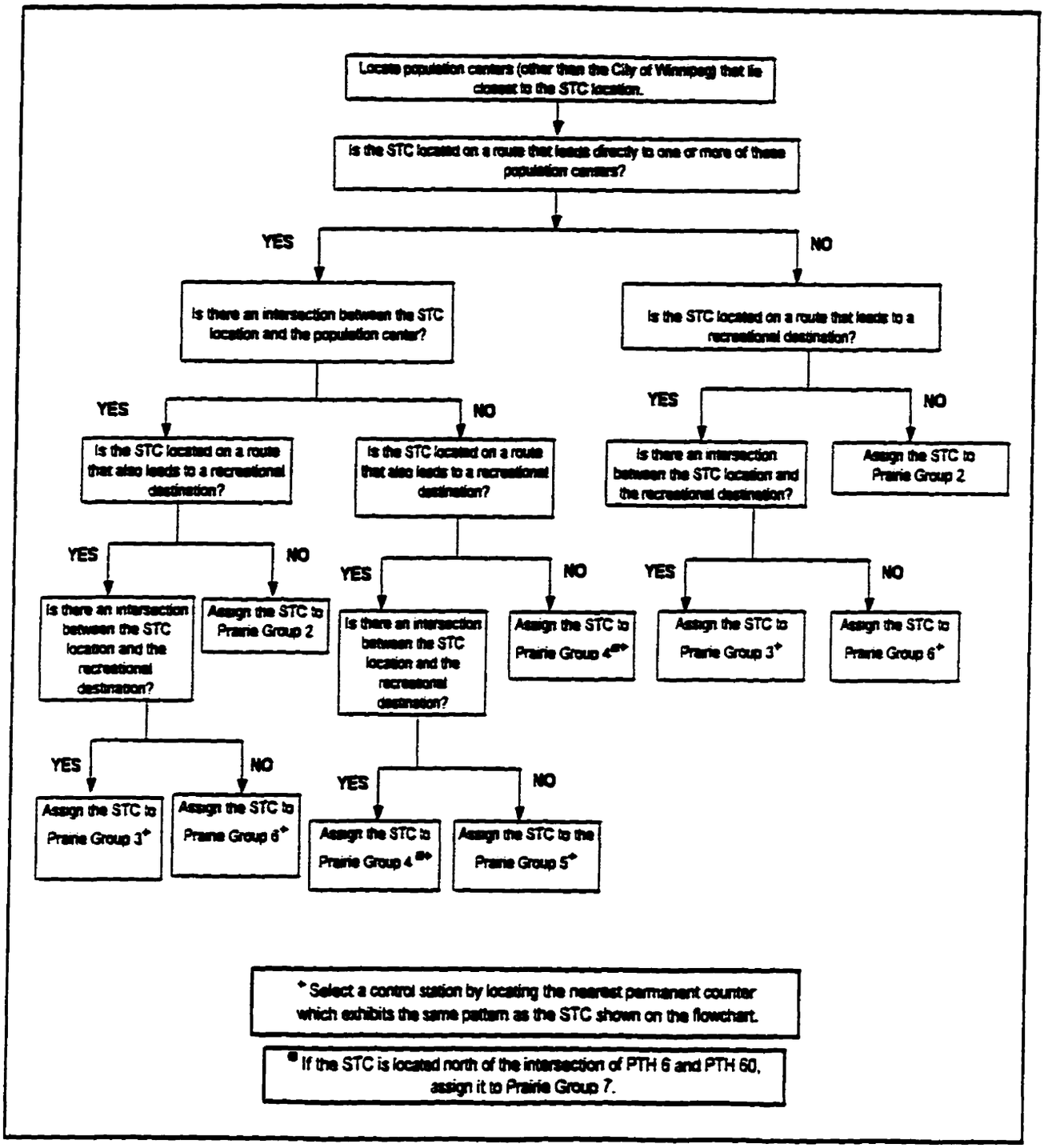


Figure 6-2

Location of Short-Term Counting Station 1165 and Surrounding Control Stations

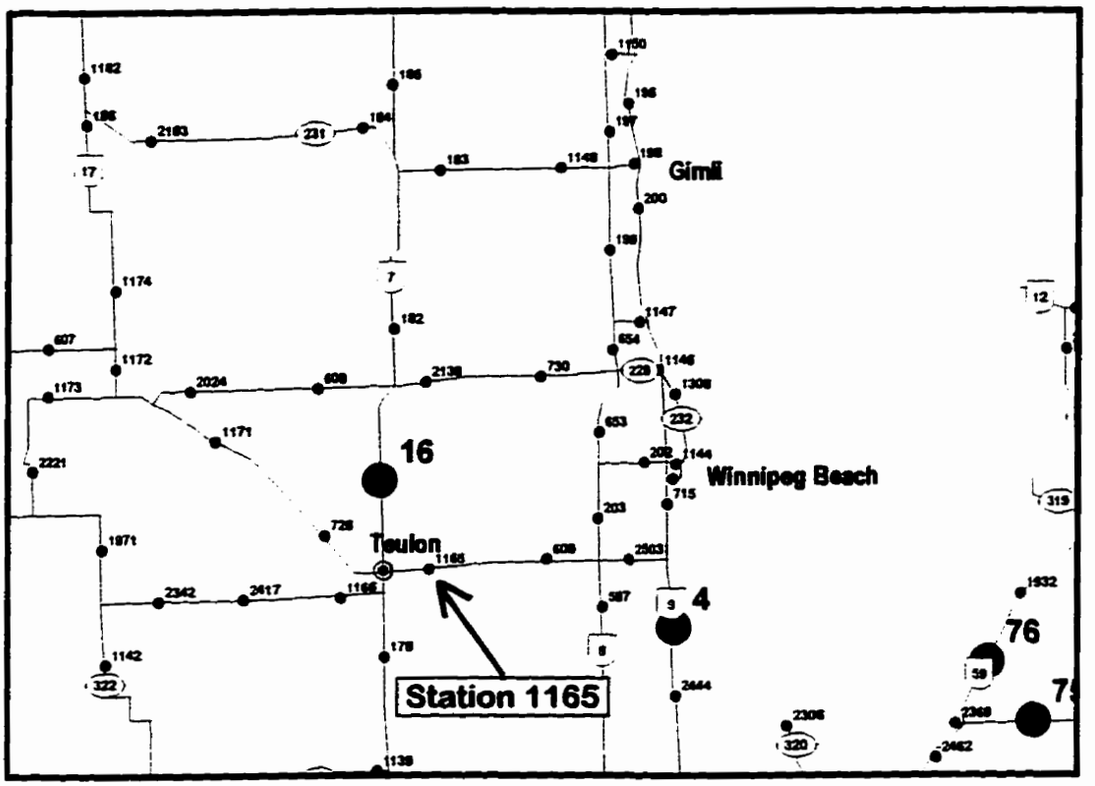
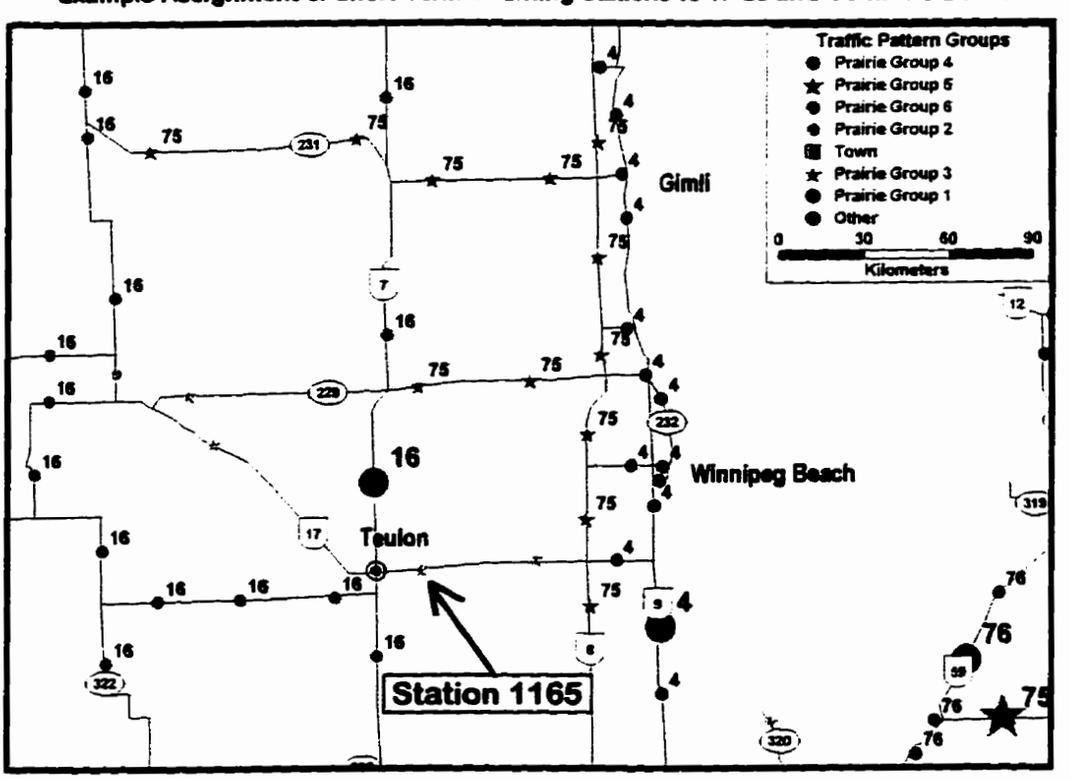


Figure 6-3

Example Assignment of Short-Term Counting Stations to TPGs and Control Stations



Source: University of Manitoba Transport Information Group

1997-03-29

Other short-count sites in the same area are shown in Figure 6-3. The same procedure was used to select the most appropriate TPG and control station for these sites, and these are shown in Figure 6-3. In this figure, each colour represents a different TPG and the number labeled beside the short-count site represents the control station which was selected for that site. As shown, the majority of the sites that lie on highways closest to the Winnipeg Beach area, for example on PTH 9 and PR 232, are assigned to Prairie Group 6 which exhibits the highest seasonal rise of all the groups. These routes are used mainly for summer recreational travel. The sites represented by the green stars indicate a moderate degree of seasonal variation and belong to Prairie Group 3, for example PTH 8. These routes serve longer trip purposes as well as carry a significant component of summer traffic. Other sites which lie closest to population centers for example, Teulon, Manitoba, are assigned to Prairie Group 4 which has a flat seasonal pattern, and higher afternoon peaks during the weekday representing more of a commuter pattern.

This example shows that the new method can be used to assign short-count sites to appropriate TPGs and control stations. The advantages of the proposed method are:

- Sites can be systematically and efficiently assigned to the most appropriate TPG and control station;
- The selection of a TPG and control station for any short-count site can be better justified;
- A rule-base can be maintained which keeps a record of the rules that were used to assign a particular short-count site to a TPG and a control station.
- The rule-base can be modified to further refine the assignment process. For example, one method of enhancing the rule-base is by involving traffic engineers from different districts to incorporate knowledge about routes in the different districts.

The disadvantages of this method are:

- The new method requires some judgment on the part of the analyst in selecting an appropriate control station. Further research should be conducted to relate short-count sites to control stations.
- The new method is based on TPGs that were developed from 1995 permanent counter data. These traffic patterns should be evaluated periodically and if any new traffic patterns emerge the rules must be modified to take this into account.

- The assignment process is not based on actual count data. In order to verify the assignments, more short-counts over different seasons would be required.
- The new method assumes that the traffic patterns can change at an intersection, and hence can assign two sites located on the same highway on either side of an intersection to different TPGs. In reality, the traffic patterns at the two sites may not be different. Judgment should be made for sites which fall into this category.

6.5 Assigning Short-Term Count Sites using the New Method

The new method was used to assign the 2013 short-count sites in Manitoba to a TPG and control station. Appendix D lists the new assignments as well as the former assignments for each short-count site. In this method, permanent counters based in Manitoba and Saskatchewan could be assigned as control stations. In those cases where a Saskatchewan-based control station is selected, a second control station based in Manitoba was also identified to facilitate future comparisons between both methods. This differs from the previous method which only uses Manitoba-based permanent counters as control stations.

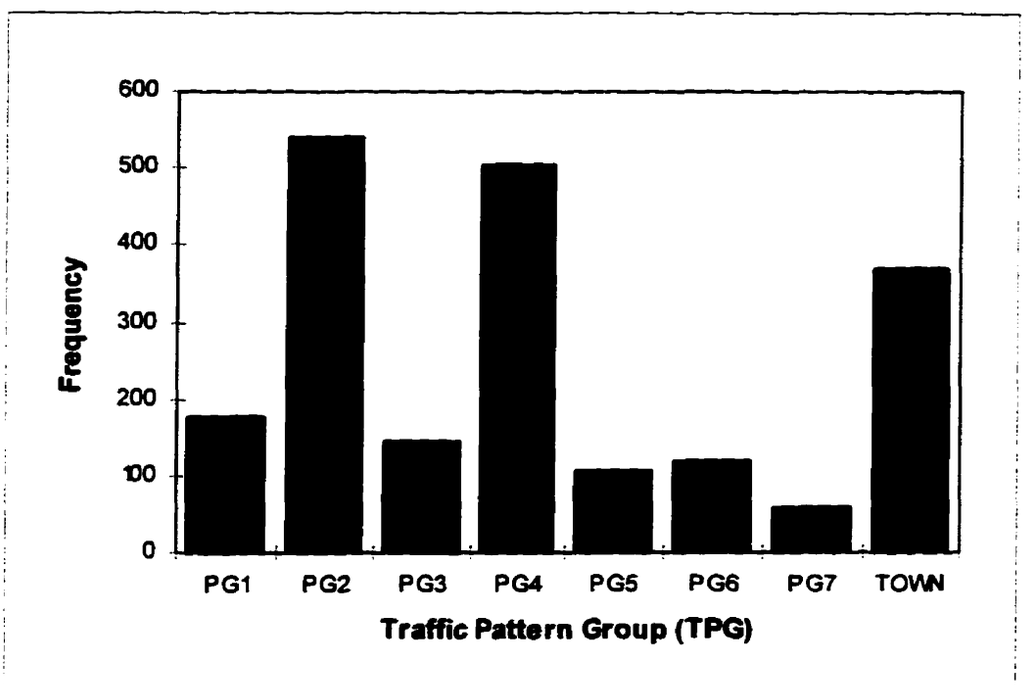
Figure 6-4 shows a frequency graph of the number of short-count sites which were assigned to each new TPG. This figure shows that the majority of Manitoba's short-count sites are assigned to Prairie Group 2 (27 percent) and Prairie Group 4 (25 percent). Prairie Group 2 (PG2) consists of highways which have a moderate seasonal rise and steady traffic throughout the weekdays and weekends. These highways are not located close to population centers or recreational destinations, rather they serve mainly longer trip purposes. Examples include PTH 1, PTH 75, PTH 59, and other provincial trunk highways that serve longer trip purposes.

Prairie Group 4 (PG4) consists of highways that lie adjacent to rural population centers such as Neepawa (MB), Roblin (MB), Prince Albert (SK), Yorkton (SK), and other rural population centers.

In addition, a significant number of sites are also located within towns (TOWN). Currently, town counts are not expanded to AADT using the same method as short-term counts because there are no control stations that are located within towns. Town

Figure 6-4

Frequency of Short-Count Sites' Assignments to TPGs



counts are reported at the end of the year as the actual counts (tube counts are corrected first using the axle correction factor) divided by the number of days when the count was conducted.

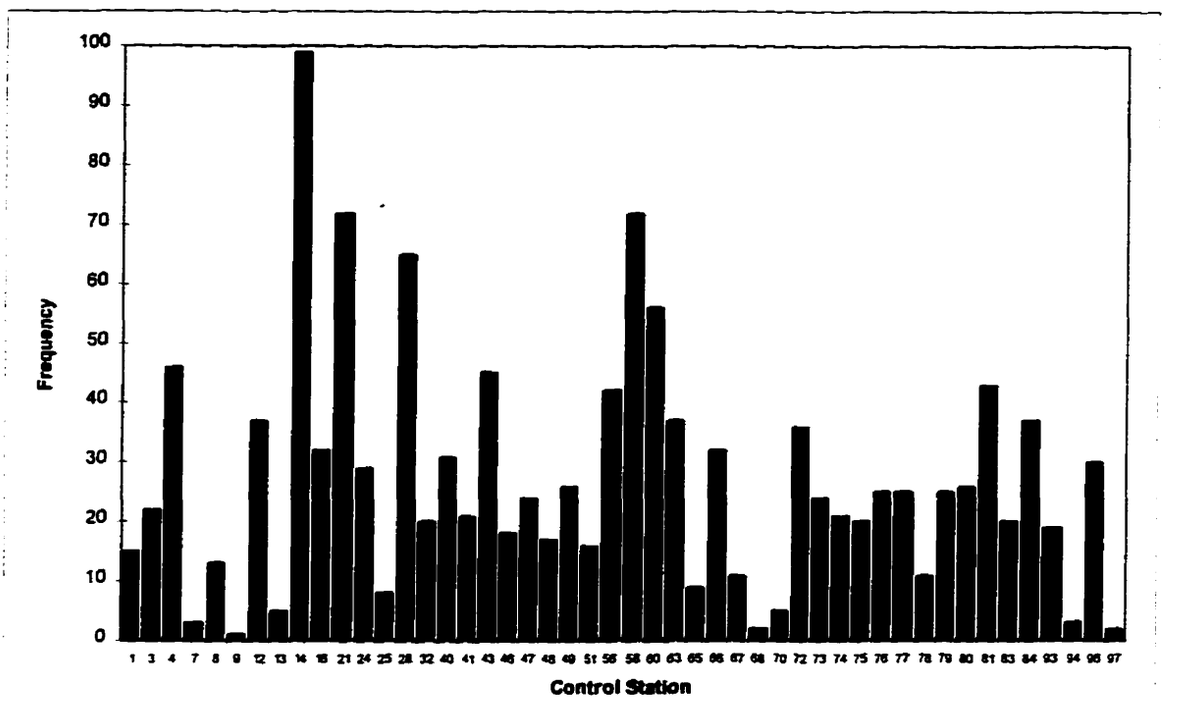
The least frequently assigned TPG is Prairie Group 7, which represents a unique pattern found in Northern Manitoba near The Pas.

Figure 6-5 shows a frequency graph of the number of short-count sites which are assigned to each control station. This figure shows that the most commonly assigned control station is Station 14 located on PTH 12, 3.7 kilometers south of PR 303, and

which belongs to Prairie Group 4. This follows from the previous graph which showed that Prairie Group 4 was one of the most frequently assigned TPGs.

Figure 6-5

Frequency of Short-Count Sites' Assignments to Control Stations



Other frequently assigned control stations include Station 58 (six-percent, belongs to Prairie Group 4), 21 (six-percent, belongs to Prairie Group 5) and 28 (five-percent, belongs to Prairie Group 4). The three least frequently assigned control stations were Station 9 (Prairie Group 1), Station 68 (Prairie Group 2), and Station 97 (Prairie Group 5).

Based on the new method, 11 out of the 2,013 short-count sites in Manitoba were identified as having a more appropriate control station which is located in Saskatchewan. Most of these sites are located on routes which lead to the Duck Mountain Provincial Park and have been assigned to Station 92 in Saskatchewan, which is also located on a route (Highway 57) that leads to the same destination.

Hence, Station 92 was selected as being the most appropriate control station for these short-count sites.

During the re-assignment process, several problems were found with the existing assignments including:

- 24 percent of the sites had no control station identified.
- 21 percent of the sites were assigned to a TPG which did not match that of its control station.
- 6 percent of the sites were assigned to a control station which had been removed.

Finally, engineering judgment must be used in order to identify a more appropriate TPG and/or control station for any particular site. The rules are meant to be used as a systematic method of assigning the numerous short-count sites in Manitoba to a TPG and control station that best reflects that of the short-count site based on its geographic characteristics.

Chapter 6 References

1. Lucas, Brian. "Design, Development and Implementation of the Manitoba Highway Traffic Information System". M.Sc. Thesis. University of Manitoba, 1996.

2. Sharma, Satish C. and Allipuram, Reddy R. "Duration and Frequency of Seasonal Traffic Counts". Journal of Transportation Engineering, Vol. 119, No. 3, May/June, 1993.

3. FHWA. *Traffic Monitoring Guide*. 1996.

4. Davis, Gary and Guan, Yuzhe. "Bayesian Assignment of Coverage Count Locations to Factor Groups and Estimation of Average Daily Traffic". Preprint, Transportation Research Board 75th Annual Meeting, January 7-11, 1996, Washington, D.C.

5. Anderson, Tom. Traffic Information Engineer. Planning and Coordination Branch, Saskatchewan Highways and Transportation. Personal communication throughout duration of research project.

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1. Davis, Gary A. "Accuracy of Estimates of Mean Daily Traffic: A Review". Transportation Research Board 76th Annual Meeting. January 12-16, 1997, Washington, D.C.

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CHAPTER 7

Summary, Conclusions and Recommendations

7.1 Summary

This research investigated three ways of enhancing AADT estimates on Manitoba's provincial highways: (1) utilizing human-intervention techniques to systematically evaluate provincial highway AADT estimates, (2) enhancing traffic pattern groups by using an expanded permanent counter database, and (3) developing a transparent methodology for assigning short-count sites to the most appropriate traffic pattern group and control station.

The three human-intervention techniques that were presented in this research included visual route consistency checks, comparison of current year AADT estimates with historical AADT estimates, and intersection balancing. These methods allows AADT estimates to be systematically evaluated, which in turn leads to the production of better quality AADT estimates.

The second technique for enhancing AADT estimates was based on developing new TPGs for the region consisting of the provincial highway network in Manitoba and Saskatchewan. This idea was based on the premise that traffic patterns on a highway are affected by the transportation, activity, and flow systems within the region and not by a political boundary that separates the two provinces. This research found that the new TPGs can improve AADT estimates for short-count sites in Manitoba.

Third, the research developed a transparent method for assigning short-count sites to TPGs and control stations. Appropriate traffic pattern groups and control stations are necessary to produce estimates of AADT which reflect actual highway traffic volumes. The former procedure is manual, highly subjective, not well-documented,

and can result in inconsistent assignments. The new method employs a rule-based procedure to identify the most appropriate TPG and control station for Manitoba's short-count sites. This method is transparent, efficient, and produces consistent results.

As part of this research, a survey of traffic data needs was conducted to determine the engineering needs for AADT estimates and related traffic data in the transportation profession in Manitoba and how well the current MHTIS is serving the needs of these traffic data users. The survey showed that AADT was the single most important traffic statistic to these individuals, and is considered essential for planning, design, and construction of highways, prioritizing projects, and for implementing appropriate traffic control devices.

7.2 Conclusions

1. AADT estimates that are produced through the current MHTIS can be systematically evaluated using human-intervention techniques. These techniques allow the identification of inconsistent AADT estimates, and can be automated to further improve the efficiency in checking these numbers. This is an improvement over the current system where no formal documented methods for evaluating AADT estimates have been made.

2. AADT estimates can be improved in quality by utilizing the new TPGs developed from Manitoba and Saskatchewan permanent counter data. The new traffic patterns are more representative of actual highway traffic patterns in this region, hence, allowing AADT estimates to be improved.

3. Manitoba's short-count sites can be assigned to appropriate TPGs and control stations using a more transparent rule-based procedure as described in this research. This procedure is reproducible and does not require subjective human-judgment to identify appropriate TPGs and control stations for the numerous short-count sites in Manitoba.

4. The survey of traffic data needs indicated that more users require more truck-related data in their functions. Currently, there is a lack of available and reliable truck data in the province. Many users indicated that more truck data, including vehicle classifications, vehicle weights, and truck percentages is required because

many decisions are currently being based on assumed values, and not on actual truck data on Manitoba's provincial highways.

5. Based on the survey of traffic data needs, the majority of traffic data users are less interested in traffic data on low volume roads. In general, these users consider roads to be of low volume if the AADT is less than 300 vehicles per day. Because of the nature of traffic on low volume roads, these users could tolerate a greater degree of uncertainty in traffic estimates for these roads compared to higher volume roads.

7.3 Recommendations

Based on the research, the following recommendations are made:

- The human-intervention techniques presented in this research should be automated to facilitate efficient evaluation of AADT estimates.

- More research should be conducted to develop formal, systematic computer-based human-intervention methods to evaluate AADT estimates from short-term counts as well as permanent counters in order to further enhance the quality of AADT estimates on Manitoba's provincial highways.

- Further research should also be conducted to evaluate other traffic estimates produced through the MHTIS, including ASDT, percent trucks, and 30th highest hour percentages.

- An integrated traffic monitoring system should be developed for Manitoba and Saskatchewan. The need for more accurate traffic estimates continue to grow over time as traffic data users are becoming more concerned over the quality rather than quantity of traffic data. One of the ways in which better quality AADT estimates can be achieved is by developing an integrated traffic monitoring system.

  An integrated system should be developed which can (1) improve the current level of traffic data quality on the region's provincial highways, as was shown in this research, and (2) reduce traffic monitoring costs. Better quality traffic data can be obtained by joining efforts for data collection and incorporating a standardized method for data analysis and reporting. Traffic monitoring costs can be reduced by removing existing count sites, and counting at fewer sites only where necessary. A joint system such as this can provide enhanced and highly useful traffic information which is critical for the operation of highway agencies. Possibilities for integration with other jurisdictions including the City of

Winnipeg Streets and Transportation Department, North Dakota, Minnesota, and Ontario should also be considered.

- The transparent methodology for assigning short-term counting stations to appropriate traffic pattern groups and control stations that was presented in this thesis should be validated and refined by involving input from traffic engineers in each district.

- The traffic patterns at short-term count sites should be confirmed by conducting these counts during different times of the year to obtain a seasonally balanced sample of short-counts.

- More truck data on major provincial highways is needed to serve the needs of many traffic data users. Currently there are 15 AVC/WIM sites in the province, and MDHT has recently purchased several new AVCs to increase coverage of classification count sites in Manitoba. These counters should be installed on routes which carry higher volumes of truck traffic.

- An improved method of obtaining reliable truck data from weigh-in-motion sites should be developed to allow better use of the data that is collected from these sites.

- Low volume roads should be counted less frequently since the majority of traffic data users are less interested in traffic estimates on these roads. In 1993, the *Design* report recommended that MDHT to count on low volume roads on a five year cycle due to the inherent variability in traffic volume at these locations. Since then, MDHTs short-count program has been changed and currently roads with AADTs of less than 200 vehicles per day are counted once every four years. However, as indicated in the needs survey, this counting plan still exceeds the needs of the majority of traffic data users. A five year counting cycle on roads with less than 300 vehicles per day would be adequate for the purposes of most of these traffic data users. This would permit more resources to be allocated for collecting and processing traffic estimates on higher volume roads.

- The traffic data needs of users should be periodically reviewed to (1) assess the performance of the MHTIS, and (2) keep informed about the current traffic data needs of users. This will allow areas of improvement and change to be identified in order for the system to better meet the needs of traffic data users in Manitoba. In this way, better quality traffic data estimates can be provided and unnecessary data can be eliminated, and the adequacy and level of coverage of the current traffic counting program can be assessed.

- More research in the statistical area should be conducted to further enhance traffic estimates on provincial highways.

APPENDIX A

Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

Table A-1

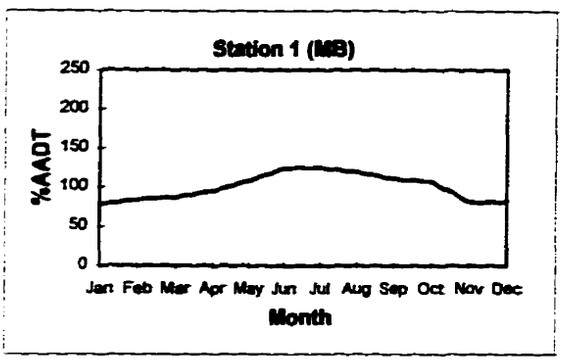
List of Permanent Counters in Manitoba and Saskatchewan Analyzed in this Thesis

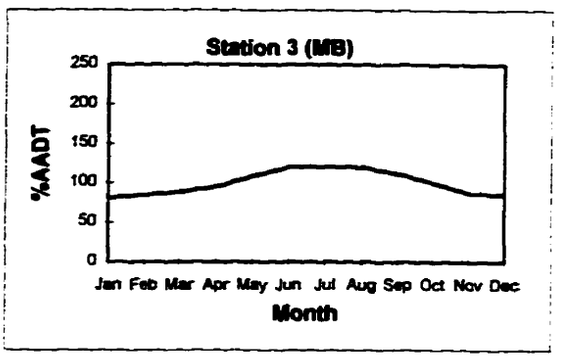
MANITOBA			SASKATCHEWAN		
PCS No.	Hwy. No.	Location	ATR No.	Hwy. No.	Location
1	8	1.4 KM S. OF P.R. #321	1	11	1.5 KM. W. OF JCT. #48
3	9	1.7 KM S. OF P.T.H. #27	2	1	6.0 KM. W. OF JCT. #6
4	9	SOUTH OF PTH 17	3	39	3.0 KM. SE. OF YELLOW GRASS
7	210	EAST OF P.T.H. #59	4	10	6.5 KM. E. OF BALCARRES
8	59	N. OF N. JCT. P.R. #210	5	11	5.0 KM. S. OF ROAD TO DUNDURN
9	75	1.1 KM N. OF P.R. #247	8	1	0.5 KM. W. OF JCT. #32
12	44	3.7 KM E. OF P.R. #215	9	16	1.5 KM. NW. OF ORCADIA
13	1	5.8 KM E. OF P.T.H. #12	10	48	3.0 KM. SE. OF DAVIN
14	12	3.7 KM S. OF P.R. #303	11	11	5.0 KM. E. OF JCT. #54
16	7	3.7 KM N. OF P.T.H. #17	13	7	8.0 KM. E. OF JCT. #4
21	10	1.6 KM N. OF P.R. #448	15	49	8.0 KM. E. OF JCT. #38
24	10	1.3 KM N. OF P.T.H. #1	16	38	8.0 KM. S. OF JCT. #49
25	1	WEST OF P.T.H. #41	17	4	1.5 KM. N. OF JCT. #13
28	21	3.2 KM N. OF P.T.H. #24	18	210	8.1 KM. N. OF JCT. HWY. #10
32	5	4.0 KM E. OF E. JCT. P.R. #274	20	4	1.5 KM. S. OF GLASLYN
40	2	2.4 KM E. OF P.T.H. #83	21	2	1.5 KM. N. OF JCT. HWY. #355
41	5	3.2 KM N. OF P.R. #583	22	1	5 KM. E. OF GRENFELL
43	16	3.2 KM E. OF E. JCT. P.R. #354	28	6	1.5 KM. S. OF JCT. #15
46	16	2.4 KM N. OF P.T.H. #1	34	44	6.0 KM. W. OF WARTIME
47	100	0.8 KM S. OF P.T.H. #1	36	36	2.0 KM. N. OF GALILEE
48	1	4.0 KM E. OF P.R. #332	38	38	N OF LIPTON
49	5	1.6 KM E. OF P.T.H. #20	39	33	SE OF FRANCIS
51	3	0.3 KM S.W. OF P.T.H. #2	40	40	1.0 KM. W. OF JCT. #29
56	3	3.2 KM E. OF N. JCT. P.T.H. #83	41	41	NE OF ABERDEEN
58	34	0.8 KM S. OF P.R. #449	42	55	SW OF GREEN LAKE
59	325	WEST OF P.T.H. #6	43	3	W OF PRINCE ALBERT
60	6	S. OF S. JCT. P.R. #325	44	11	NE OF ROSTHERN
63	75	5.1 KM SOUTH OF P. R. #210	45	5	E OF WATSON
65	1	WEST OF MACGREGOR	46	322	1.6 KM. NW OF SILTON
66	2	EAST OF NESBITT	71	106	MILE 75 OF HANSON LAKE ROAD
67	4	WEST OF SELKIRK BR.	74	9	10.5 KM. N. OF HUDSON BAY
68	320	CONNECTING RTE - SELKIRK BR. TO PR 320	75	10	10.0 KM. NE. OF JCT. #1
70	100	W. END OF RED RIV. BRIDGE	91	20	NW OF CRAVEN
72	10	SOUTH OF P.R. #287	92	57	SW OF DUCK MOUNTAIN PARK
73	287	EAST OF P.T.H. #10			
74	1	WEST OF ONTARIO BDRY			
75	317	EAST OF P.T.H. #59			
76	59	NORTH OF P.R. #317			
77	101	1.1 KM W. OF P.T.H. #59			
78	59	SOUTH OF BIRDS HILL PARK ENTRANCE			
79	1	4.3 KM W. OF P.T.H. #5			
80	16	0.8 KM. E. OF SASK. BDRY.			
81	13	2 MILES S. OF OAKVILLE			
83	50	1.3 KM S. OF PR 265			
84	10	3.8 KM S OF S JCT #10A (ETHELBERT)			
93	313	EAST OF P.R. #315			
94	315	NORTH OF P.R. #313			
96	10	SOUTH OF P.R. #357			
97	357	EAST OF P.T.H. #10			
Total Number of MB Sites = 49			Total Number of SK sites = 34		
Total Number of Sites Analyzed = 83					

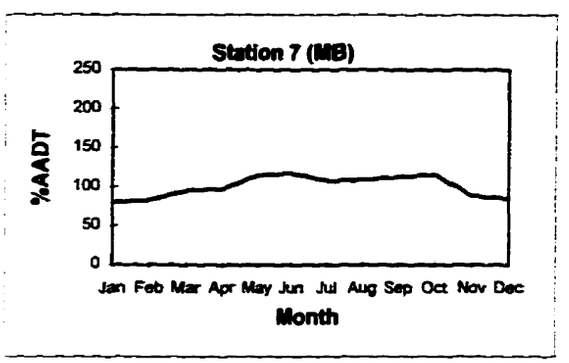
Figure A-1

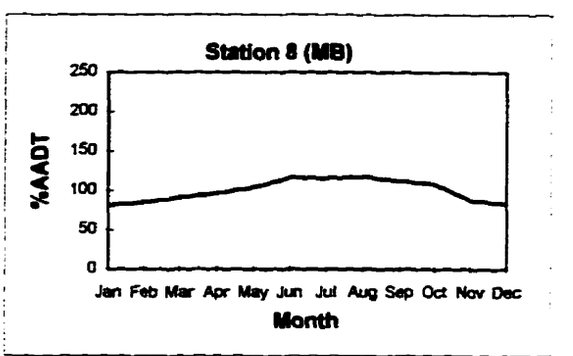
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

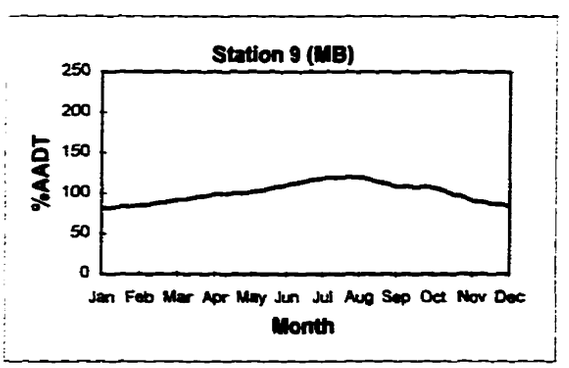
Prairie Group 1

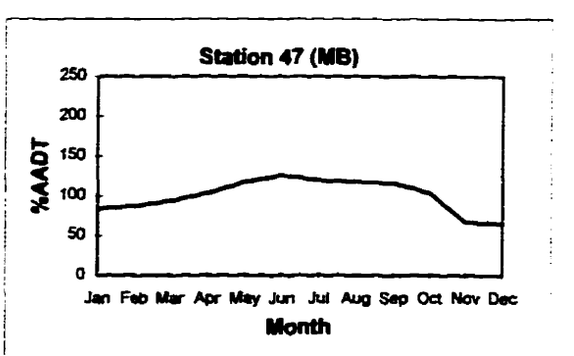


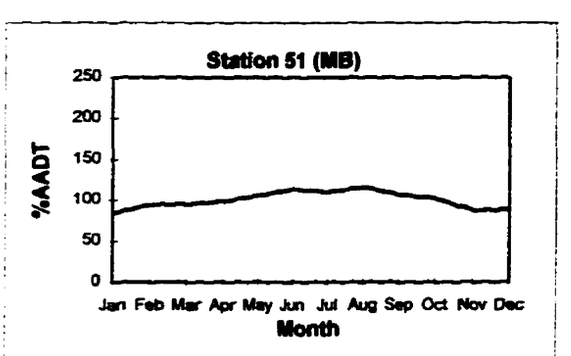












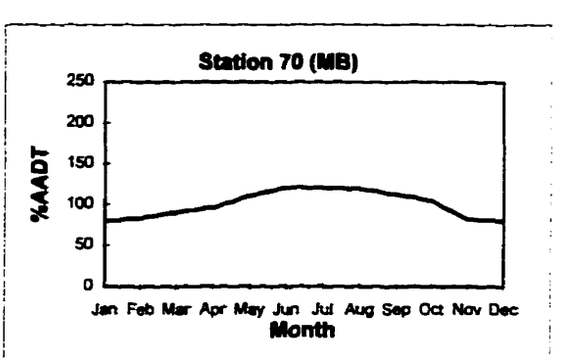
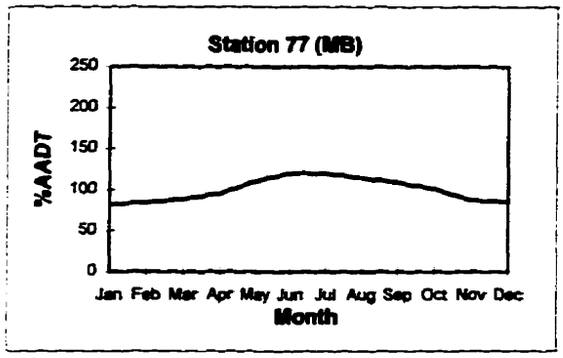
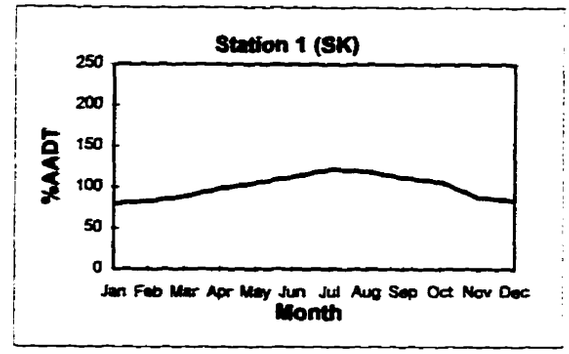


Figure A-1 (continued)

Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 1 (continued)





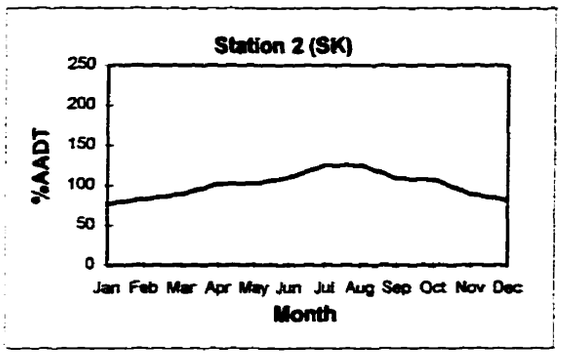


Figure A-1 (continued)

Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 2

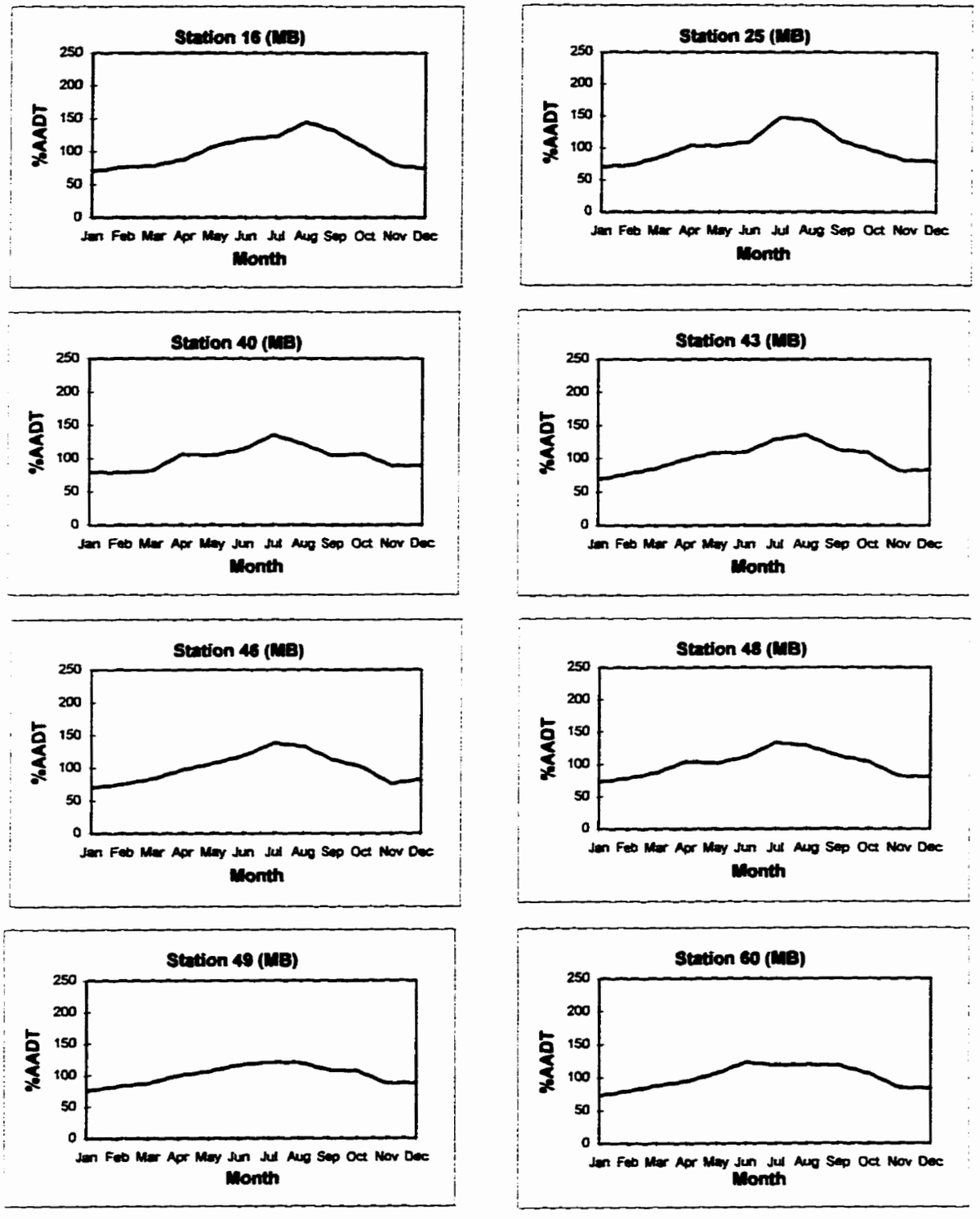


Figure A-1 (continued)

Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 2 (continued)

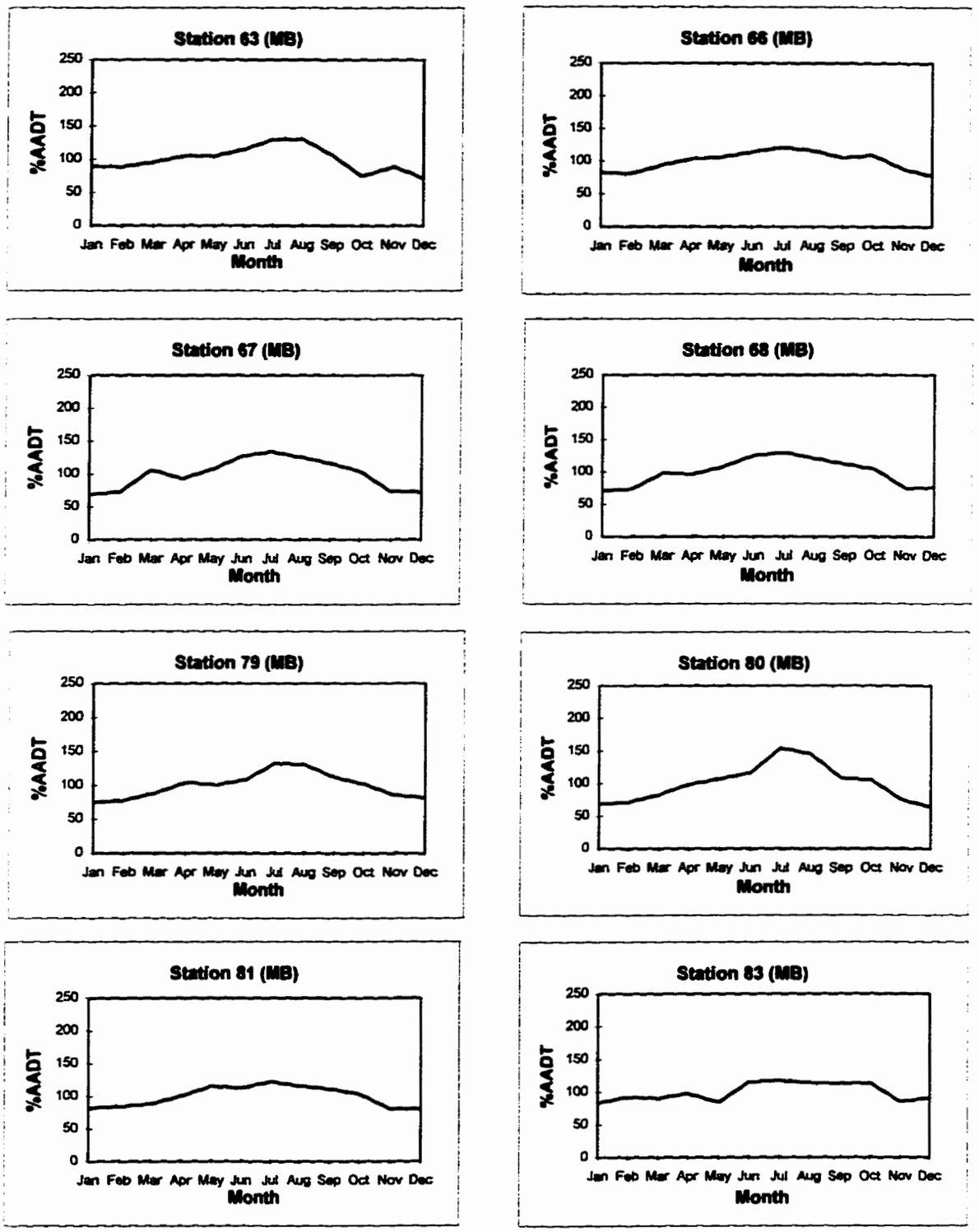
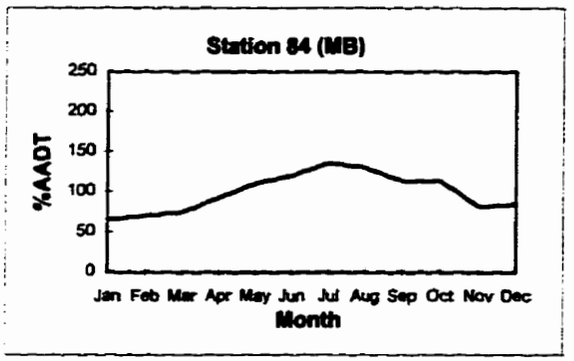
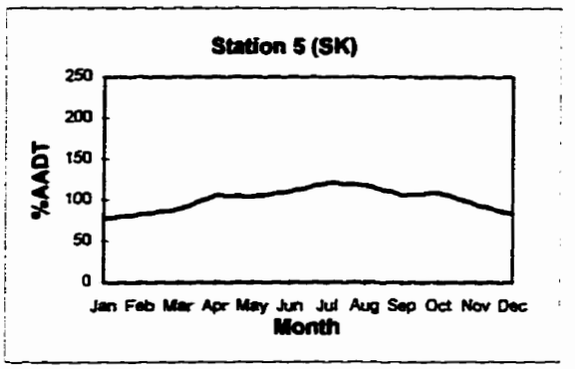


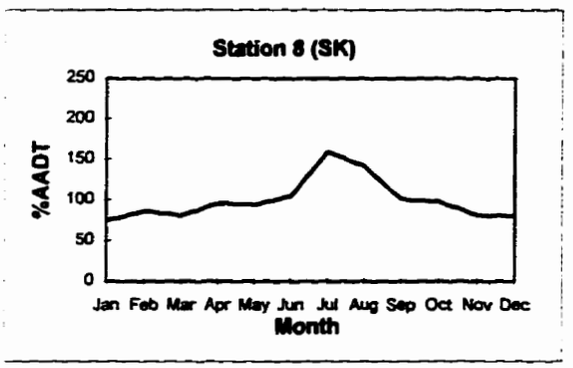
Figure A-1 (continued)

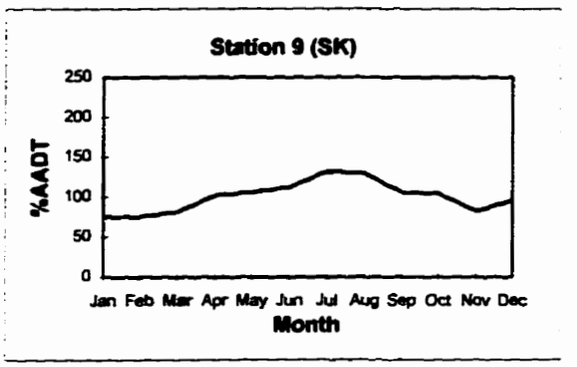
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

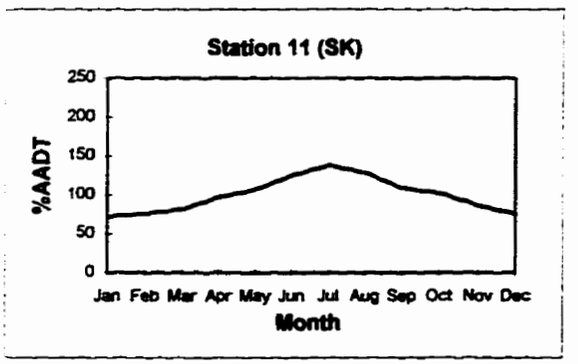
Prairie Group 2 (continued)

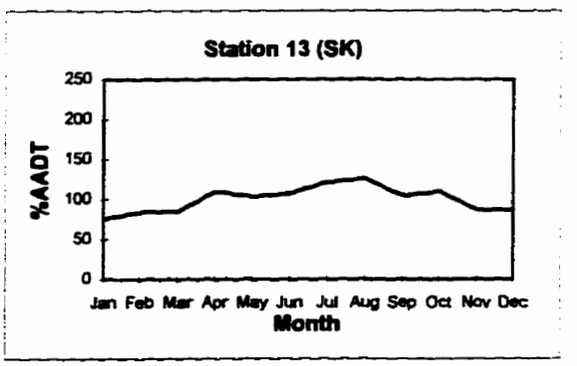


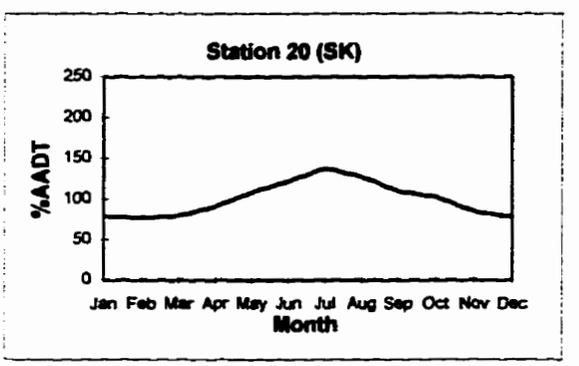












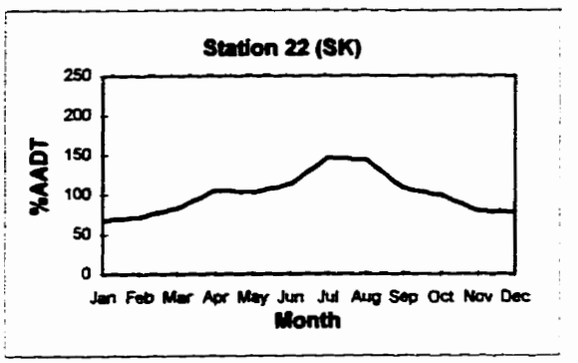
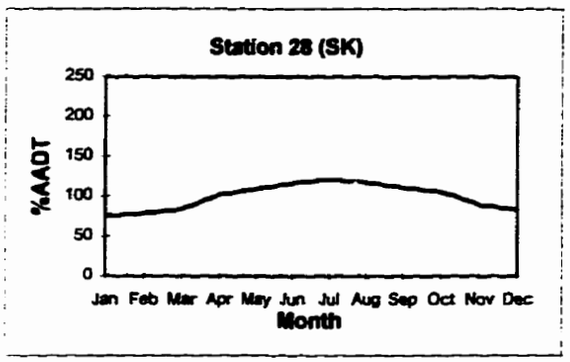
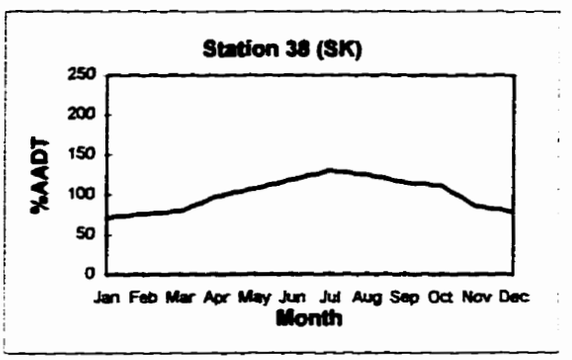


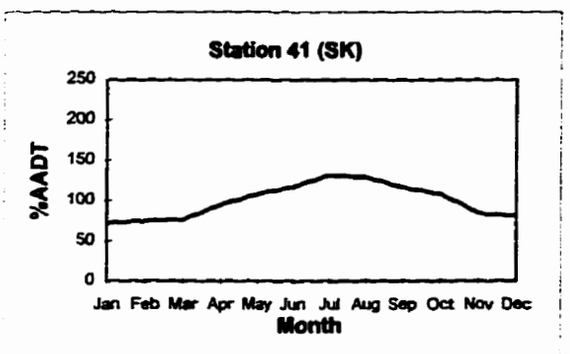
Figure A-1 (continued)

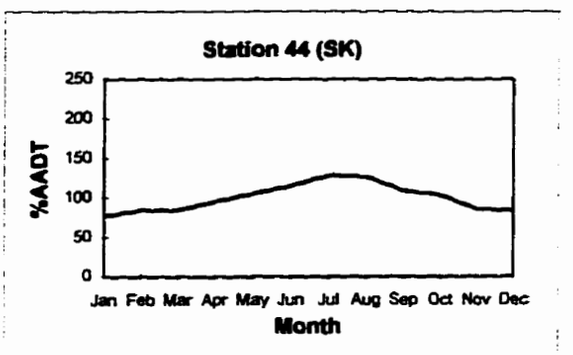
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

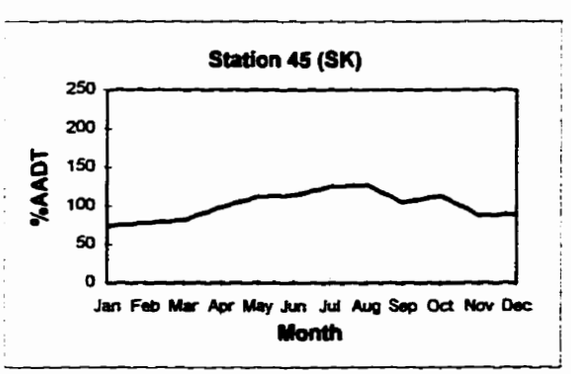
Prairie Group 2 (continued)











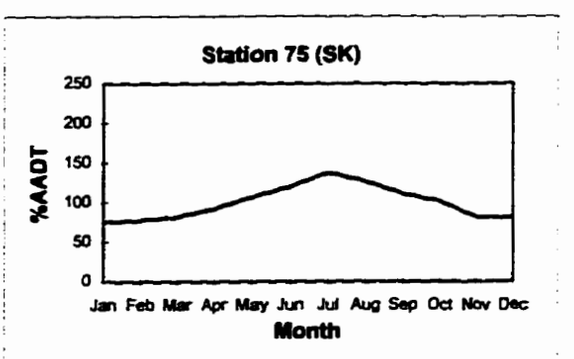
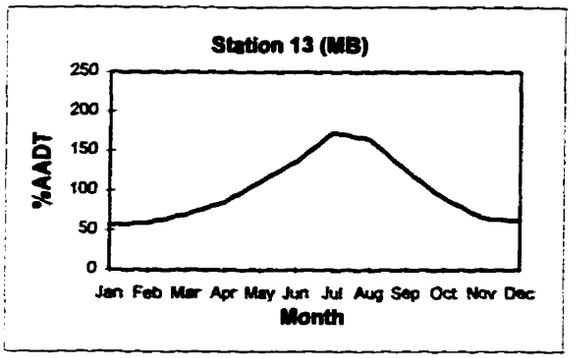
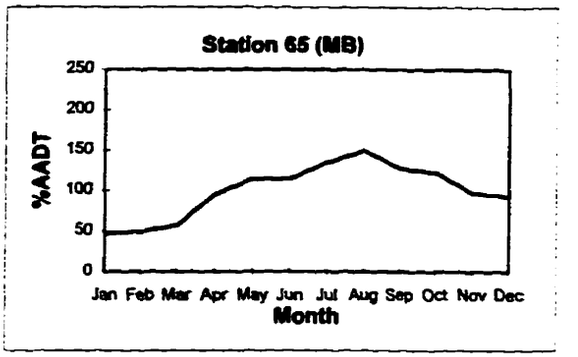


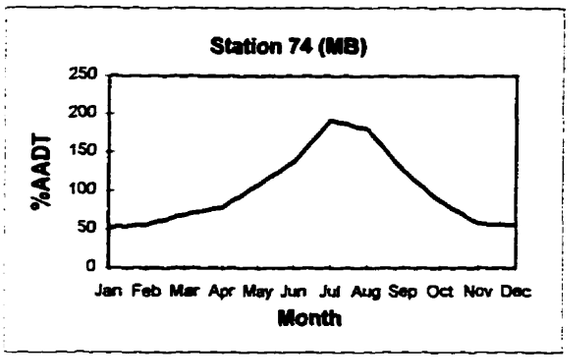
Figure A-1 (continued)

Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 3







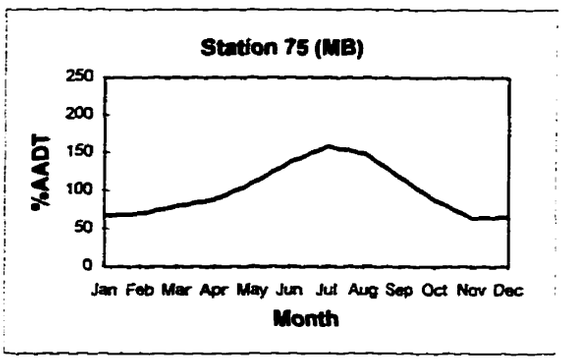
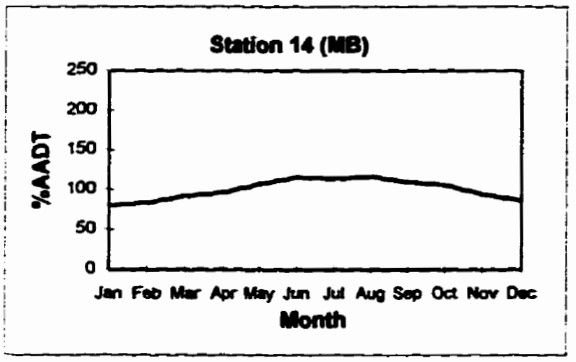
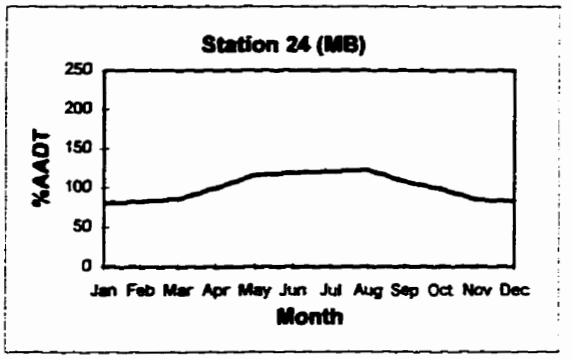


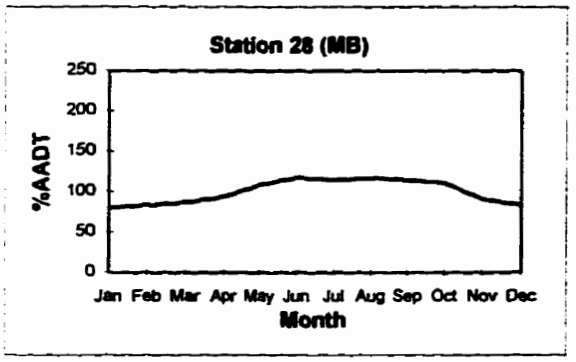
Figure A-1 (continued)

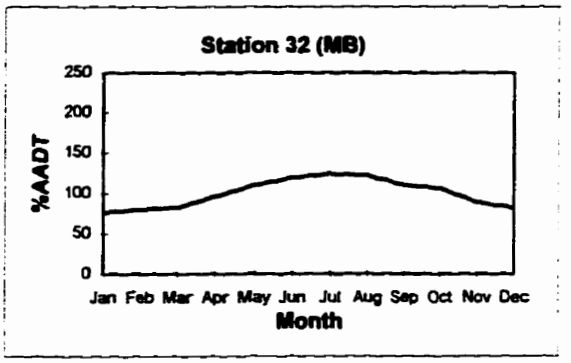
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

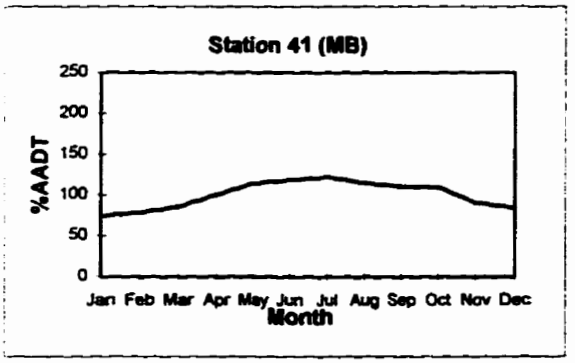
Prairie Group 4

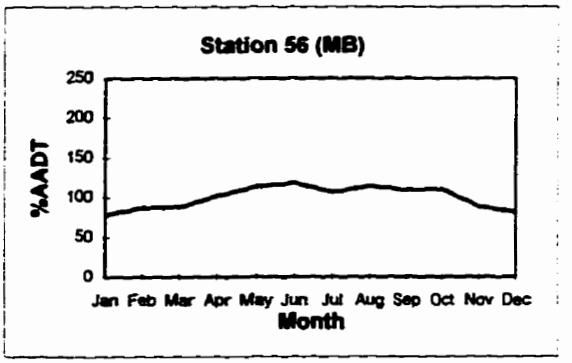


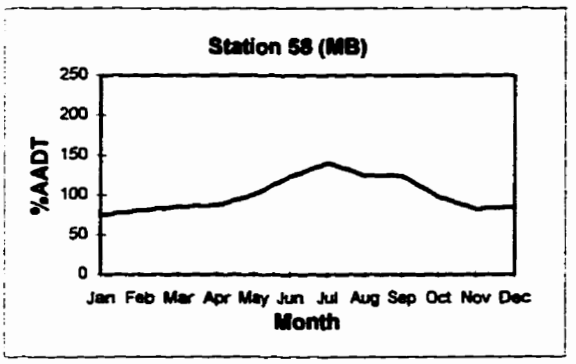












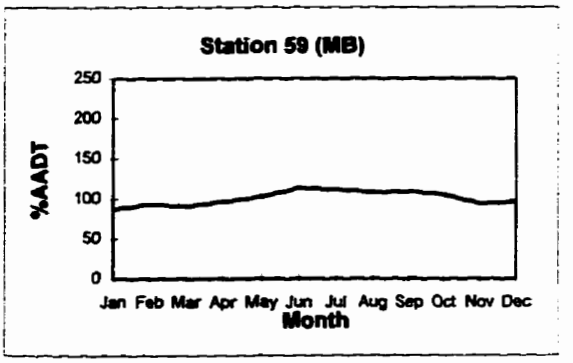
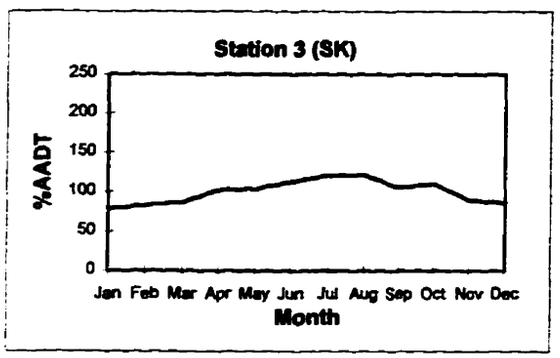
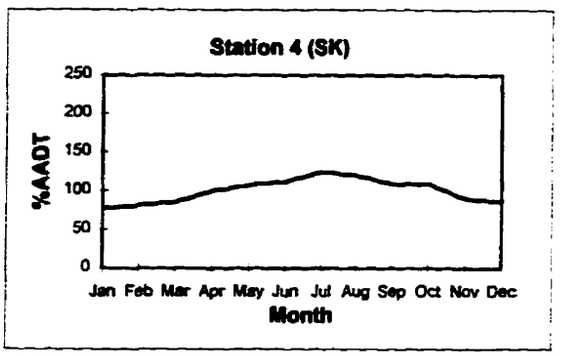


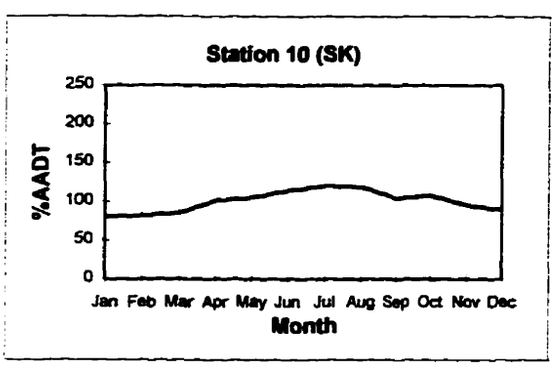
Figure A-1 (continued)

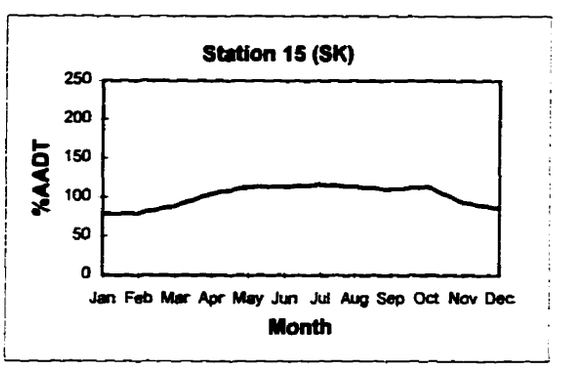
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

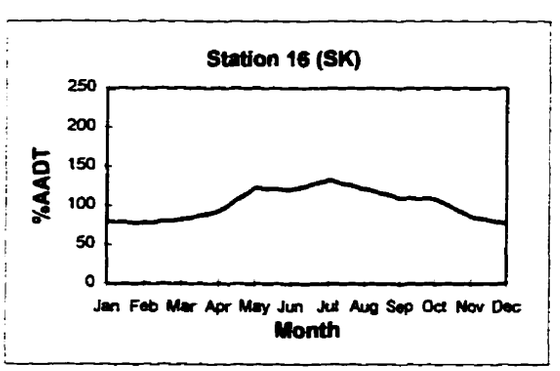
Prairie Group 4 (continued)

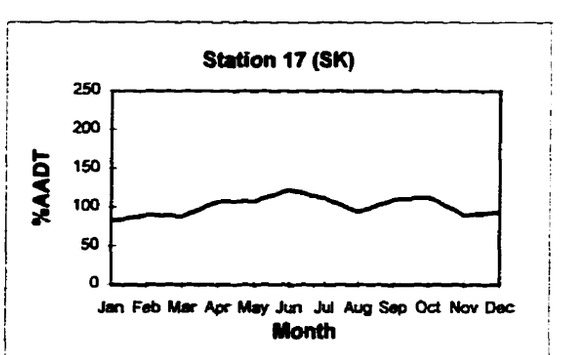


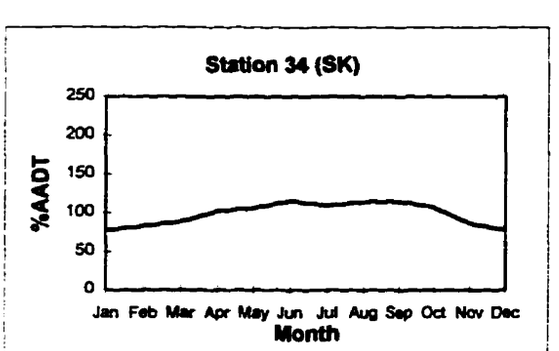












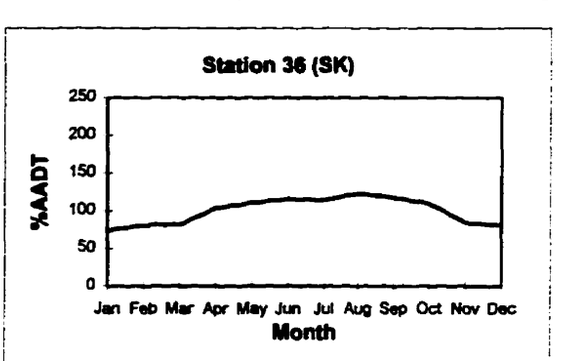
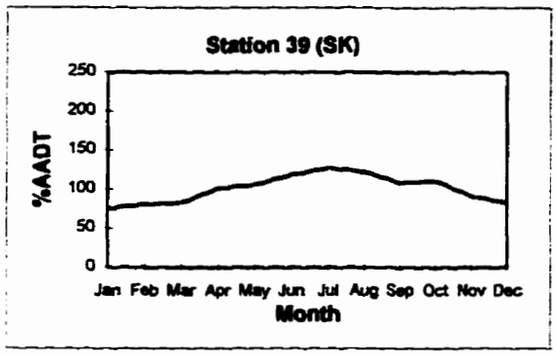
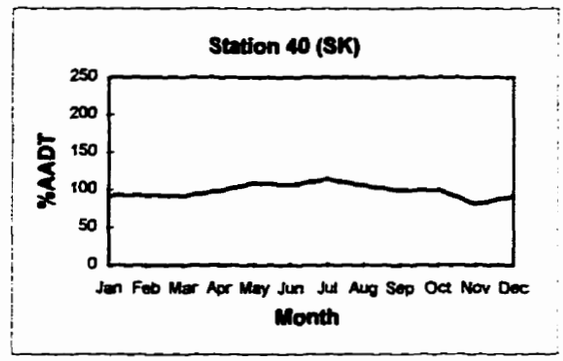


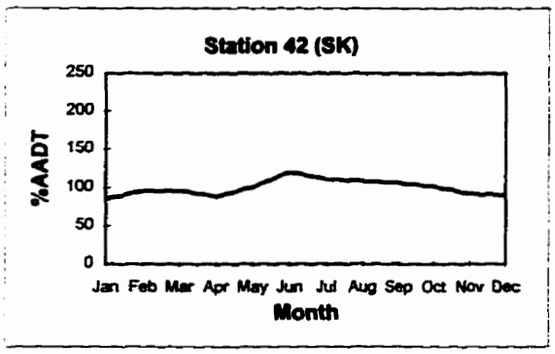
Figure A-1 (continued)

Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 4 (continued)







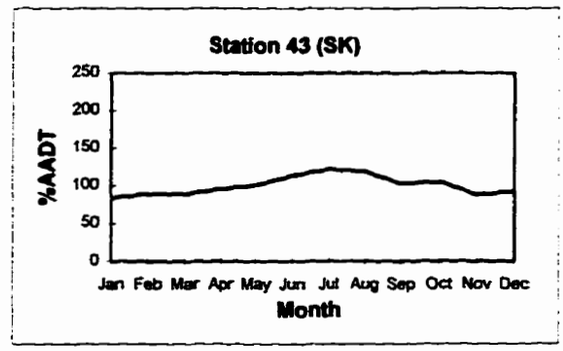
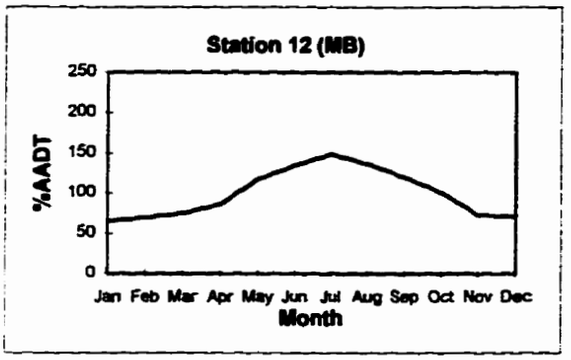
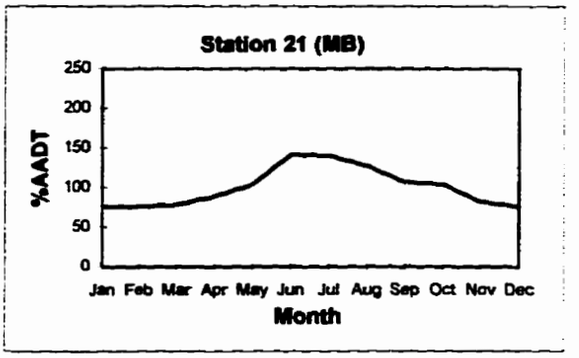


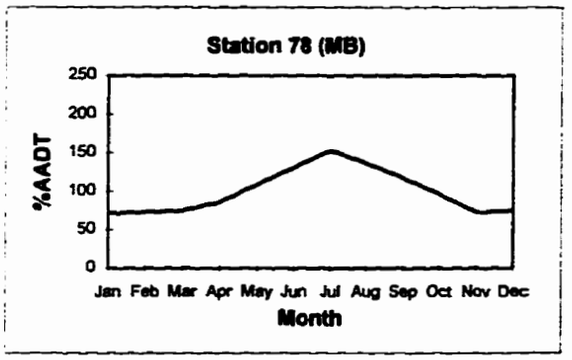
Figure A-1 (continued)

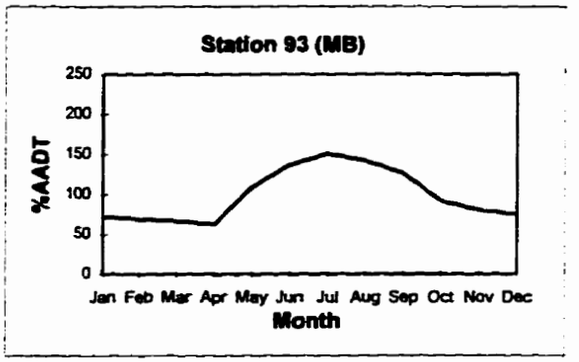
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

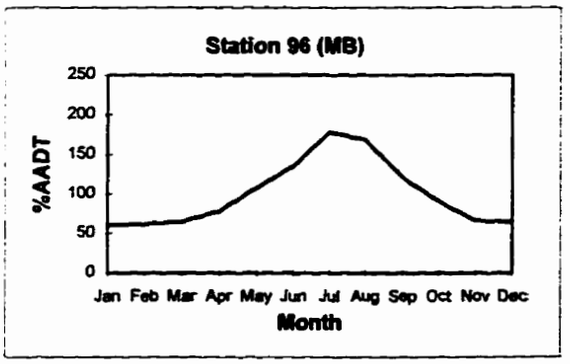
Prairie Group 5

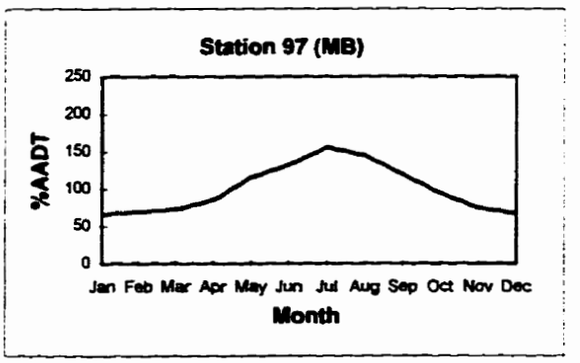












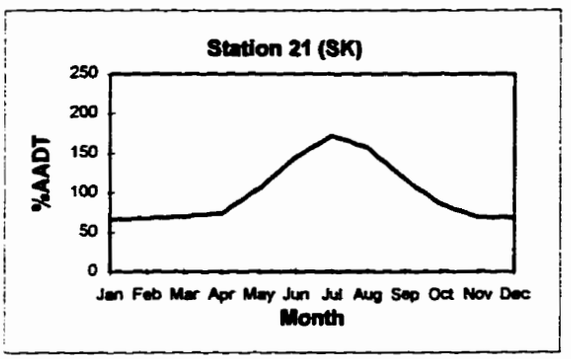
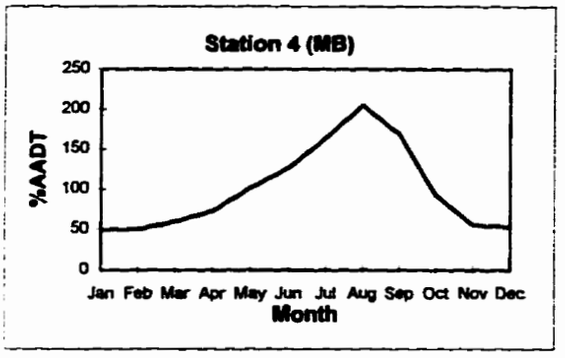
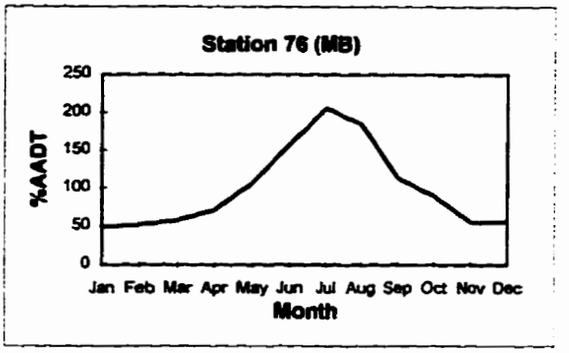


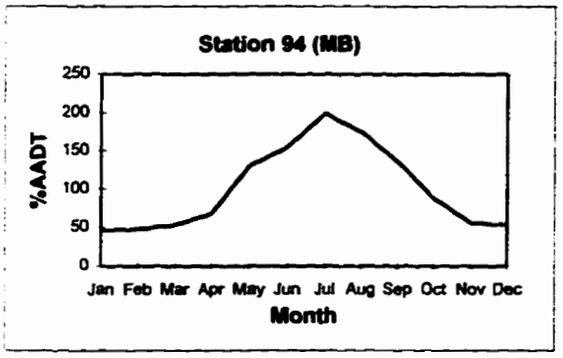
Figure A-1 (continued)

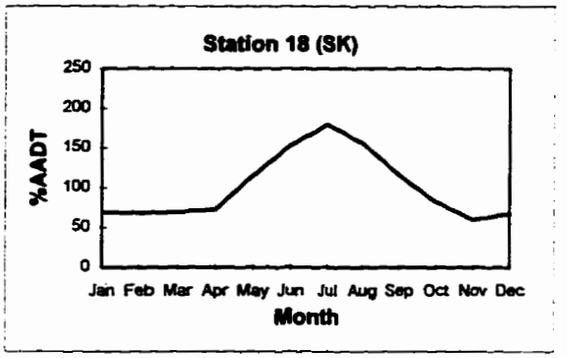
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

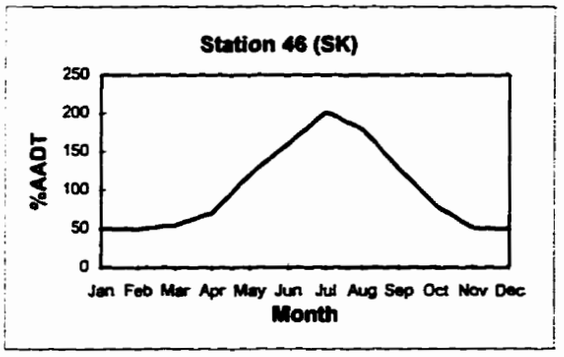
Prairie Group 6

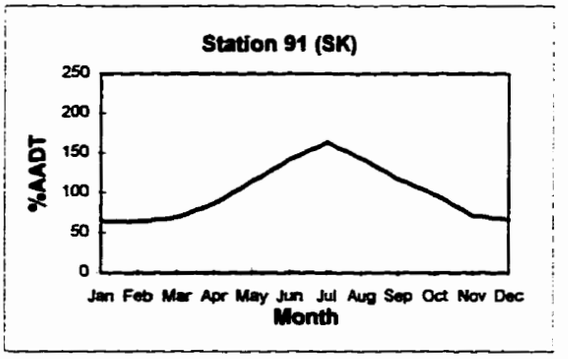












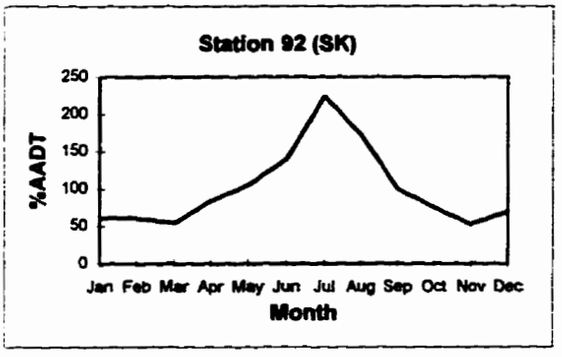
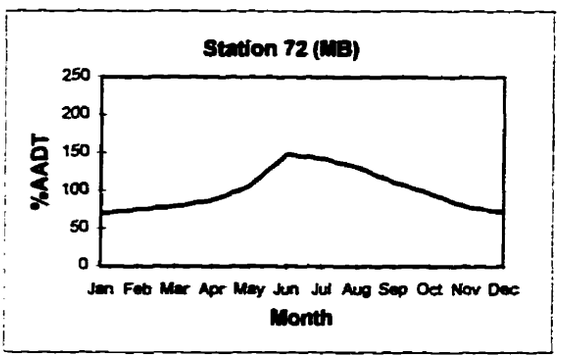
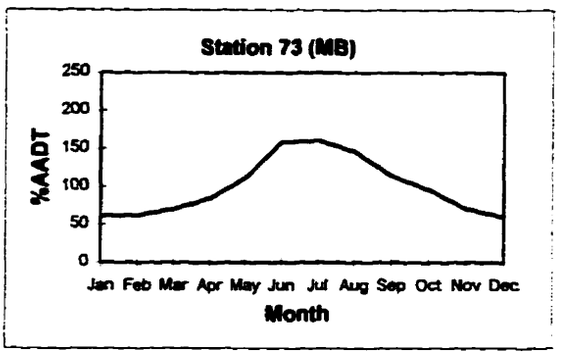


Figure A-1 (continued)

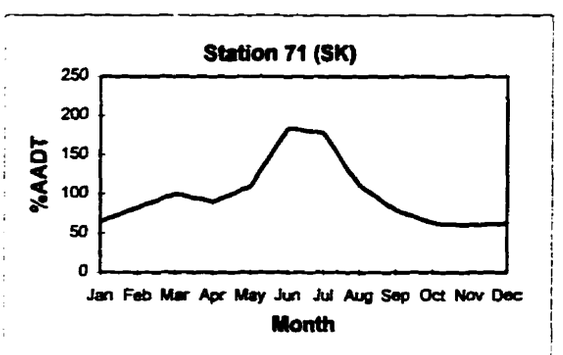
Seasonal Traffic Variations at Permanent Counters in Manitoba and Saskatchewan (1995)

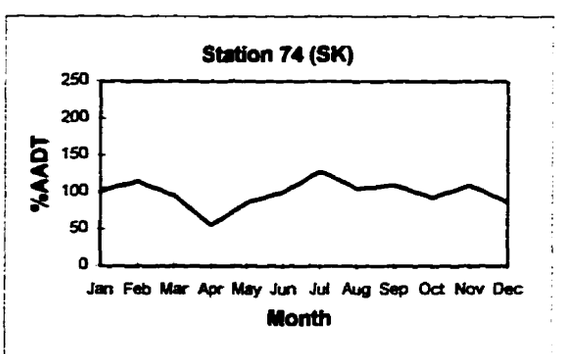
Prairie Group 7





Ungrouped Sites





APPENDIX B

Average Hourly Traffic Variations at Permanent Counters
in Manitoba and Saskatchewan (1995)

Figure B-1

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 1

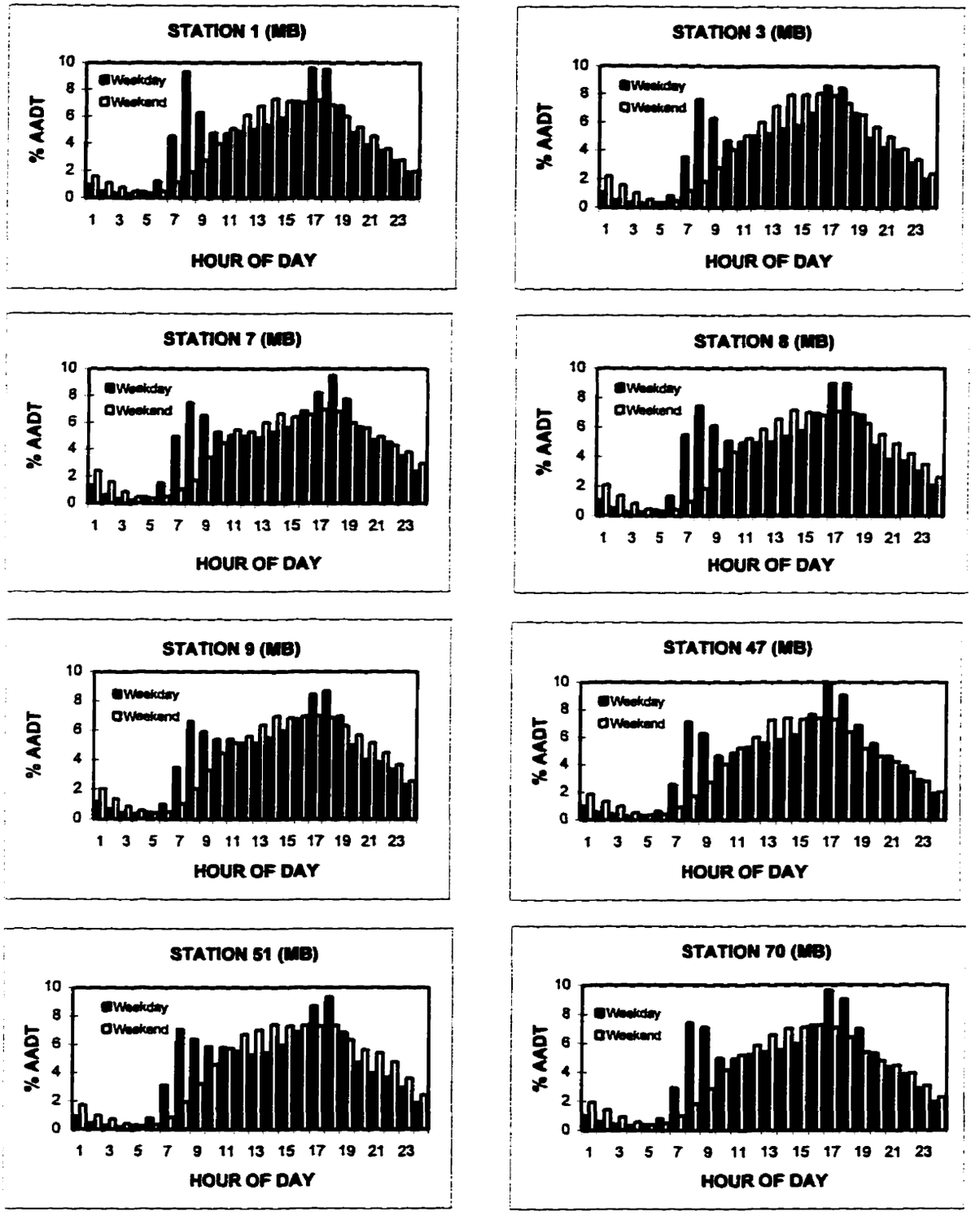
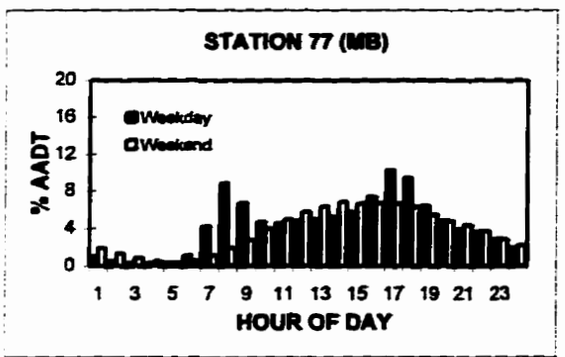
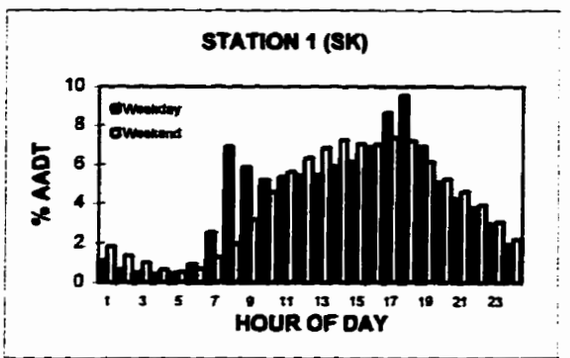


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 1 (continued)





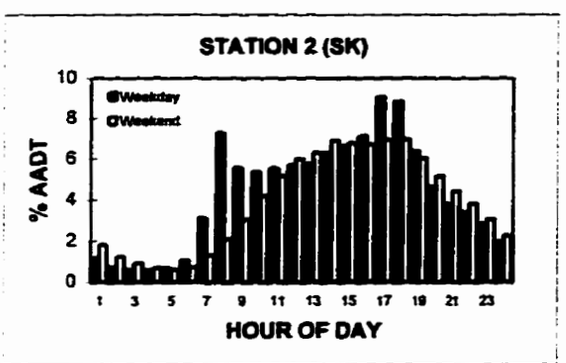


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 2

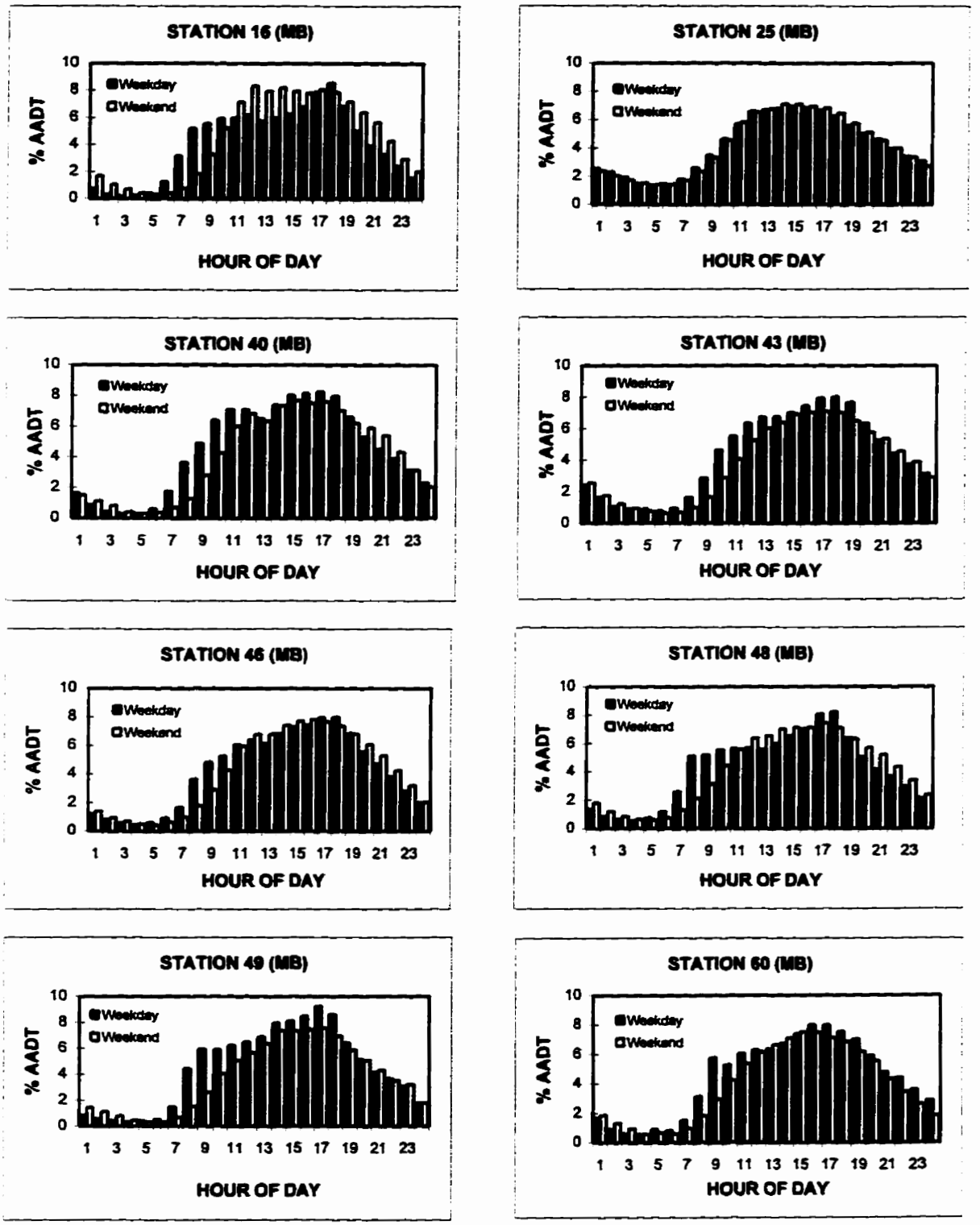


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 2 (continued)

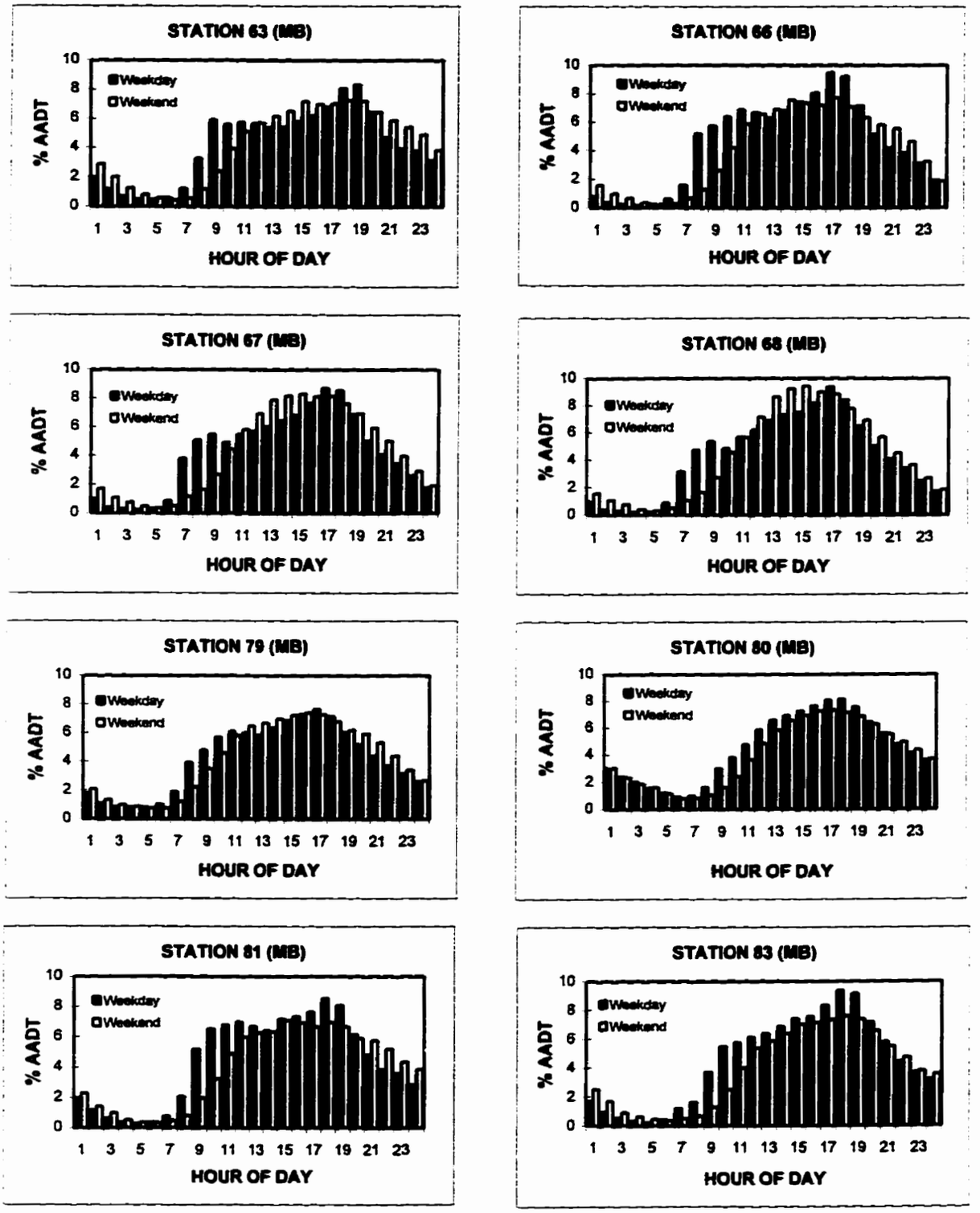


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 2 (continued)

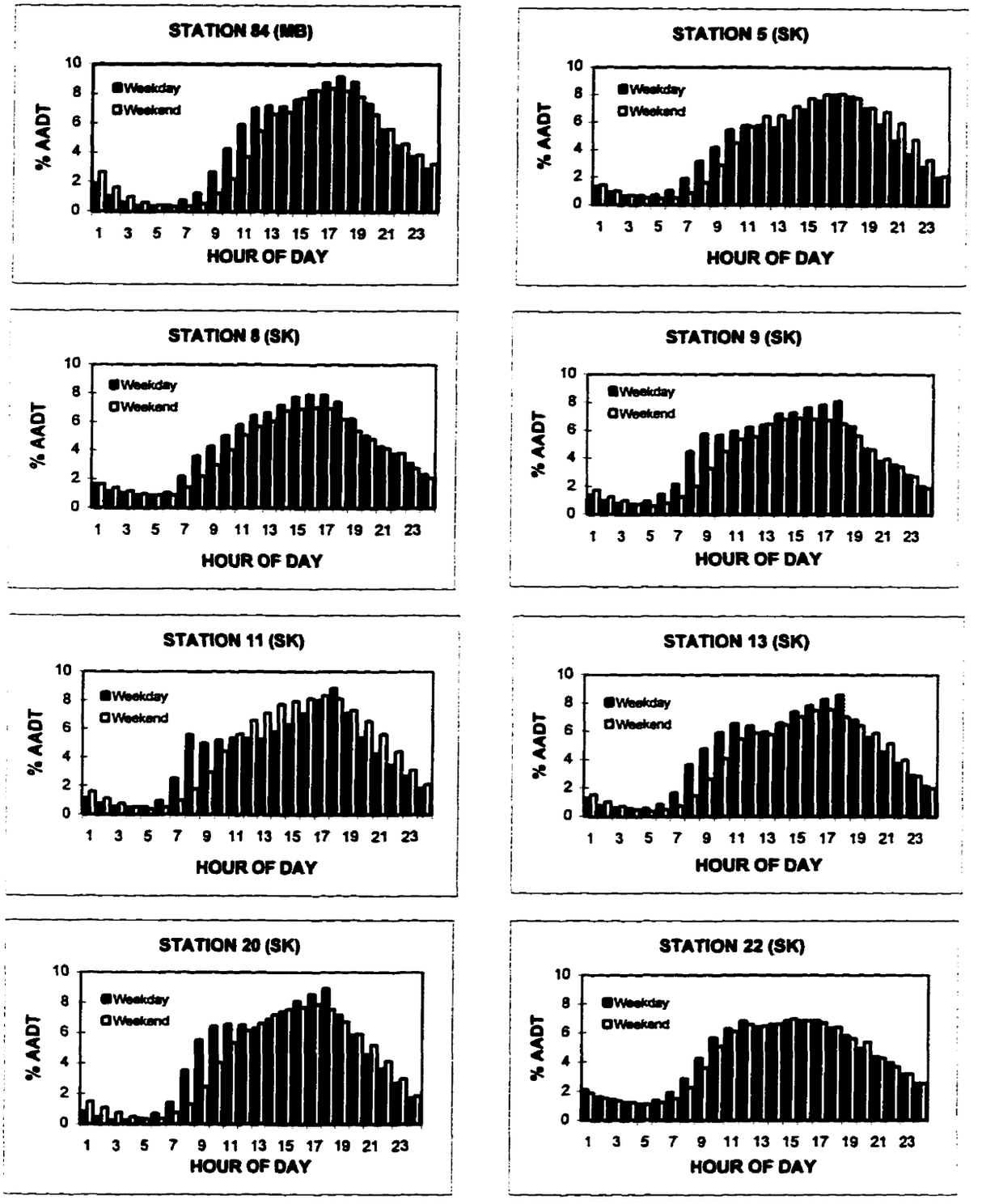
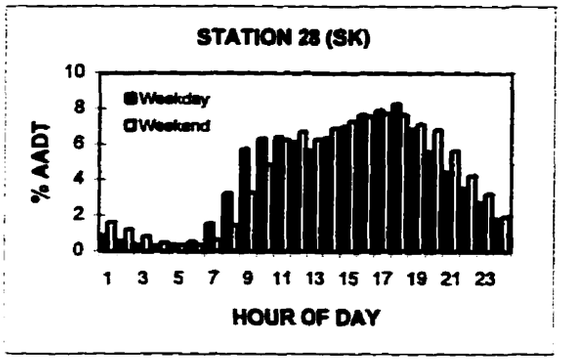
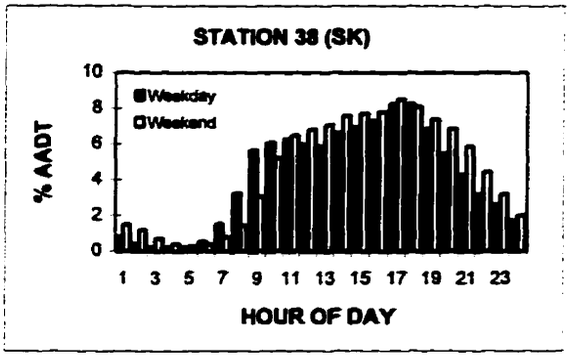


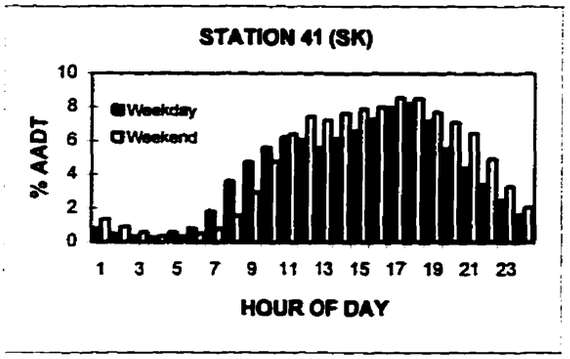
Figure B-1 (continued)

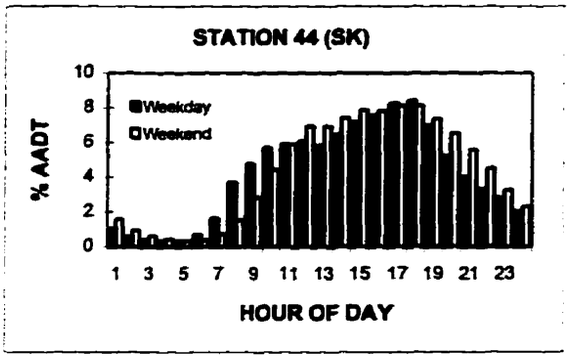
Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

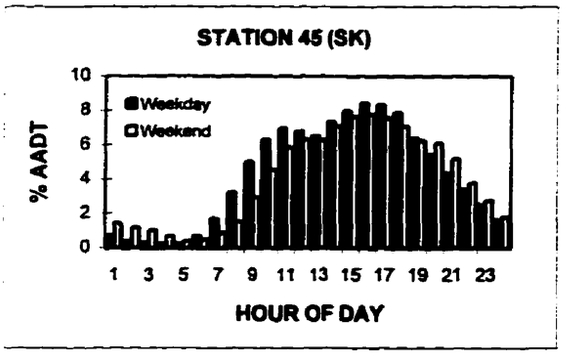
Prairie Group 2 (continued)











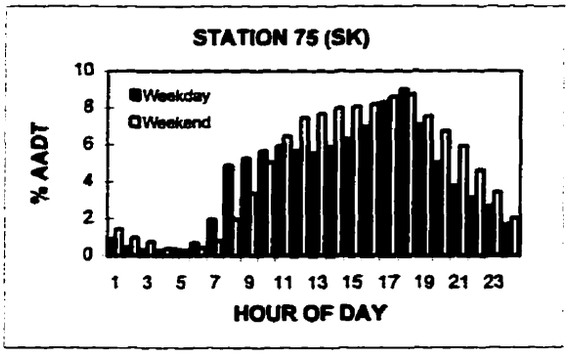


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 3

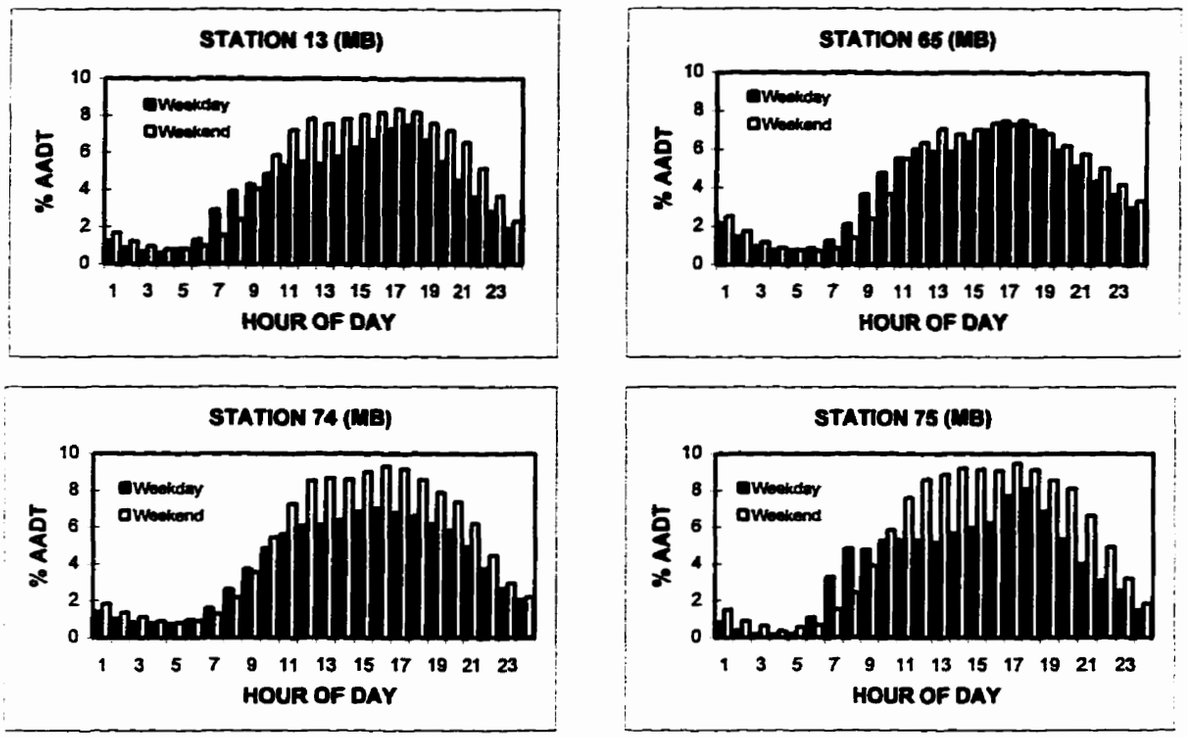


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 4

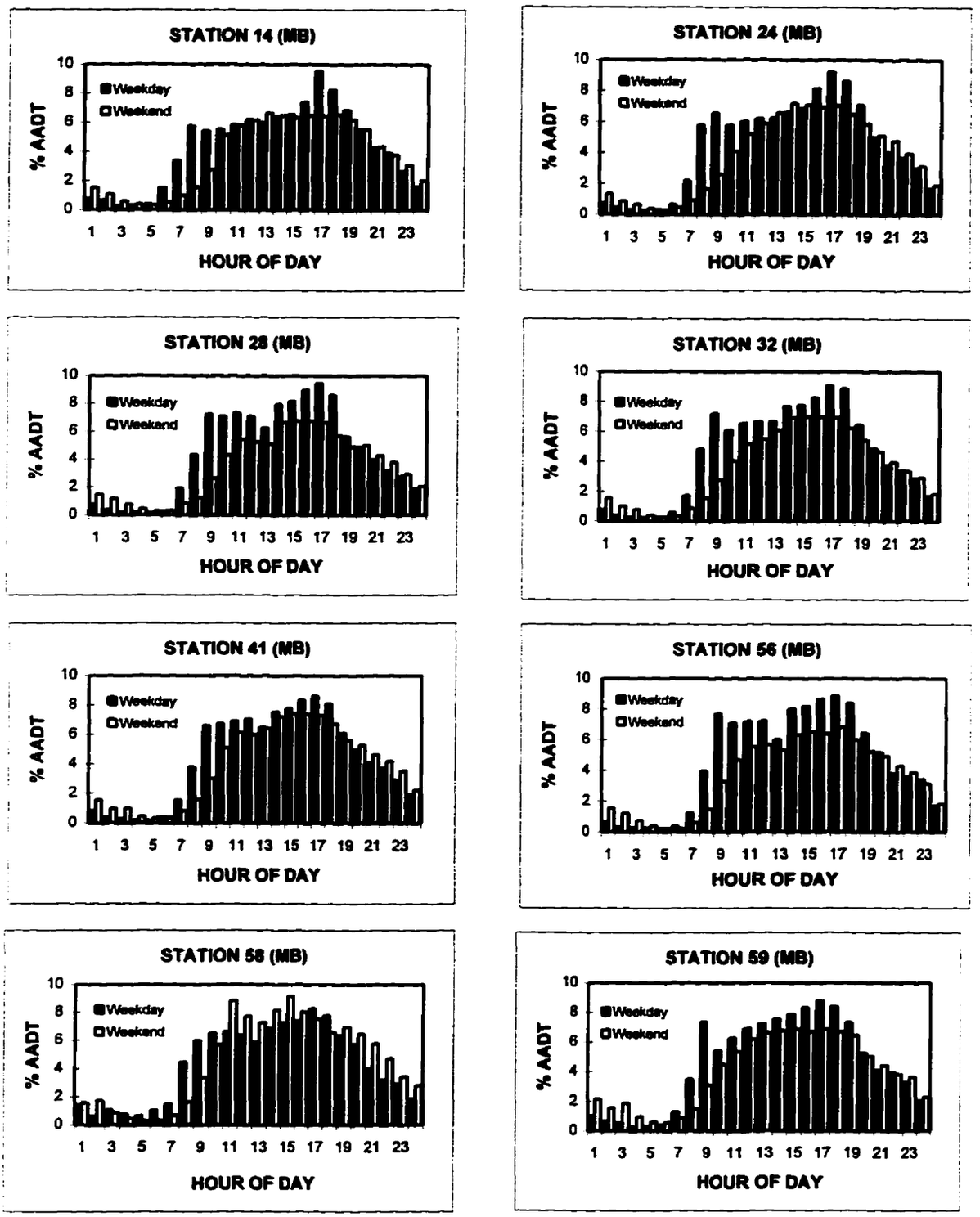


Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 4 (continued)

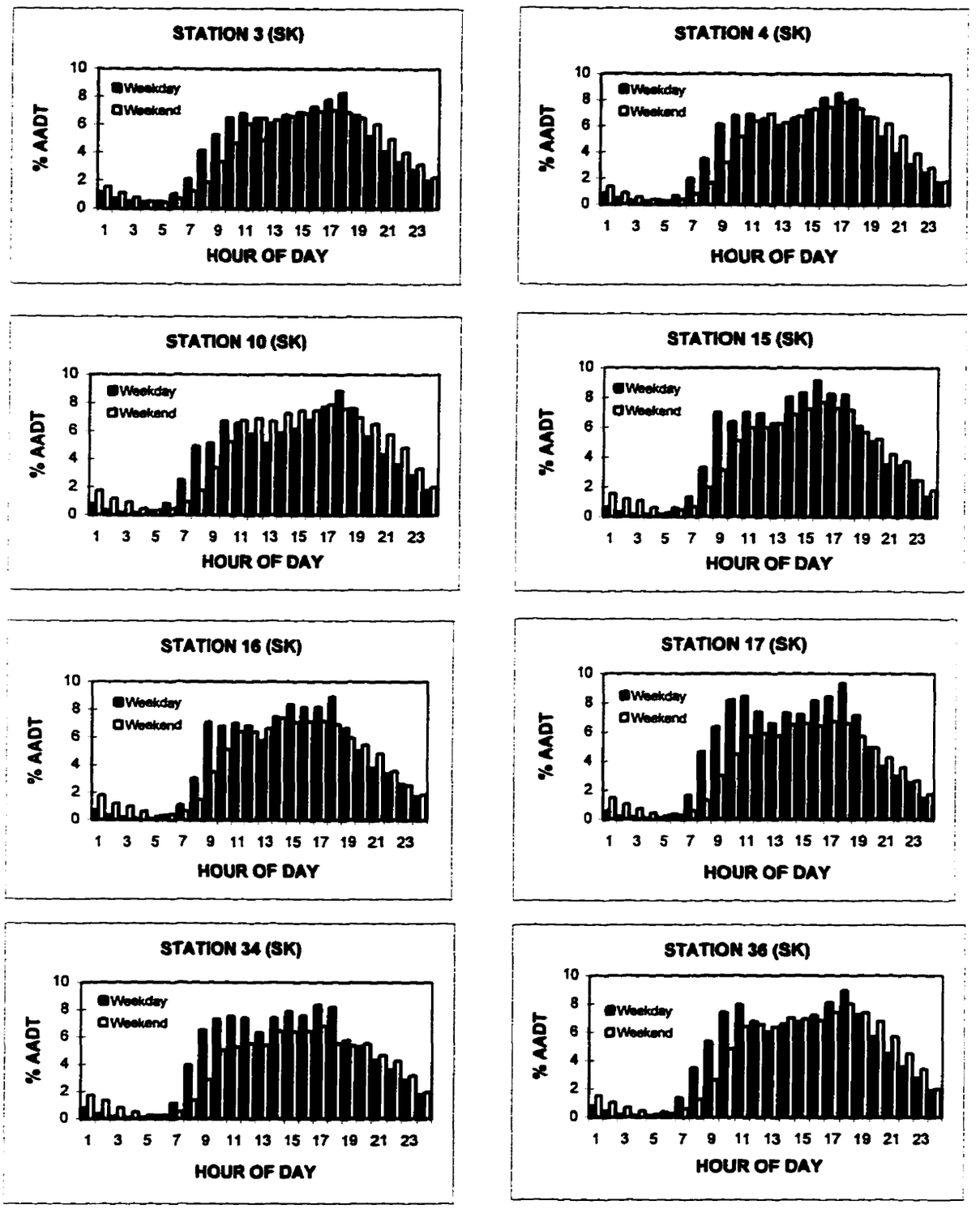
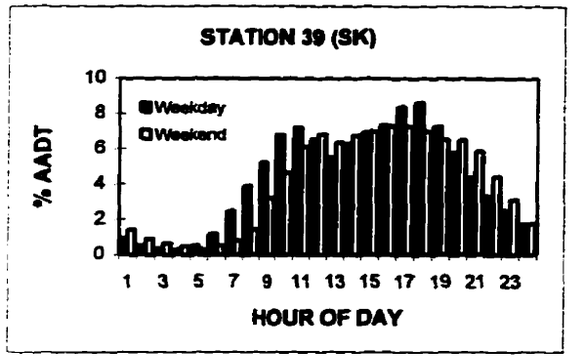
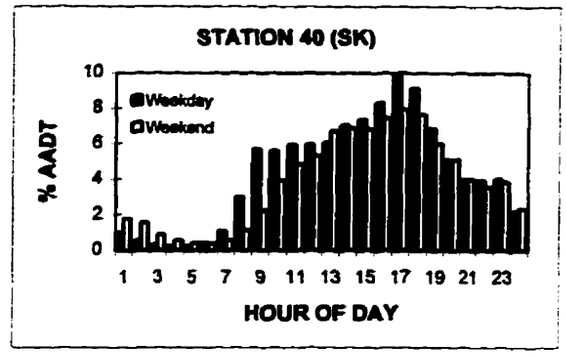


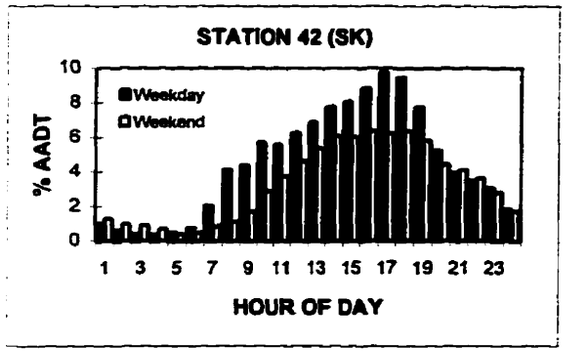
Figure B-1 (continued)

Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

Prairie Group 4 (continued)







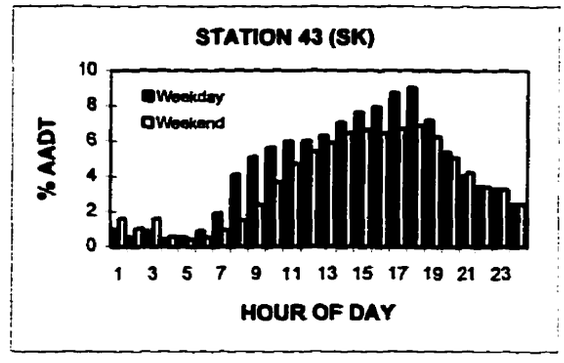
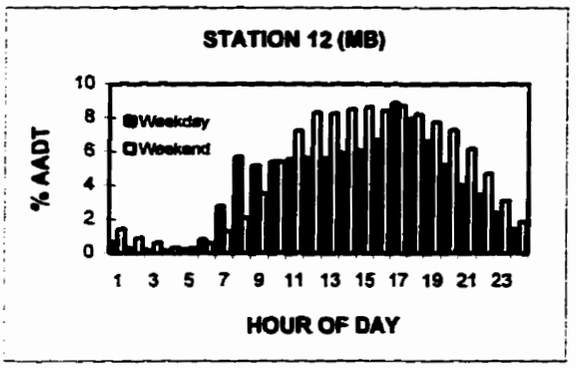
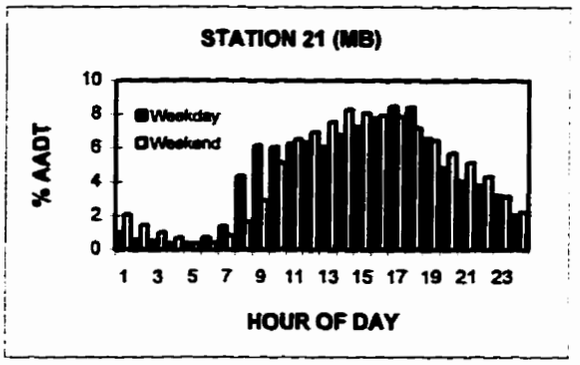


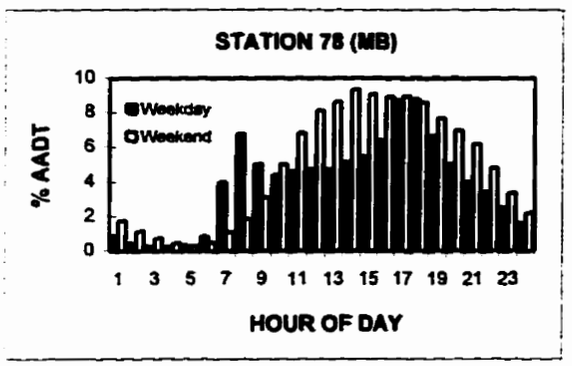
Figure B-1 (continued)

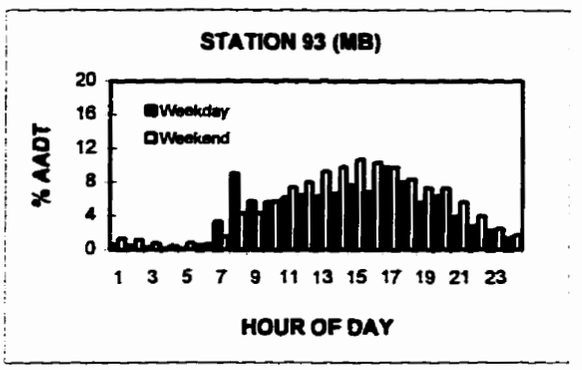
Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

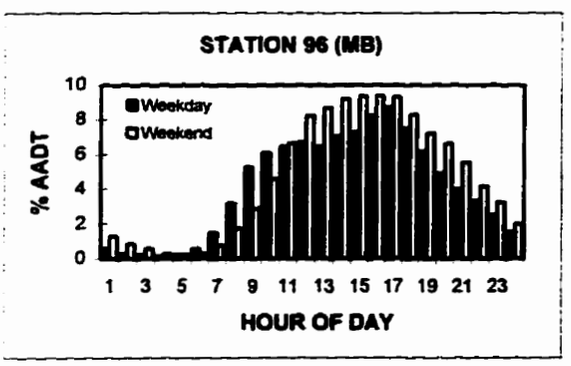
Prairie Group 5

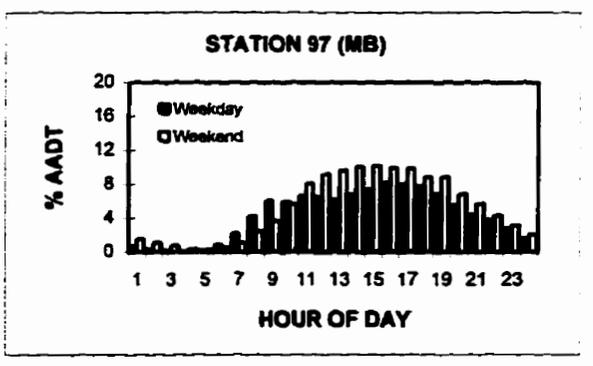












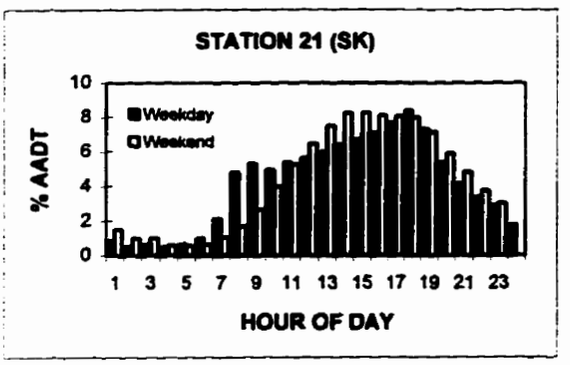
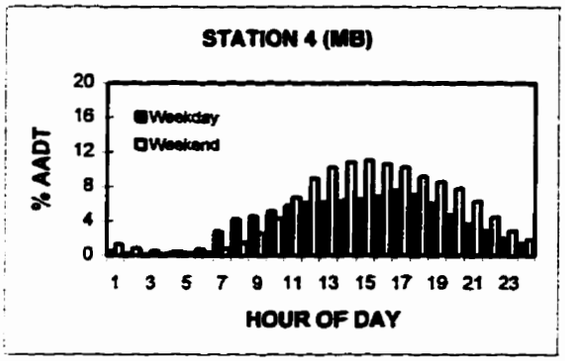
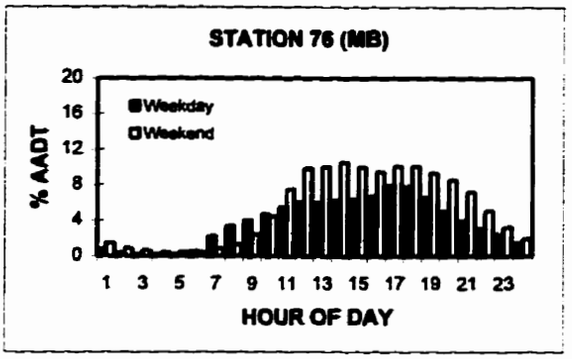


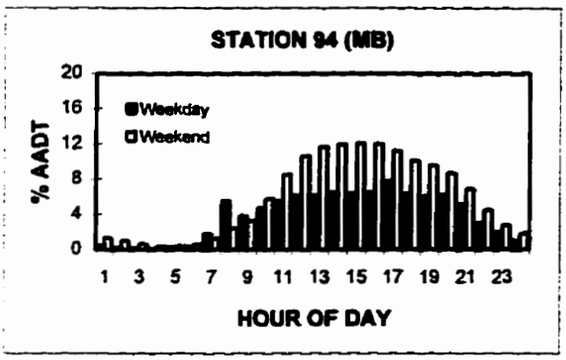
Figure B-1 (continued)

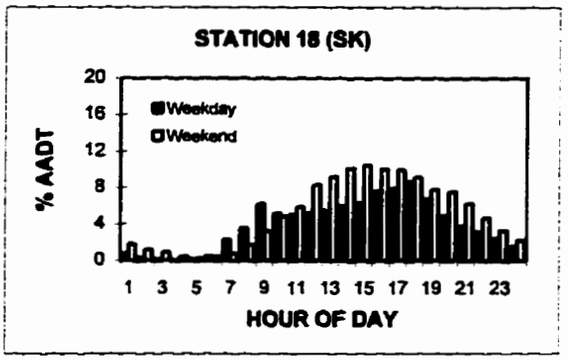
Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

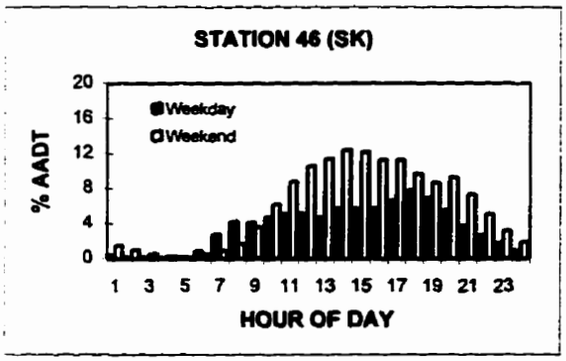
Prairie Group 6

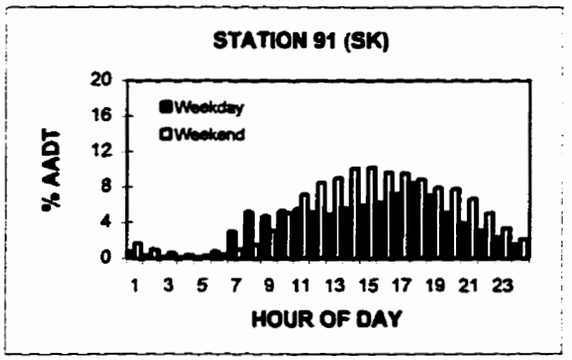












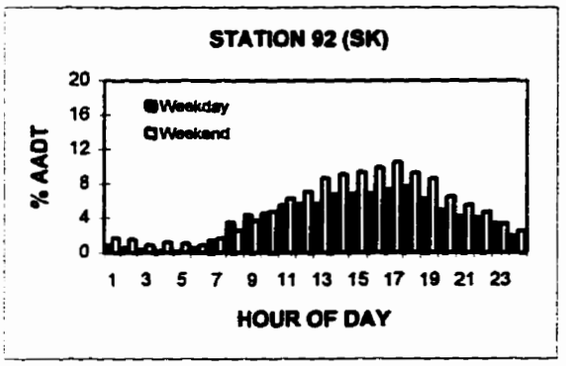
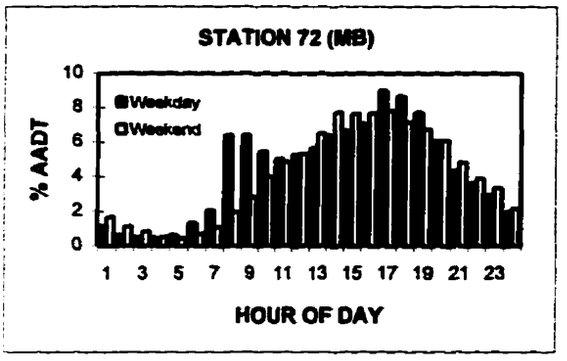
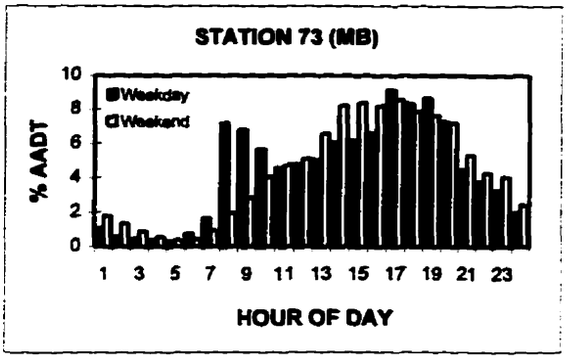


Figure B-1 (continued)

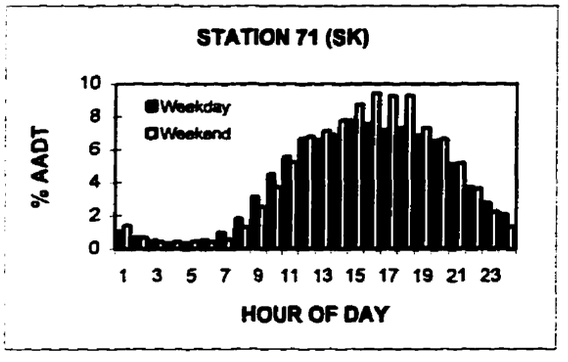
Average Hourly Traffic Variations (Weekdays and Weekends) at Permanent Counters in Manitoba and Saskatchewan (1995)

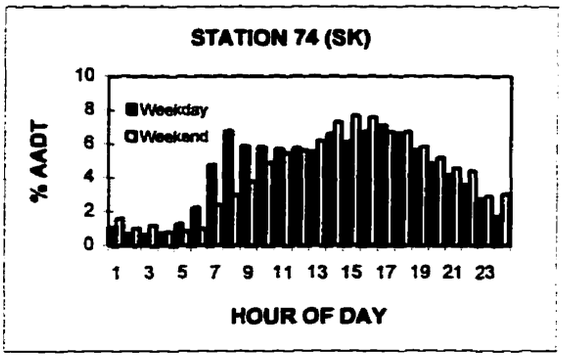
Prairie Group 7





Ungrouped Sites





APPENDIX C

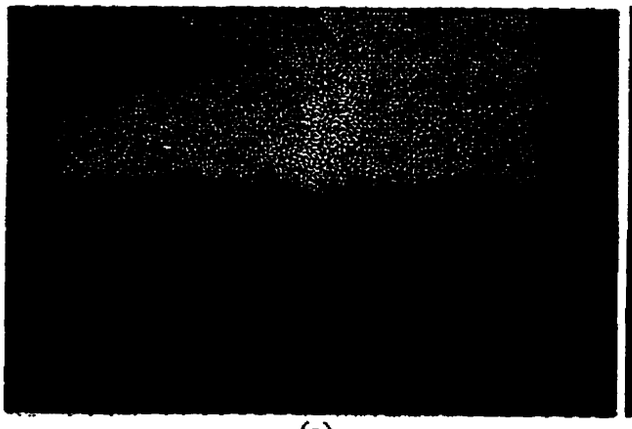
Overview of the New Traffic Pattern Groups

Overview of the New Traffic Pattern Groups

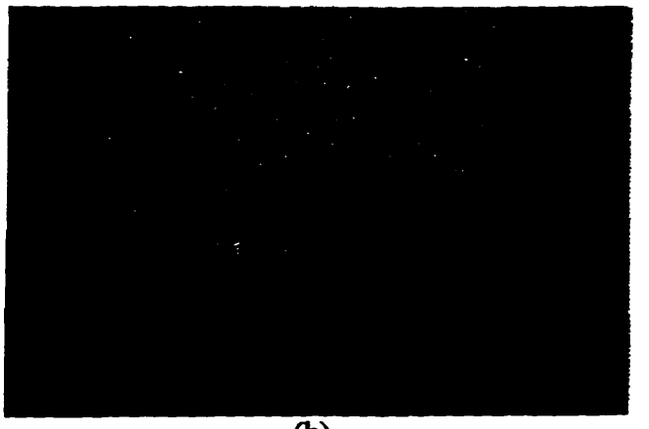
A field survey was undertaken to provide an overview of the most common traffic patterns on Manitoba's and Saskatchewan's provincial highways. This survey was conducted on a typical weekend and weekday in January. The following photographs and notes in Figures C-1 to C-3 show the highlights of this survey.

Figure C-1

Examples of Typical Prairie Group 1 Routes



(a)



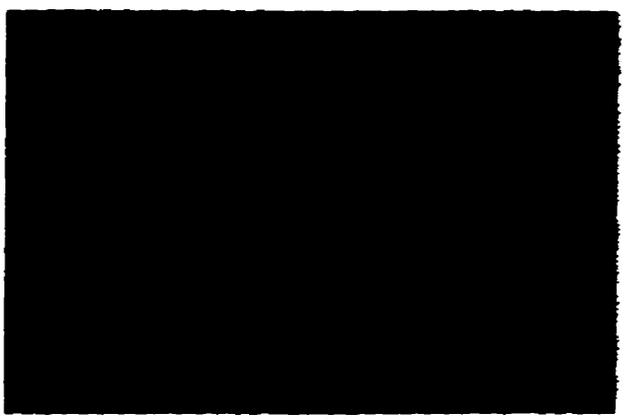
(b)

- Description: Figure C-1 (a) shows PTH 100 (the perimeter highway) south of the City of Winnipeg, Manitoba at 4pm on a typical weekday.
- Type of road: Paved, 4-lane divided highway.
- Functional class: Expressway.
- Weekday traffic: On weekdays, this highway carries mainly commuter traffic within the city of Winnipeg. The peak times of the day in which the highest traffic volumes occur is between 7-9 am and 4-6 pm.
- Weekend traffic: The same type of pattern can be found on this route on weekends. There is steady increasing traffic throughout the weekend.
- Surveyed volumes: On a typical weekday in January between 4-5pm, there are 1100 vehicles (combined direction), and on a typical weekend during the same period, there are 380 vehicles.

- Description: Figure C-1 (b) shows a photo of Highway #1 just west of the City of Regina, Saskatchewan at 8am on a typical weekday.
- Type of road: Paved, 4-lane divided highway.
- Functional class: Expressway.
- Weekday traffic: On weekdays, this route carries a significant proportion of commuter traffic within the town of Regina and between Regina and Moose Jaw, SK. The peaks periods are between 7-9 am and 4-6 pm.
- Weekend traffic: Also consists of mainly commuter traffic, and remains steady throughout the day. Peaks are not as apparent as during weekdays.
- Surveyed volumes: On a typical weekday in January between 8-9am, there are 820 vehicles (combined direction), and on a typical weekend during the same period, there are 460 vehicles, approximately half the

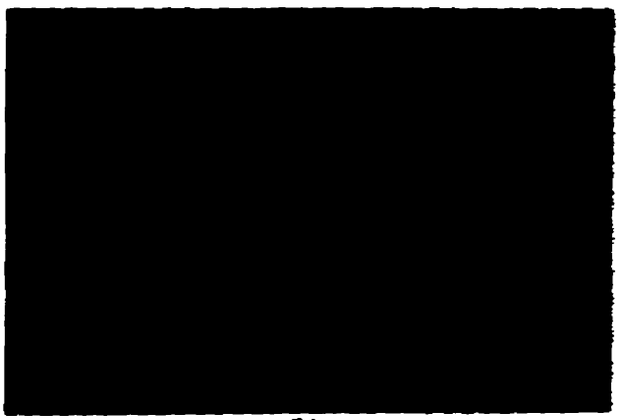
Figure C-2

Examples of Typical Prairie Group 2 Routes



(a)

- Description: Figure C-2 (a) shows a photo of PTH 5, north of PR 265 in Manitoba at 5pm.
- Type of road: Paved, 2-lane undivided road.
- Functional class: Arterial.
- Weekday traffic: Steady traffic volume throughout the day.
- Weekend traffic: Same as weekday pattern.
- Seasonal traffic: Moderately high summer rise.
- Surveyed volumes: 80 vehicles between 5-6pm on a weekday, and 58 vehicles on the weekend.

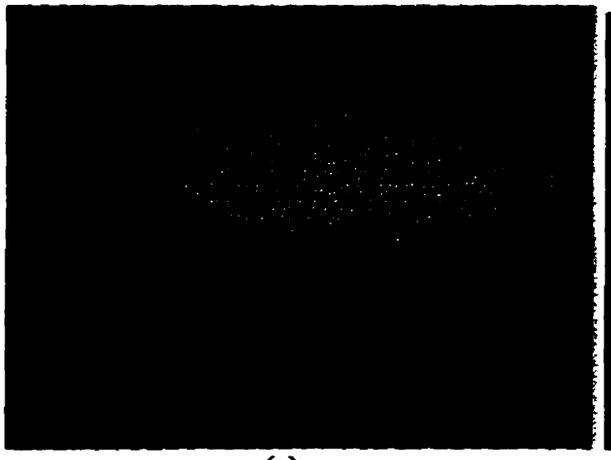


(b)

- Description: Figure C-2 (b) shows a photo of Highway 10, east of Highway 22 in Saskatchewan at 10am.
- Type of road: Paved, 2-lane undivided highway.
- Functional class: Arterial.
- Weekday traffic: Steady traffic volumes throughout the day.
- Weekend traffic: Same as weekday pattern.
- Seasonal traffic: Moderately high summer rise.
- Surveyed volumes: 130 vehicles between 10-11 am on a weekday, and 110 vehicles on the weekend.

Figure C-3

Examples of Typical Prairie Group 4 Routes



(a)

(b)

- Description: Figure C-3 (a) shows PTH 5, 1 km north of the town of Neepawa, Manitoba on a weekday at 5pm.
- Type of road: Paved, 2-lane, undivided highway.
- Functional class: Arterial.
- Weekday traffic: Highest traffic volumes occur during the weekday afternoons, between 4-6pm.
- Weekend traffic: Steady increases throughout the day, no defined peaks.
- Seasonal traffic: Flat seasonal variation.
- Surveyed volumes: 190 vehicles between 5-6pm on a weekday, and 140 vehicles on a weekend.

- Description: Figure C-3 (b) shows Highway 10 outside of Yorkton, Saskatchewan at 11am.
- Type of road: Paved, 2-lane undivided highway.
- Functional class: Arterial.
- Weekday traffic: Highest traffic volumes occur during the weekday afternoons, between 4-6 pm.
- Weekend traffic: Steady increases throughout the day, no defined peaks.
- Seasonal traffic: Flat seasonal variation.
- Surveyed volumes: 290 vehicles between 11-12 noon on a weekday, and 190 vehicles on the weekend.

APPENDIX D

List of Short-Term Counting Stations' Assignments
to Traffic Pattern Groups and Control Stations

Table D-1

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
102	C	301		SOUTH OF P.T.H. #44	PG6			RES	74
104	C	307		N. OF CPR TRACKS AT BRERETON	PG5	93		RES	93
105	C	44		WEST OF RENNIE	PG3	74		TS	74
106	C	44		E. OF E. JCT. P.T.H. #11	PG3	74		TS	74
107	C	11		W. OF E. JCT. P.T.H. #44	PG3	74		TS	61
108	C	11		S. OF E. JCT. P.T.H. #44	PG3	74		TS	12
109	C	11		3.2 KM SOUTH OF P.T.H. #15	PG3	74		TS	12
111	C	11		E. OF W. JCT. P.T.H. #44	PG5	12		TS	61
114	C	44		W. OF W. JCT. P.T.H. #11	PG5	12		RC	12
115	C	11		0.8 KM N. OF P.R. #313	PG5	93		RC	12
116	C	313		W. OF WPG. RIVER BRIDGE	PG5	93		RC	93
117	C	11		4.2 KM N. OF GREAT FALLS	PG3	75		T	76
118	C	11		WEST OF P.R. #304	PG3	75		TS	76
119	C	11		EAST OF P.T.H. #59	PG3	75		TS	76
120	C	59		SOUTH OF P.R. #504	PG6	76		RES	76
121	C	59		SOUTH OF P.T.H. #11	PG6	76		RES	76
122	C	59		N. OF N. JCT. P.T.H. #12	PG6	76		RES	76
123	C	12		W. OF N. JCT. P.T.H. #59	PG6	76		RES	76
124	C	12		S. OF N. JCT. P.T.H. #59	PG6	76		RES	76
125	C	304		EAST OF P.T.H. #12	PG4	14		RC	75
126	C	12		1.6 KM N. OF BROKENHEAD RIVER	PG6	76		T	75
127	C	12		N. OF E. JCT. P.T.H. #44	PG5	12		T	12
128	C	12		4.8 KM W. OF E. JCT. P.T.H. #44	PG5	12		TS	12
129	C	44		W. OF W. JCT. P.T.H. #12	PG1	77		UC	77
130	C	12		S. OF W. JCT. P.T.H. #44	PG5	12		T	12
131	C	44		EAST OF P.T.H. #59	PG1	77		UC	77
132	C	59		NORTH OF P.T.H. #44	PG5	78		RC	78
133	C	44		WEST OF P.T.H. #59	PG1	77		UC	77
140	C	15		1.6 KM W. OF P.T.H. #12	PG3	13		UC	64
141	C	15		EAST OF P.T.H. #12	PG3	13		TS	61
142	C	12		0.2 KM SOUTH OF P.T.H. #15	PG2	61		T	14
143	C	12		NORTH OF P.T.H. #1	PG2	61		T	14
144	C	1		WEST OF P.T.H. #12	PG1	8		UC	13
145	C	12		SOUTH OF P.T.H. #1	PG4	14		RC	14
146	C	1		WEST OF P.T.H. #11	PG3			TS	61
147	C	11		0.8 KM N. OF P.T.H. #1	PG3	75		TS	12
148	C	1		EAST OF P.T.H. #11	PG3			TS	74
149	C	12		S. OF S. JCT. P.R. #311	PG4	14		RC	14
150	C	52		4.8 KM E. OF STEINBACH	PG4	14		RC	14
151	C	52		4.8 KM W. OF P.T.H. #12	PG4	14		RC	14
152	C	302		SOUTH OF P.T.H. #12	PG4	14		RC	14
153	C	12		S.E. OF P.R. #302	PG4	14		T	14
155	C	12		N.W. OF P.T.H. #89	PG4	14		T	14
156	C	201		WEST OF P.T.H. #89	PG1	14		RC	35
157	C	89		3.2 KM N. OF U.S. BDRY.	PG3			TS	14
158	C	12		S.E. OF P.T.H. #89	PG4	14		T	14
159	C	310		NORTH OF U.S. BDRY.	PG3	74		T	14
160	C	12		0.5 KM N. OF U.S. BDRY.	PG4	14		T	14
161	C	201		3.2 KM W. OF VITA	PG1	14		RC	35
162	C	59		3.2 KM N. OF U.S. BDRY.	PG2	63		TS	14
163	C	201		WEST OF P.T.H. #59	PG1	14		T	16
164	C	59		NORTH OF P.R. #201	PG2	63		RC	14
165	C	59		SOUTH OF P.T.H. #23	PG1	14		RC	14
166	C	59		0.8 KM N. OF P.T.H. #23	PG1	14		RC	8
167	C	23		1.6 KM W. OF P.T.H. #59	PG4			T	14
168	C	59		SOUTH OF P.T.H. #52	PG1	14		RC	8
169	C	52		EAST OF P.T.H. #59	PG4	14		RC	14
170	C	59		NORTH OF P.T.H. #52	PG1	14		UC	8
172	C	800		STE. ANNE'S RD. N. OF P.T.H. #100	TOWN			UC	
173	C	800		STE. MARY'S RD. N. OF P.T.H. #100	TOWN			UC	
174	C	101		WEST OF P.T.H. #7	PG1	77		UC	2
175	C	7		NORTH OF P.T.H. #101	PG1	77		UC	2
176	C	67		WEST OF P.T.H. #7	PG4	14		T	16
177	C	67		EAST OF P.T.H. #7	PG4	14		UC	3
178	C	7		1.6 KM S. OF P.R. #415	PG2	16		T	16
182	C	7		NORTH OF P.R. #229	PG2	16		T	16
183	C	231		1.6 KM E. OF P.T.H. #7	PG6	4		T	75
184	C	231		3.2 KM W. OF P.T.H. #7	PG6	4		T	75
185	C	7		N. OF N. JCT. P.R. #231	PG2	16		T	16
186	C	17		1.6 KM S. OF P.R. #231	PG2	16		T	16
187	C	17		4.8 KM S. OF P.T.H. #68	PG2	16		T	16
188	C	17		3.2 KM N. OF P.T.H. #68	PG2	16		T	16
189	C	68		1.6 KM W. OF P.T.H. #17	PG4			T	16
190	C	68		4.8 KM E. OF P.T.H. #17	PG2	16		T	16
192	C	7		SOUTH OF P.T.H. #68	PG2	16		T	16
193	C	8		NOUTH OF P.T.H. #68	PG3	75		T	4
194	C	68		WEST OF P.T.H. #8	PG6	4		TS	4
195	C	8		SOUTH OF P.T.H. #68	PG3	75		TS	4
196	C	222		3.2 KM N. OF GIMLI	PG6	4		RCS	75
197	C	8		NORTH OF P.R. #231	PG3	75		RC	4
198	C	231		EAST OF P.T.H. #8	PG6	4		T	75
199	C	8		SOUTH OF P.R. #231	PG3	75		RC	4
200	C	9		4.8 KM S. OF GIMLI	PG6	4		RC	4
202	C	225		WEST OF P.T.H. #9	PG6	4		TS	75
203	C	8		NORTH OF P.T.H. #17	PG3	75		T	4
205	C	9		N. OF N. JCT. P.T.H. #9A	PG6	4		RC	3
206	C	9		NORTH OF P.T.H. #44	PG6	3		UC	3

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.*	Old TPG	Old Control Stn.
207	C	9		SOUTH OF P.T.H. #44	PG6	3		UC	3
208	C	8		NORTH OF P.R. #230	PG1	1		UC	1
209	C	8		SOUTH OF P.T.H. #27	PG1	1		UC	1
210	C	27		WEST OF P.T.H. #9	PG1	3		T	3
211	C	204		NORTH OF HODDINOTT ROAD	PG1	3		UC	77
212	C	67		3.2 KM E. OF P.T.H. #6	PG4	14		T	16
214	C	6		3.2 KM S. OF LAKE FRANCIS	PG3	60		TS	4
216	C	6		3.2 KM S. OF S. JCT. P.T.H. #68	PG3	60		TS	4
217	C	68		3.2 KM E. OF P.T.H. #6	PG3	60		T	16
219	C	68		WEST OF P.T.H. #6	PG3	60		T	49
223	C	6		3.2 KM N. OF MOOSEHORN	PG3			T	60
224	C	6		3.2 KM S. OF FAIRFORD ACCESS	PG3	60		T	60
225	C	513		3.2 KM S. OF GYPSUMVILLE	PG4			RC	60
226	C	75		NORTH OF P.R. #330	PG2	63		T	63
227	C	75		3.5 KM S. OF S. JCT. P.T.H. #23	PG2	63		T	63
228	C	23		EAST OF P.R. #246	PG4			T	14
229	C	23		EAST OF P.R. #422	PG4			T	14
230	C	75		NORTH OF P.T.H. #14	PG2	63		T	63
231	C	75		SOUTH OF P.T.H. #14	PG2	63		T	63
234	C	201		EAST OF P.T.H. #75	PG2	63		RC	35
236	C	200		SOUTH OF P.R. #218	PG4			RC	35
237	C	30		S. OF N. JCT. P.R. #243	PG4			T	48
239	C	30		SOUTH PF PTH #14	PG4			T	48
240	C	14		WEST OF P.T.H. #30	PG4			RC	35
241	C	32		4.8 KM S. OF P.T.H. #14	PG4			RC	35
242	C	14		EAST OF P.T.H. #32	PG4			RC	35
243	C	14		EAST OF P.T.H. #3	PG4			RC	35
244	C	3		NORTH OF P.T.H. #14	PG4			T	46
245	C	3		SOUTH OF P.T.H. #23	PG4			RC	35
246	C	23		WEST OF P.T.H. #3	PG4			T	14
247	C	23		EAST OF P.T.H. #3	PG4			T	14
248	C	3		7.2 KM S. OF JCT. P.T.H. #3 & #13	PG4			RC	35
249	C	3		4.5 KM E. OF P.T.H. #13	PG4			RC	35
250	C	13		5.3 KM S. OF P.T.H. #2	PG2	81		RC	81
251	C	13		NORTH OF P.T.H. #2	PG2	81		RC	81
252	C	2		EAST OF P.R. #247	PG2	48		T	48
256	C	3		EAST OF P.T.H. #31	PG4			RC	35
257	C	3		WEST OF P.T.H. #31	PG4			RC	35
258	C	31		SOUTH OF P.T.H. #3	PG2	21		T	35
260	C	3		N. OF W. JCT. P.T.H. #34	PG4	58		RC	35
261	C	3		N. OF E. JCT. P.T.H. #3A	PG4	58		RC	35
262	C	3		W. OF E. JCT. P.T.H. #34	PG4	58		RC	35
263	C	3		EAST OF P.T.H. #34	PG4			RC	35
264	C	34		NORTH OF P.T.H. #3	PG4	58		RC	58
265	C	3		W. OF W. JCT. P.T.H. #34	PG4	58		RC	58
266	C	23		WEST OF P.R. # 244	PG4			T	66
267	C	23		EAST OF P.T.H. #34	PG4	58		T	58
268	C	23		WEST OF P.T.H. #34	PG4	58		T	58
269	C	34		SOUTH OF P.T.H. #23	PG4	58		RC	58
270	C	34		NORTH OF P.T.H. #23	PG4	58		RC	58
271	C	23		4.8 KM E. OF BALDUR	PG4	58		T	66
272	C	244		2.4 KM S. OF P.T.H. #2	PG2	81		RC	58
273	C	2		2.9 KM E. OF P.R. #244	PG2	81		T	46
274	C	2		EAST OF P.T.H. #34	PG4	58		T	46
275	C	2		1.9 KM W. OF P.T.H. #34	PG4	58		RC	58
277	C	34		5.0 KM N. OF P.T.H. #2	PG4	58		RC	58
276	C	2		3.4 KM W. OF P.R. #342	PG2	66		RC	58
280	C	2		EAST OF P.T.H. #18	PG2	66		T	66
281	C	2		WEST OF P.T.H. #18	PG2	66		T	66
282	C	18		SOUTH OF P.T.H. #2	PG2	66		T	66
283	C	18		3.2 KM N. OF NINETTE	PG2	66		T	66
284	C	23		W. OF W. JCT. P.T.H. #18	PG4	58		T	66
285	C	23		4.8 KM E. OF NINETTE	PG4	58		T	66
286	C	18		S. OF W. JCT. P.T.H. #23	PG2	66		T	66
288	C	3		4.8 KM W. OF N. JCT. P.T.H. #18	PG2	21		RC	56
289	C	3		3.2 KM N. OF S. JCT. P.T.H. #18	PG2	21		RC	56
290	C	18		S. OF S. JCT. P.T.H. #3	PG2	66		T	66
291	C	3		E. OF S. JCT. P.T.H. #18	PG2	21		RC	56
292	C	5		SOUTH OF P.T.H. #3	PG2	21		RC	58
293	C	3		1.6 KM E. OF P.T.H. #5	PG2	21		RC	58
294	C	3		WEST OF P.T.H. #5	PG2	21		RC	58
296	C	10		SOUTH OF P.T.H. #3	PG2	21		T	21
297	C	3		WEST OF P.T.H. #10	PG2	21		RC	56
298	C	3		EAST OF P.T.H. #10	PG2	21		RC	56
299	C	10		NORTH OF P.T.H. #3	PG2	21		T	21
300	C	10		S. OF S. JCT. P.T.H. #23	PG2	21		T	21
301	C	10		N. OF S. JCT. P.T.H. #23	PG2	21		T	21
302	C	10		N. OF N. JCT. P.T.H. #23	PG2	21		T	21
303	C	23		E. OF S. JCT. P.T.H. #10	PG4	58		T	66
304	C	23		W. OF N. JCT. P.T.H. #10	PG4	58		T	40
305	C	10		S. OF S. JCT. P.T.H. #2	PG2	21		T	21
306	C	10		N. OF N. JCT. P.T.H. #2	PG2	21		T	66
308	C	2		WEST OF WEIGH SCALES	PG2	66		T	40
309	C	2		4.0 KM E. OF P.R. #250	PG2	66		T	40
310	C	250		3.7 KM N. OF P.T.H. #2	PG4	24		RC	24
311	C	2		E. OF E. JCT. P.T.H. #21	PG2	40		T	40
312	C	2		W. OF E. JCT. P.T.H. #21	PG2	40		T	40

Abbreviations:
PG = Prairie Group
TOWN = located within a town
*Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
313	C	21		N. OF E. JCT. P.T.H. #2	PG2			T	78
314	C	2		W. OF W. JCT. P.T.H. #21	PG2	40		T	40
315	C	21		S. OF W. JCT. P.T.H. #2	PG2	40		T	78
316	C	21		NORTH OF P.T.H. #23	PG4	56		T	78
317	C	21		SOUTH OF P.T.H. #23	PG4	56		T	78
318	C	23		EAST OF P.T.H. #21	PG4	56		T	40
319	C	21		N. OF N. JCT. P.T.H. #3	PG2	21		T	78
320	C	3		S. OF N. JCT. P.T.H. #21	PG2	21		RC	56
321	C	3		WEST OF P.T.H. #21	PG4	56		RC	56
322	C	3		EAST OF P.T.H. #21	PG4	56		RC	56
323	C	21		8.0 KM S. OF DELORAINE	PG2	21		T	78
326	C	83		S. OF S. JCT. P.T.H. #3	PG2	40		T	40
327	C	3		W. OF S. JCT. P.T.H. #83	PG4	56		RC	56
328	C	3		6.4 KM S. OF P.R. #445	PG4	56		RC	56
330	C	83		3.2 KM N. OF N. JCT. P.T.H. #3	PG4	56		T	40
331	C	83		SOUTH OF P.T.H. #2	PG2	40		T	40
332	C	83		NORTH OF P.T.H. #2	PG2	40		T	40
333	C	2		1.6 KM W. OF P.T.H. #83	PG2	40		T	40
334	C	2		1.6 KM E. OF SASK. BDRY.	PG2	40		T	40
336	C	255		WEST OF P.T.H. #83	PG2	40		T	56
338	C	1		EAST OF P.T.H. #41	PG2	25		T	25
339	C	41		NORTH OF P.T.H. #1	PG2	25		T	25
340	C	1		W. OF W. JCT. P.T.H. #83	PG2	25		T	25
341	C	1		E. OF W. JCT. P.T.H. #83	PG2	25		T	25
342	C	83		N. OF W. JCT. P.T.H. #1	PG2	40		T	40
343	C	259		1.6 KM N. OF P.T.H. #1	PG4	28		RC	24
344	C	1		WEST OF P.R. #257	PG2			T	62
346	C	257		WEST OF P.T.H. #83	PG2	40		RC	56
348	C	1		0.5 KM W. OF P.T.H. #21	PG2			T	62
349	C	1		EAST OF P.T.H. #21	PG2			T	62
350	C	21		SOUTH OF GRISWOLD ACCESS	PG2			T	78
351	C	21		NORTH OF P.T.H. #1	PG2			T	78
353	C	250		NORTH OF P.R. #455	PG2			RC	24
354	C	1	A	E. OF W. JCT. P.T.H. #1 - BDN	PG4	24		RC	24
355	C	1		W. OF W. JCT. P.T.H. #10	PG4	24		RC	24
356	C	340		SOUTH OF P.T.H. #1	PG4	56		RC	66
357	C	5		SOUTH OF P.T.H. #1	PG4	24		RC	24
358	C	5		NORTH OF P.T.H. #1	PG2	79		T	79
359	C	1		WEST OF P.T.H. #34	PG3	65		TS	65
360	C	1		EAST OF P.T.H. #34	PG3	65		TS	65
361	C	34		1.5 KM S. OF P.T.H. #1	PG4	58		RC	58
362	C	34		NORTH OF P.T.H. #1	PG4	58		RC	58
363	C	1		WEST OF P.T.H. #16	PG3	65		TS	65
366	C	240		SOUTH OF P.T.H. #1	PG4			RC	35
367	C	331		EAST OF P.R. #240	PG4	58		RC	81
368	C	1	A	0.8 KM W. OF W. JCT. P.T.H. #26 (PTGE)	PG3	65		RC	81
369	C	1	A	2.4 KM E. OF W. JCT. P.T.H. #26	PG3	65		T	48
370	C	26		WEST OF HIGH BLUFF ACCESS	PG4	81		RC	81
372	C	13		SOUTH OF P.T.H. #1	PG2	81		RC	81
374	C	1		EAST OF P.T.H. #13	PG2	48		T	48
375	C	1		WEST OF P.T.H. #13	PG2	48		T	48
376	C	26		N. OF E. JCT. P.T.H. #1	PG1	48		UC	48
377	C	241		3.2 KM W. OF JCT. P.R. #334	PG1	47		UC	47
378	C	16		EAST OF P.T.H. #50	PG2	46		T	46
379	C	16		WEST OF P.T.H. #50	PG2	46		T	46
380	C	50		NORTH OF P.T.H. #16	PG2	83		RC	46
381	C	50		NORTH OF P.R. #265	PG2	83		RC	46
382	C	16		1.3 KM E. OF P.T.H. #34	PG2	46		T	46
383	C	16		1.6 KM W. OF P.T.H. #34	PG2	46		T	43
384	C	34		SOUTH OF P.T.H. #16	PG4	58		RC	58
385	C	260		NORTH OF P.T.H. #16	PG2	83		RC	58
386	C	352		NORTH OF P.T.H. #16	PG5			T	58
387	C	16		4.8 KM E. OF E. JCT. P.T.H. #5	PG2	46		T	43
388	C	16		1.6 KM W. OF W. JCT. P.T.H. #5	PG2	46		T	43
389	C	5		3.2 KM N. OF P.T.H. #16	PG2	79		T	79
390	C	5		0.5 KM S. OF P.T.H. #16	PG2	79		T	79
391	C	262		SOUTH OF P.T.H. #16	PG2	43		RC	24
392	C	16		N. OF E. JCT. P.T.H. #16	PG4	28		RC	90
393	C	16		E. OF N. JCT. P.T.H. #10 + #16	PG4	28		RC	90
394	C	10		N. OF W. JCT. P.T.H. #16	PG3	96		TS	96
395	C	16		W. OF W. JCT. P.T.H. #10	PG4	28		T	43
396	C	16		WEST OF P.R. #270	PG2	43		T	43
397	C	270		1.6 KM S. OF P.T.H. #16	PG2	43		RC	24
399	C	16		3.2 KM E. OF P.T.H. #21	PG2	43		T	43
400	C	16		3.2 KM W. OF P.T.H. #21	PG2	43		T	46
401	C	21		3.2 KM S. OF SHOAL LAKE	PG4	28		T	78
402	C	42		3.2 KM SW. OF P.T.H. #16	PG4	28		RC	90
403	C	21		3.2 KM N. OF P.T.H. #16	PG4	28		T	78
404	C	45		4.8 KM E. OF P.T.H. #21	PG3	96		RC	90
405	C	83		1.6 KM S. OF P.T.H. #42	PG2	43		RC	90
406	C	42		1.6 KM E. OF E. JCT. P.T.H. #83	PG2	43		RC	90
407	C	42		W. OF W. JCT. P.T.H. #83	PG2	43		RC	90
408	C	83		S. OF E. JCT. P.T.H. #16	PG2	43		RC	90
409	C	16		E. OF S. JCT. P.T.H. #83	PG2	43		T	46
410	C	16		W. OF S. JCT. P.T.H. #83	PG2	80		T	80
411	C	41		NORTH OF P.T.H. #42	PG2	80		T	25
412	C	41		NORTH OF P.R. #545	PG2	80		T	25

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
413	C	16		SOUTH EAST OF P.T.H. #41	PG2	80		T	80
414	C	41		SOUTH OF P.T.H. #16	PG2	80		T	25
415	C	16		3.2 KM N. OF P.R. #478	PG2	80		T	80
416	C	16		0.8 KM S. OF P.T.H. #45	PG2	80		T	80
417	C	83		N. OF N. RUSSELL ACCESS	PG4	41		RC	41
418	C	45		0.8 KM E. OF P.T.H. #16	PG2	80		RC	90
419	C	16		0.8 KM W. OF N. JCT. P.T.H. #83	PG2	80		T	80
420	C	83		NORTH OF P.T.H. #24	PG4	28		RC	90
421	C	24		EAST OF P.T.H. #83	PG4	28		T	78
422	C	83		SOUTH OF P.T.H. #24	PG4	28		T	40
423	C	24		WEST OF P.T.H. #21	PG4	28		T	78
424	C	24		EAST OF P.T.H. #21	PG4	28		T	78
425	C	21		SOUTH OF P.T.H. #24	PG4	28		T	78
426	C	24		WEST OF P.R. #270	PG4	28		T	78
427	C	24		WEST OF P.T.H. #10	PG4	28		T	78
428	C	282		EAST OF P.T.H. #10	PG2	43		RC	24
429	C	10		NORTH OF P.T.H. #25	PG2	21		RC	24
430	C	10		SOUTH OF P.T.H. #25	PG2	21		RC	24
431	C	25		WEST OF P.T.H. #10	PG2	79		T	78
432	C	25		3.2 KM WEST OF RIVERS	PG4	28		RC	24
433	C	250		3.2 KM N. OF RIVERS	PG4	28		RC	24
434	C	259		0.8 KM W. OF WHEATLAND	PG4	28		RC	24
435	C	259		3.2 KM W. OF P.T.H. #21	PG4	28		RC	24
436	C	10		SOUTH OF P.T.H. #45	PG3	96		TS	96
438	C	45		WEST OF P.T.H. #10	PG3	96		RC	75
439	C	10		1.6 KM S. OF S. GATE (CLEAR LAKE)	PG3	96		TS	96
440	C	10		S. OF E. JCT. P.T.H. #5	PG3	96		TS	96
442	C	5		3.2 KM S. OF RIDING MOUNTAIN	PG3	96		T	79
443	C	261		EAST OF P.T.H. #5	PG2	83		RC	32
444	C	5		SOUTH OF P.T.H. #19	PG4	32		RC	32
445	C	5		NORTH OF P.T.H. #19	PG4	32		RC	32
446	C	19		WEST OF P.T.H. #5	PG6			RC	96
447	C	5		1.6 KM S. OF P.T.H. #50	PG4	32		RC	32
448	C	5		NORTH OF P.T.H. #50	PG2	49		T	49
449	C	50		2.0 KM EAST OF MCCREARY	PG5			RC	49
450	C	50		3.2 KM W. OF ALONSA	PG2	83		RC	49
451	C	276		NORTH OF P.T.H. #50	PG3			RC	75
452	C	50		SOUTH OF P.R. #278	PG2	83		RC	49
453	C	5		SOUTH OF P.T.H. #68	PG2	49		T	49
454	C	5		WEST OF P.R. #276	PG2	49		T	49
455	C	68		EAST OF P.T.H. #5	PG2	49		T	49
456	C	276		3.2 KM N. OF P.T.H. #5	PG3			RC	75
458	C	20		3.2 KM N. OF OCHRE RIVER	PG3	60		RC	75
459	C	20		EAST OF S. JCT. P.T.H. #20A	PG3	60		RC	75
460	C	5		N. OF S. JCT. P.T.H. #10	PG2	49		T	49
463	C	10		N. OF W. JCT. P.T.H. #5	PG2	84		RC	32
464	C	5		W. OF W. JCT. P.T.H. #10	PG4	32		RC	32
465	C	5		4.8 KM E. OF P.R. #366	PG4	32		RC	32
466	C	366		3.2 KM N. OF GRANDVIEW	PG4	41		RC	32
467	C	5		3.2 KM E. OF P.T.H. #83	PG4	41		RC	41
468	C	5		3.2 KM W. OF P.T.H. #83	PG4	41		RC	41
469	C	83		SOUTH OF P.R. #593	PG4	41		RC	41
470	C	267		EAST OF P.T.H. #10	PG2	84		T	32
471	C	267		WEST OF P.T.H. #20	PG2	84		T	32
474	C	20		NORTH OF FISHING RIVER	PG3	60		RC	75
476	C	20		3.2 KM S. OF P.R. #364	PG3	60		RC	75
477	C	20		3.2 KM N. OF P.R. #364	PG3	60		RC	75
478	C	271		WEST OF P.T.H. #20	PG2	84		RC	32
479	C	20		3.2 KM S. OF CAMPERVILLE	PG6			RC	75
480	C	20		WEST OF P.R. #272	PG3	60		RC	75
481	C	272		NORTH OF P.T.H. #20	PG6			RES	76
482	C	20		EAST OF P.T.H. #10	PG3	60		RC	75
483	C	10		1.6 KM N. OF P.T.H. #20	PG3	96		TS	36
484	C	10		SOUTH OF P.T.H. #20	PG2	84		TS	36
485	C	271		3.2 KM E. OF PINE RIVER	PG4			RC	32
487	C	10		3.2 KM S. OF ETHELBERT	PG2	84		RC	32
488	C	10		EAST OF P.R. #366	PG2	84		TS	36
489	C	268		NORTH OF P.T.H. #10	PG2	84		RC	36
490	C	366		NORTH OF P.R. #485	PG2	84		RC	36
492	C	83		NORTH OF BENITO	PG4			RC	36
493	C	83		SOUTH OF P.T.H. #49	PG4			RC	36
494	C	49		WEST OF P.T.H. #83	PG4		15	T	49
495	C	10		NORTH OF P.R. #268	PG5			TS	36
496	C	10		SOUTH OF P.T.H. #77	PG3	96		TS	36
497	C	10		NORTH OF P.T.H. #60	PG7	72		TS	72
498	C	10		4.8 KM S. OF THE PAS	PG7	72		TS	72
499	C	283		4.8 KM W. OF THE PAS	PG7	72		RC	73
500	C	10		3.2 KM S. OF CRANBERRY PORTAGE	PG7	72		TS	72
501	C	10		S. OF S. JCT. P.T.H. #10A (Flin Flon)	PG7	72		T	72
502	C	214		0.5 KM N. OF P.T.H. #44	PG5	12		RC	12
504	C	10		1.6 KM S. OF REPAP ROAD	PG7	72		TS	72
505	C	261		WEST OF P.T.H. #50	PG2	83		RC	32
506	C	260		N. OF E. JCT. P.R. #265	PG2	83		RC	56
507	C	44		EAST OF P.T.H. #9	PG1	78		UC	78
508	C	89		SOUTH OF P.T.H. #12	PG3			TS	14
509	C	7		NORTH OF P.T.H. #67	PG2	16		T	16
510	C	7		SOUTH OF P.T.H. #67	PG2	16		UC	2

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
511	C	1	A	S. OF SERVICE ROAD - BDN	PG4	24		RC	24
512	C	308		3.2 KM N. OF SPRAGUE	PG3	74		RES	93
514	C	210		3.2 KM S OF PR 203	PG2			RC	
515	C	3		W. OF SOUTH ACCESS TO CRYSTAL CITY	PG4	58		RC	621
516	C	210		3.2 KM S. OF P.T.H. #52	PG1	14		RC	12
517	C	200		2.4 KM N. OF P.R. #201	PG4			RC	35
519	C	200		SOUTH OF P.T.H. #23	PG4			RC	35
520	C	200		NORTH OF P.T.H. #23	PG4			RC	35
521	C	200		3.5 KM S. OF P.R. #210	PG1	8		RC	35
522	C	6		SOUTH OF P.T.H. #67	PG2	16		UC	2
523	C	239		WEST OF P.T.H. #6	PG2	60		RC	12
524	C	26		1.5 KM E. OF POPLAR POINT	PG2	81		RC	81
525	C	240		NORTH OF P.R. #227	PG6	4		RC	35
526	C	233		EAST OF P.T.H. #17	PG2	60		RC	81
527	C	224		3.2 KM N. OF P.R. #325	PG6	4		TS	75
528	C	8		4.0 KM N. OF P.R. #329	PG6	4		TS	4
529	C	8		EAST OF P.R. #234	PG6	4		TS	4
530	C	234		NORTH OF P.T.H. #8	PG6	4		TS	75
531	C	304		3.2 KM W. OF BISSETT	PG6	76		RES	56
532	C	304		3.2 KM E. OF BISSETT	PG6	76		RES	56
533	C	304		3.2 KM S. OF MANIGOTOGAN ACCESS RD.	PG6	76		RES	56
534	C	304		4.8 KM N. OF P.T.H. #11	PG5	93		RES	56
537	C	315		SOUTH OF P.R. #314	PG6	94		RES	93
538	C	315		EAST OF P.R. #314	PG6	94		RES	93
540	C	22		5.3 KM S. OF P.T.H. #2	PG2	66		T	21
541	C	251		WEST OF P.T.H. #21	PG2	40		T	56
543	C	83		3.2 KM N. OF U.S. BDRY.	PG2	40		T	40
544	C	251		WEST OF P.T.H. #83	PG2	40		T	56
547	C	45		WEST OF P.R. #264	PG2	80		RC	90
550	C	68		NORTH OF P.R. #278	PG2	49		T	49
551	C	59		SOUTH OF P.R. #202	PG1	77		UC	77
552	C	83		NORTH OF P.R. #367	PG2	84		RC	41
553	C	367		EAST OF SAN CLARA	PG5			RC	41
554	C	367		W. OF W. JCT. P.R. #366	PG6			RC	41
555	C	283		EAST OF P.R. #282	PG7	72		RC	73
556	C	283		WEST OF P.R. #282	PG7	72		RC	73
557	C	282		SOUTH OF P.R. #283	PG7	72		RC	73
559	C	1		E. OF W. JCT. P.T.H. #1A (BDN)	PG4	24		RC	24
560	C	44		1.3 KM N. OF P.T.H. #1	PG3	74		TS	74
561	C	307		4.0 KM E. OF P.R. #406	PG5	93		RES	93
563	C	9		2.4 KM S. OF N. JCT. P.T.H. #9A	PG1	3		RC	75
564	C	9	A	S. OF N. JCT. P.T.H. #9	PG1	3		UC	3
565	C	9	A	N. OF S. JCT. P.T.H. #9	PG1	3		UC	3
568	C	204		WEST OF P.R. #212	PG2	67		UC	77
569	C	212		WEST OF P.T.H. #59	PG1	67		UC	67
570	C	204		NORTH OF P.T.H. #44	PG1	77		UC	77
572	C	59		SOUTH OF P.T.H. #100	PG1	8		UC	8
573	C	240		3.2 KM N. OF PORTAGE LA PRAIRIE	PG5			RC	35
577	C	6		N. OF N. GYPSUMVILLE ACCESS	PG3	60		T	16
578	C	5		0.5 KM W. OF P.T.H. #20	PG2	49		T	49
579	C	10		0.8 KM W. OF P.R. #488	PG4			TS	36
580	C	20		N. OF N. JCT. P.T.H. #20A	PG4	32		RC	32
581	C	5		4.8 KM W. OF P.R. #366	PG2	49		RC	41
582	C	1		W. OF W. JCT. P.T.H. #1A (BDN)	PG4	24		TS	61
583	C	2		2.4 KM W. OF P.T.H. #13	PG2	48		T	46
585	C	202		NORTH OF REBECK ROAD	PG1	77		UC	77
586	C	8		NORTH OF P.T.H. #67	PG6	4		T	1
587	C	8		SOUTH OF P.T.H. #17	PG3	75		T	4
588	C	44		EAST OF P.R. #307	PG3	74		TS	74
589	C	800		STE. ANNE'S RD.,S. OF P.T.H. #100	TOWN			UC	
590	C	200		SOUTH OF P.T.H. #100	PG1	70		RC	35
591	C	1		W. OF W. JCT. P.T.H. #100	PG1	47		T	47
592	C	1		E. OF E. JCT. P.T.H. #26	PG2	48		T	47
593	C	59		NORTH OF P.R. #212	PG5	78		RC	78
594	C	12		S. OF S. JCT. P.T.H. #12	PG6	76		RES	76
595	C	309		NORTH OF P.R. #307	PG6	76		RES	93
596	C	215		EAST OF P.T.H. #12	PG5	12		RC	12
597	C	205		E. OF S. JCT. OF P.R. #216	PG1	14		RC	35
598	C	205		EAST OF P.T.H. #59	PG1	14		RC	35
599	C	67		EAST OF P.T.H. #6	PG1	3		UC	3
602	C	214		S.W. OF P.T.H. #11	PG5	12		RC	12
603	C	8		EAST OF CAUSEWAY	PG6	4		TS	4
604	C	8		1.6 KM N. OF HECLA	PG6	4		RES	76
605	C	233		NORTH OF P.T.H. #68	PG5			RC	81
606	C	229		3.2 KM E. OF P.T.H. #6	PG2	60		T	81
607	C	229		WEST OF P.T.H. #17	PG2	16		T	81
608	C	229		2.4 KM W. OF KOMARNO	PG2	16		T	81
609	C	17		WEST OF P.T.H. #6	PG2	16		T	16
610	C	248		1.9 KM S. OF P.T.H. #1	PG2	48		RC	81
611	C	248		SOUTH OF P.T.H. #26	PG4			RC	81
612	C	305		NORTH OF P.T.H. #2	PG2	46		T	46
613	C	305		0.2 KM S. OF P.T.H. #1	PG2	46		T	46
614	C	245		EAST OF P.R. #244	PG4	58		RC	58
615	C	244		NORTH OF P.T.H. #23	PG2	81		RC	58
616	C	244		SOUTH OF P.T.H. #23	PG2	81		RC	58
617	C	244		0.8 KM N. OF MANITOU	PG4			RC	58
618	C	245		2.4 KM W. OF P.T.H. #3	PG4			RC	58

Abbreviations
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
619	C	242		AT PEMBINA RIVER BRIDGE(LA RIVIERE)	PG2	81		RC	58
620	C	253		1.6 KM W. OF PILOT MOUND	PG2	66		RC	58
621	C	34		SOUTH OF P.T.H. #3	PG4	58		RC	58
622	C	251		EAST OF P.T.H. #83	PG2	40		T	56
623	C	256		SOUTH OF P.R. #251	PG2	21		T	56
624	C	256		SOUTH OF P.R. #257	PG2	21		T	56
625	C	257		1.6 KM E. OF SASK. BDRY.	PG2	40		RC	56
626	C	278		SOUTH OF P.T.H. #68	PG3			RC	75
627	C	237		EAST OF P.T.H. #6	PG2	60		RC	75
630	C	367		WEST OF P.T.H. #10	PG6			RC	41
631	C	489		WEST OF P.T.H. #20	PG5			RC	79
632	C	266		3.5 KM N. OF P.R. #587 (EXACTLY)	PG4			RC	36
633	C	268		EAST OF BIRCH RIVER	PG4			RC	36
634	C	77		3.2 KM E. OF SASK. BDRY.	PG3		74	T	49
635	C	285		1.6 KM E. OF THE PAS	PG7	73		RCS	73
636	C	39		EAST OF P.T.H. #10	PG2			RC	73
637	C	39		W. OF W. JCT. P.R. #382	PG2			RC	73
638	C	392		N. OF P.T.H. #39	PG7	73		RC	82
639	C	39		N. OF JCT. P.R. #596	PG7	72		RC	82
640	C	201		3.9 KM W. OF W. JCT. P.R. #200	PG1	14		RC	35
641	C	1		0.5 KM E. OF FALCON LAKE ACCESS	PG3	74		TS	74
642	C	1		0.5 KM W. OF FALCON LAKE ACCESS	PG3	74		TS	74
644	C	800		PORTAGE AVE. WPG.,E. OF W. JCT. PTH. #100	TOWN			UC	
646	C	2		EAST OF P.R. #248	PG2	48		T	48
647	C	2		WEST OF P.R. #248	PG2	48		T	48
648	C	3		N.E. OF P.T.H. #100	PG1	51		UC	51
649	C	3		1.6 KM N.E. OF P.R. #332	PG1	51		UC	51
650	C	3		1.6 KM S.W. OF P.R. #305	PG1	51		UC	51
651	C	44		SOUTH OF P.R. #312	PG3	74		TS	74
652	C	44		1.6 KM W. OF CADDY LAKE	PG3	74		TS	74
653	C	8		SOUTH OF P.R. #229	PG3	75		T	4
654	C	8		NORTH OF P.R. #229	PG3	75		T	4
655	C	204		SOUTH OF P.T.H. #101	PG1	77		UC	77
656	C	204		NORTH OF P.T.H. #101	PG1	77		UC	77
657	C	11		NORTH OF P.R. #211	PG3	75		RC	12
658	C	11		1.6 KM S. OF ST. GEORGE	PG3	75		T	76
659	C	11		W. OF R.R. TRACKS IN PINE FALLS	PG3	75		TS	76
660	C	15		EAST OF P.R. #207	PG1			UC	64
661	C	20		SOUTH OF P.R. #257	PG3	60		RC	32
662	C	59		SOUTH OF P.T.H. #101	PG1			UC	64
663	C	75		S. OF S. JCT. P.R. #246	PG2	63		T	14
664	C	75		N. OF N. JCT. P.R. #246	PG2	63		T	14
665	C	75		SOUTH OF P.R. #205	PG2	63		T	14
667	C	75		1.6 KM N. OF P.R. #305	PG2	63		T	14
668	C	800		PEMBINA HWY. WPG.,S. OF P.T.H. #100	TOWN			UC	
669	C	800		PEMBINA HWY. WPG.,N. OF P.T.H. #100	TOWN			UC	
670	C	100		WEST OF P.T.H. #75	PG1	70		UC	70
671	C	100		WEST OF WAVERLEY ST.	PG1	70		UC	70
672	C	100		NORTH OF P.T.H. #3	PG1	47		UC	47
673	C	100		SOUTH OF P.R. #427	PG1	47		UC	47
674	C	100		NORTH OF P.R. #427	PG1	47		UC	47
676	C	101		WEST OF P.T.H. #9	PG1	77		UC	77
677	C	101		EAST OF P.R. #409	PG1	77		UC	2
678	C	101		NORTH OF P.T.H. #1	PG1	47		UC	47
679	C	77		WEST OF P.T.H. #10	PG3		74	T	49
681	C	800		ROBLIN BLVD. WPG.,E. OF P.T.H. #100	TOWN			UC	
682	C	241		WEST OF P.T.H. #100	PG1	47		UC	47
683	C	300		N. OF S. JCT. P.T.H. #59	PG1			UC	64
684	C	307		WEST OF P.R. #309	PG5	93		RES	93
685	C	800		WILKES AVE. WPG.,E. OF P.T.H. #100	TOWN			UC	
686	C	427		WEST OF P.T.H. #100	PG1	51		UC	51
687	C	276		NORTH OF P.R. #364	PG5			RC	75
688	C	276		SOUTH OF P.R. #364	PG5			RC	75
689	C	17		SOUTH OF P.R. #325	PG2	16		T	16
690	C	218		1.6 KM S. OF P.T.H. #59	PG4	14		RC	35
691	C	22		NORTH OF P.T.H. #23	PG2	21		T	21
692	C	211		EAST OF P.T.H. #11	PG5	93		RC	93
693	C	312		EAST OF P.T.H. #44	PG3	74		RES	74
694	C	314		NORTH OF P.R. #315	PG6	94		RES	93
695	C	238		1.3 KM N. OF P.R. #410	PG1	3		UC	3
696	C	325		1.6 KM E. OF P.T.H. #6	PG3	60		T	60
697	C	325		WEST OF P.R. #234	PG3	60		T	60
698	C	363		WEST OF P.T.H. #83	PG4	41		RC	41
701	C	307		EAST OF P.T.H. #11	PG5	93		RES	93
702	C	5		4.5 KM N. OF P.T.H. #2	PG4	58		T	79
703	C	10		W. OF E. JCT. P.T.H. #16	PG4	24		RC	24
704	C	10		NORTH OF P.R. #275(SWAN RIVER)	PG4			RC	32
705	C	10		0.8 KM N. OF S. JCT. P.T.H. #10A (SWAN RIV.)	PG4			RC	36
706	C	57		WEST OF P.T.H. #83	PG6		92	RES	41
707	C	3		3.2 KM E. OF SASK BDRY.	PG4	58		RC	56
708	C	100		EAST OF P.T.H. #59	PG1	70		UC	70
709	C	1		EAST OF P.T.H. #16	PG2	46		TS	51
711	C	9		SOUTH OF P.T.H. #101	PG1	3		UC	3
712	C	8		SOUTH OF P.T.H. #101	PG1	1		UC	1
713	C	29		SOUTH OF P.T.H. #75	PG4			T	82
714	C	204		SOUTH OF P.R. #202	PG1	77		UC	77
715	C	9		S. OF S. JCT. P.R. #232	PG6	4		RC	75

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
716	C	14		WEST OF P.T.H. #75	PG4			RC	35
717	C	10		2.0 KM S. OF RICHMOND AVE.	PG4	24		T	66
718	C	1		1.6 KM E. OF E. JCT. P.T.H. #10	PG4	24		RC	24
719	C	16		1.6 KM E. OF E. JCT. P.T.H. #16A	PG4	28		T	43
720	C	83		3.2 KM S. OF SWAN RIVER	PG2	84		RC	36
721	C	10		SOUTH OF P.R. #271	PG2	84		TS	36
722	C	23		E. OF E. JCT. P.R. #240	PG4			T	14
723	C	2		EAST OF P.T.H. #10	PG2	66		T	66
724	C	18		3.2 KM N. OF N. JCT. P.T.H. #3	PG2	66		T	66
725	C	6		2.4 KM N. OF S. JCT. P.T.H. #68	PG3	60		T	
726	C	11		NORTH OF P.R. #307	PG5	12		RC	12
727	C	75		NORTH OF P.R. #243	PG2	63		T	14
728	C	17		4.8 KM N.W. OF TEULON	PG2	16		T	16
729	C	206		SOUTH OF P.T.H. #44	PG1	77		UC	77
730	C	229		WEST OF P.T.H. #8	PG8	4		T	75
731	C	100		W. OF ST. ANNE'S RD.	PG1			UC	64
732	C	100		WEST OF P.T.H. #59	PG1			UC	64
733	C	100		EAST OF P.T.H. #2	PG1	70		UC	70
734	C	243		WEST OF P.T.H. #75	PG4			RC	35
735	C	243		3.7 KM E. OF P.T.H. #30	PG4			RC	35
736	C	26		E. OF E. JCT. P.R. #248	PG1	48		UC	48
737	C	395		WEST OF P.R. #392	PG7	73		RC	82
738	C	635		MIDDLEBRO - N. OF P.T.H. #12	TOWN			RC	
739	C	308		NORTH OF P.T.H. #12	PG3	74		RES	93
741	C	308		SOUTH OF P.R. #525	PG3	74		RES	93
742	C	308		WEST OF S. ENTRANCE TO PARK	PG3	74		RES	93
743	C	641		WAMPUM - S. OF P.T.H. #12	TOWN			RC	
744	C	639		VASSAR - N. OF S. JCT. P.T.H. #12	TOWN			RC	
745	C	639		VASSAR - E. OF N. JCT. P.T.H. #12	TOWN			RC	
746	C	203		NORTH OF P.T.H. #12	PG2	16		RC	75
748	C	201		WEST OF SUNDOWN	PG2	63		RC	35
749	C	302		NORTH OF P.R. #201	PG4	14		RC	12
750	C	201		EAST OF P.R. #302	PG2	63		RC	35
751	C	209		SOUTH OF P.R. #201	PG1	14		RC	35
752	C	201		EAST OF P.T.H. #59	PG1	14		RC	35
753	C	209		0.6 KM E. OF P.T.H. #59	PG1	14		RC	35
758	C	218		SOUTH OF P.R. # 201	PG4	14		RC	35
759	C	218		EAST OF P.R. #200	PG4	14		RC	35
760	C	200		NORTH OF P.R. #218	PG4			RC	35
761	C	201		E. OF E. JCT. P.R. #200	PG1	14		RC	35
762	C	203		6.4 KM N. OF BADGER	PG2	16		RC	75
763	C	210		1.6 KM N. OF P.R. #203	PG4	14		RC	12
765	C	203		1.6 KM W. OF P.R. #210	PG1	14		RC	75
766	C	203		EAST OF P.R. #404	PG2	16		RC	75
767	C	404		NORTH OF P.T.H. #12	PG5			RC	
768	C	210		NORTH OF P.T.H. #12	PG4	14		RC	12
772	C	210		SOUTH OF P.R. #404	PG4	14		RC	12
773	C	404		SOUTH OF P.R. #210	PG5			RC	
777	C	210		W. OF R.R. TRACK (MARCHAND)	PG4	14		RC	12
778	C	210		E. OF MUN. RD. E. OF MARCHAND	PG4	14		RC	12
783	C	216		NORTH OF P.T.H. #59	PG4	12		RC	12
785	C	218		SOUTH OF P.R. #217	PG4	14		RC	35
786	C	217		W. OF W. JCT. P.R. #218	PG4			RC	35
788	C	217		EAST OF P.R. #200	PG4	14		RC	35
789	C	200		S. OF S. JCT. P.R. #217	PG4			RC	35
791	C	217		WEST OF P.R. #200	PG4	14		RC	35
792	C	217		EAST OF P.R. #246	PG4	14		RC	35
793	C	246		5.8 KM N. OF P.R. #217	PG4			RC	35
795	C	205		WEST OF P.T.H. #12	PG1	14		RC	35
797	C	216		S. OF S. JCT. P.R. #205	PG4	12		RC	12
799	C	403		EAST OF P.T.H. #59	PG5			T	
800	C	246		1.0 KM N. OF P.T.H. #23	PG2	63		RC	35
801	C	302		NORTH OF P.R. #303	PG4	14		RC	12
802	C	303		EAST OF P.T.H. #12	PG4	14		RC	14
804	C	216		N. OF N. JCT. P.R. #205	PG4	12		RC	12
805	C	205		W. OF N. JCT. OF P.R. #216	PG1	14		RC	35
807	C	205		0.6 KM W. OF P.T.H. #59	PG1	14		RC	35
808	C	205		EAST OF P.R. #200	PG1	14		RC	35
809	C	205		WEST OF P.R. #200	PG1	14		RC	35
811	C	200		EAST OF P.R. #246	PG4			RC	35
815	C	216		SOUTH OF P.T.H. #52	PG4	12		RC	12
816	C	210		WEST OF N. JCT. P.R. #302	PG4	14		RC	12
817	C	311		0.5 KM W. OF P.R. #210	PG4	14		RC	8
818	C	311		EAST OF P.T.H. #12	PG4	14		RC	8
819	C	311		0.2 KM W. OF P.T.H. #12	PG4	14		RC	8
820	C	311		EAST OF P.R. #206	PG4	14		RC	8
821	C	206		NORTH OF P.R. #311	PG1	14		RC	12
822	C	206		SOUTH OF P.R. #311	PG1	14		RC	12
823	C	311		WEST OF P.R. #206	PG4	14		RC	8
824	C	216		SOUTH OF P.R. #311	PG4	12		RC	12
825	C	311		EAST OF P.T.H. #59	PG4	14		RC	8
826	C	311		WEST OF P.T.H. #59	PG4	14		RC	8
828	C	311		EAST OF P.R. #200	PG4	14		RC	8
829	C	200		NORTH OF P.R. #305	PG2	63		RC	35
830	C	305		EAST OF P.R. #200	PG2	63		T	63
831	C	305		WEST OF P.T.H. #59	PG2	63		T	63
833	C	210		WEST OF P.T.H. #12	PG4	14		UC	8

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
835	C	210		EAST OF P.R. #206	PG4	14		UC	8
836	C	210		0.5 KM W. OF P.R. #206	PG1	7		UC	8
840	C	200		1.4 KM N. OF P.R. #210	PG1	8		RC	35
842	C	405		3.2 KM E. OF P.T.H. #59	PG1	8		RC	
843	C	207		S. OF W. JCT. P.T.H. #1	PG1			UC	64
844	C	207		WEST OF P.R. #206	PG1	7		UC	64
845	C	206		NORTH OF P.R. #207	PG1	6		RC	12
846	C	207		EAST OF P.R. #206	PG1			UC	64
847	C	206		NORTH OF P.R. #405	PG1	14		RC	12
848	C	405		WEST OF P.R. #206	PG1	7		RC	
849	C	301		3.2 KM E. OF FALCON LAKE ACCESS	PG6			RES	74
851	C	308		SOUTH OF P.T.H. #1	PG3	74		RES	93
852	C	308		NORTH OF P.R. #503	PG3	74		RES	93
853	C	308		SOUTH OF P.R. #503	PG3	74		RES	93
854	C	503		WEST OF P.R. #308	PG6			RES	93
855	C	503		EAST OF P.R. #505	PG6			RES	93
856	C	505		WEST OF P.R. #503	PG6			RES	93
857	C	503		NORTH OF P.R. #505	PG6			RES	93
859	C	506		NORTH OF P.T.H. #1	PG5	12		RC	93
860	C	506		SOUTH OF P.R. #507	PG4			RC	93
861	C	506		NORTH OF P.R. #507	PG4			RC	93
862	C	507		WEST OF P.R. #506	PG5	12		RC	93
865	C	302		NORTH OF P.T.H. #1	PG4	14		RC	12
866	C	302		NORTH OF P.R. #501	PG4	14		RC	12
867	C	501		EAST OF P.T.H. #1	PG1	8		RC	13
868	C	206		NORTH OF P.T.H. #1	PG1			RC	12
869	C	207		0.5 KM NORTH OF P.T.H. #1	PG1			UC	64
871	C	406		SOUTH OF P.T.H. # 11	PG5	12		RC	
872	C	15		2.4 KM E. OF P.R. #302	PG3	13		TS	61
873	C	302		SOUTH OF P.T.H. #15	PG4	14		RC	12
874	C	302		NORTH OF P.T.H. #15	PG4	14		RC	12
876	C	207		NORTH OF P.T.H. #15	PG1	77		UC	77
878	C	206		NORTH OF P.R. #213	PG1	8		UC	77
880	C	307		SOUTH OF P.R. #309	PG5	93		RES	93
881	C	406		SOUTH OF P.R. #307	PG5	93		RC	
882	C	408		NORTH OF P.T.H. #11	PG5	93		RC	
883	C	621		MOLSON - S. OF P.T.H. #44	TOWN			RC	
885	C	435		WEST OF P.T.H. #12	PG5	12		RC	12
887	C	638		TYNDALL - 0.2 KM N. OF P.T.H. #44	TOWN			RC	
889	C	212		SOUTH OF P.T.H. #44	PG4	12		RC	12
890	C	212		NORTH OF P.T.H. #44	PG1	67		UC	67
895	C	433		NORTH OF P.R. #313	PG6			RES	
897	C	520		NORTH OF P.R. #313	PG5	12		RC	93
898	C	317		NORTH OF P.T.H. #11	PG5	93		RC	75
901	C	317		EAST OF P.T.H. #12	PG3	75		RC	75
902	C	317		WEST OF P.T.H. #12	PG3	75		RC	75
904	C	672		LIBAU - N. OF P.T.H. #59 (S. ACCESS)	TOWN			RC	
907	C	319		NORTH OF P.T.H. #59	PG6	76		RES	76
908	C	500		WEST OF P.T.H. #12	PG6	76		RC	76
909	C	504		NORTH OF P.T.H. #59	PG6	76		RC	93
910	C	205		EAST OF P.T.H. #75	PG1	14		RC	35
912	C	243		EAST OF P.R. #524	PG4			RC	35
913	C	524		SOUTH OF P.R. #243	PG4			RC	35
914	C	243		WEST OF P.R. #524	PG4			RC	35
915	C	243		EAST OF P.R. #521	PG4			RC	35
916	C	243		EAST OF P.T.H. #32	PG4			RC	35
918	C	521		EAST OF P.T.H. #32	PG4			RC	35
921	C	201		SOUTH OF P.R. # 432	PG2	21		RC	35
922	C	432		NORTH OF P.R. #201	PG4			RC	35
924	C	201		EAST OF P.T.H. #31	PG2	21		RC	35
925	C	201		WEST OF P.T.H. #31	PG2	21		RC	35
928	C	201		3.2 KM E. OF P.R. #242	PG2	21		RC	35
929	C	242		SOUTH OF SNOWFLAKE	PG4	58		RC	58
930	C	242		NORTH OF SNOWFLAKE	PG4	58		RC	58
932	C	421		WEST OF P.T.H. #75	PG2	63		RC	35
933	C	421		EAST OF P.T.H. #30	PG4			RC	35
935	C	201		EAST OF P.R. #306	PG2	21		RC	35
936	C	306		SOUTH OF P.R. #201	PG4			RC	35
937	C	306		NORTH OF P.R. #201	PG4			RC	35
938	C	201		EAST OF P.T.H. #32	PG2	21		RC	35
939	C	201		WEST OF P.T.H. #32	PG4			RC	35
941	C	201		WEST OF P.T.H. #75	PG2	63		RC	35
942	C	420		0.5 KM N. OF P.R. #201	PG4			RC	
943	C	201		EAST OF P.T.H. #30	PG2	63		RC	35
945	C	332		1.9 KM N. OF P.T.H. #14	PG2	81		RC	35
947	C	306		1.6 KM N. OF P.T.H. #14	PG4			RC	35
949	C	428		NORTH OF P.T.H. #14	PG4			RC	35
950	C	432		1.6 KM N. OF P.T.H. #3	PG4			RC	35
953	C	432		6.4 KM S. OF MORDEN	PG4			RC	35
957	C	240		NORTH OF P.T.H. #3	PG2	81		RC	35
958	C	528		SOUTH OF P.T.H. #3	PG4			T	35
962	C	422		NORTH OF P.T.H. #23	PG4			RC	35
963	C	332		SOUTH OF P.T.H. #23	PG2	81		RC	35
964	C	332		0.8 KM N. OF P.T.H. #23	PG2	81		RC	35
966	C	336		NORTH OF P.T.H. #23	PG4			RC	35
968	C	306		SOUTH OF P.T.H. #23	PG4			RC	35
975	C	432		SOUTH OF P.T.H. #23	PG4			RC	35

Abbreviations
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
979	C	338		N. OF W. ACCESS TO MIAMI	PG4			T	35
981	C	240		NORTH OF P.T.H. #23	PG2	81		RC	35
982	C	240		SOUTH OF P.T.H. #23	PG2	81		RC	35
985	C	242		NORTH OF P.T.H. #23	PG2	81		RC	58
986	C	242		SOUTH OF P.T.H. #23	PG2	81		RC	58
987	C	205		WEST OF P.T.H. #75	PG4			RC	35
988	C	330		0.8 KM N. OF P.T.H. #75	PG2	63		UC	63
989	C	205		WEST OF P.R. #330	PG4			RC	35
990	C	205		E. OF E. JCT. P.R. #332	PG4			RC	35
991	C	205		EAST OF P.T.H. #3	PG4			RC	35
993	C	336		SOUTH OF P.T.H. #3	PG4			RC	35
996	C	855		HOMEWOOD - N. OF P.T.H. #3	TOWN			RC	
998	C	245		EAST OF P.R. #338	PG4			RC	58
999	C	338		NORTH OF P.R. #245	PG4			T	35
1000	C	245		WEST OF P.R. #338	PG4			RC	58
1002	C	245		E. OF E. JCT. P.R. #242	PG4			RC	58
1003	C	242		N. OF W. JCT. OF P.R. #245	PG2	81		RC	58
1004	C	449		NORTH OF P.R. #245	PG4	58		RC	58
1007	C	305		WEST OF P.T.H. #75	PG1	14		RC	63
1008	C	330		N. OF N. JCT. P.R. #305	PG2	63		UC	63
1009	C	330		S. OF S. JCT. P.R. #305	PG2	63		UC	63
1010	C	305		EAST OF P.R. #332	PG2	63		T	81
1011	C	332		SOUTH OF P.R. #305	PG2	81		RC	35
1012	C	305		0.3 KM W. OF P.T.H. #3	PG4			T	81
1013	C	305		EAST OF P.T.H. #13	PG2	81		T	81
1014	C	305		WEST OF P.T.H. #13	PG2	81		T	81
1015	C	305		EAST OF P.R. #240	PG2	81		T	58
1016	C	240		SOUTH OF P.R. #305	PG2	81		RC	35
1018	C	247		WEST OF P.T.H. #75	PG1	9		UC	63
1019	C	247		EAST OF P.T.H. #3	PG1	51		UC	63
1020	C	334		SOUTH OF P.T.H. #3	PG1	47		UC	47
1021	C	334		NORTH OF P.R. #247	PG1	47		UC	47
1022	C	247		WEST OF P.R. #334	PG2	48		RC	81
1024	C	247		EAST OF P.R. #248	PG2	81		RC	81
1025	C	248		SOUTH OF P.R. #247	PG4			RC	81
1026	C	247		WEST OF P.R. #248	PG2	81		RC	81
1027	C	332		SOUTH OF P.T.H. #2	PG2	81		RC	35
1029	C	248		SOUTH OF P.T.H. #2	PG4			RC	81
1030	C	248		1.6 KM N. OF P.T.H. #2	PG4			RC	81
1034	C	240		NORTH OF P.T.H. #2	PG4	58		RC	35
1035	C	240		1.8 KM S. OF P.T.H. #2	PG4	58		RC	35
1039	C	242		NORTH OF P.T.H. #2	PG2	81		RC	58
1040	C	449		EAST OF P.T.H. #34	PG4	58		RC	58
1041	C	427		EAST OF P.R. #334	PG1	51		UC	51
1042	C	334		NORTH OF P.R. #427	PG1	47		UC	47
1043	C	425		EAST OF P.R. #334	PG1	47		UC	47
1044	C	334		NORTH OF P.R. #425	PG1	47		UC	47
1045	C	424		SOUTH OF P.R. #241	PG1	47		UC	47
1046	C	332		SOUTH OF P.T.H. #1	PG2	81		RC	35
1048	C	248		0.8 KM N. OF P.T.H. #1	PG4			RC	81
1050	C	241		EAST OF P.R. #248	PG1	46		UC	46
1051	C	681		ST. EUSTACHE - WEST OF P.R. #248	TOWN			RC	
1054	C	430		NORTH OF P.T.H. #1	PG2	81		RC	81
1055	C	250		3.2 KM S. OF P.T.H. #45	PG3	96		RC	75
1056	C	331		1.3 KM E. OF P.T.H. #13	PG4	58		RC	81
1058	C	331		3.0 KM WEST OF NEWTON	PG4	58		RC	81
1060	C	240		2.7 KM W. OF P.R. #331	PG2	81		RC	35
1061	C	242		0.8 KM S. OF P.T.H. #1	PG2	46		RC	58
1062	C	242		NORTH OF P.T.H. #1	PG2	46		RC	58
1063	C	350		NORTH OF P.T.H. #1	PG4	58		T	58
1064	C	350		1.6 KM S. OF P.T.H. #1	PG4	58		T	58
1065	C	352		WEST OF P.T.H. #34	PG2	79		T	79
1070	C	350		WEST OF LAVENHAM	PG4	58		T	58
1071	C	350		WEST OF P.R. #242	PG4	58		T	58
1072	C	242		EAST OF P.R. #350	PG2	46		RC	58
1073	C	330		SOUTH OF P.T.H. #100	PG2	63		UC	63
1074	C	221		WEST OF P.T.H. #101	PG1	47		UC	2
1075	C	236		WEST OF P.T.H. #6	PG1	51		RC	2
1076	C	236		NORTH OF P.T.H. #6	PG1	51		RC	2
1079	C	221		WEST OF P.T.H. #7	PG1	51		UC	2
1080	C	220		WEST OF P.T.H. #6	PG1	1		UC	1
1083	C	321		WEST OF P.T.H. #6	PG1	1		UC	1
1084	C	230		S. OF P.R. #410	PG1	3		UC	3
1085	C	410		EAST OF P.R. #230	PG1	3		UC	3
1087	C	230		S.W. OF P.T.H. #67	PG1	3		UC	3
1088	C	67		EAST OF P.R. #230	PG1	3		UC	3
1092	C	221		5.8 KM W. OF W. JCT. P.R. #334	PG2	48		UC	2
1094	C	221		1.6 KM E. OF P.R. #248	PG4			UC	2
1095	C	248		NORTH OF P.T.H. #26	PG4			RC	76
1099	C	67		EAST OF P.R. #220	PG4	14		UC	3
1101	C	220		SOUTH OF P.T.H. #67	PG1	1		UC	1
1102	C	321		WEST OF P.R. #220	PG1	1		UC	1
1104	C	321		WEST OF P.T.H. #7	PG1	1		UC	1
1105	C	236		SOUTH OF P.T.H. #67	PG1	1		RC	2
1106	C	321		EAST OF P.R. #322	PG1	1		UC	1
1107	C	322		SOUTH OF P.T.H. #67	PG4			RC	81
1108	C	227		WEST OF P.T.H. #6	PG4			T	81

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
1110	C	248		SOUTH OF P.R. #227	PG4			RC	76
1112	C	227		WEST OF P.R. #248	PG2	81		T	81
1113	C	430		N. OF N. JCT. P.R. #227	PG3	65		RC	81
1114	C	227		WEST OF P.R. #430	PG2	81		T	81
1115	C	430		NORTH OF P.T.H. #26	PG2	81		RC	81
1116	C	624		HIGH BLUFF - NORTH OF P.T.H. #26	TOWN			RC	
1118	C	227		EAST OF P.T.H. #16	PG2	83		T	81
1119	C	236		NORTH OF P.R. #323	PG4			RC	2
1120	C	323		EAST OF P.R. #236	PG5			RC	81
1121	C	236		SOUTH OF P.R. #323	PG4			RC	2
1122	C	323		E. OF E. JCT. P.R. #322	PG5			RC	81
1123	C	322		SOUTH OF P.R. #323	PG4			RC	81
1124	C	322		W. OF E. JCT. P.R. #323	PG4			RC	81
1125	C	323		EAST OF P.T.H. #6	PG6	4		RC	81
1127	C	248		NORTH OF P.R. #227	PG4			RC	76
1128	C	248		SOUTH OF P.R. #411	PG4			RC	76
1129	C	518		1.6 KM N. OF P.T.H. #6	PG2	16		RC	16
1130	C	411		WEST OF P.R. #248	PG5			RC	75
1132	C	411		EAST OF P.R. #430	PG5			RC	75
1135	C	320		0.5 KM S. OF P.T.H. #4	PG4	68		UC	67
1139	C	236		WEST OF P.T.H. #7	PG2	16		T	2
1141	C	322		NORTH OF P.R. #323	PG6	4		RC	81
1142	C	322		SOUTH OF P.R. #415	PG6	4		RC	81
1143	C	232		E. OF S. JCT. P.T.H. #9	PG6	4		RC	75
1144	C	225		EAST OF P.T.H. #9	PG6	4		TS	75
1145	C	647		PONEMAH - E. OF P.T.H. #9	TOWN			RC	
1146	C	229		WEST OF P.T.H. #9	PG6	4		T	75
1147	C	519		EAST OF P.T.H. #6	PG6	76		RC	93
1148	C	231		3.2 KM W. OF P.T.H. #6	PG6	4		T	75
1150	C	324		EAST OF P.T.H. #6	PG6			RC	4
1151	C	222		NORTH OF P.R. #324	PG6	4		TS	75
1152	C	604		ARNES ACCESS E. OF PTH 6	TOWN			RC	
1153	C	222		1.6 KM S. OF HNAUSA	PG6	4		TS	75
1154	C	222		1.0 KM N.W. OF RAILWAY CROSSING	PG6	4		TS	75
1155	C	640		HNAUSA - EAST OF P.T.H. #6	TOWN			RC	
1156	C	329		1.6 KM W. OF SANDYBAR	PG6	4		RC	16
1157	C	329		EAST OF P.T.H. #6	PG6	4		RC	16
1158	C	6		SOUTH OF P.R. #234	PG3	75		TS	4
1161	C	234		SOUTH OF P.R. #325	PG6	4		TS	75
1162	C	234		NORTH OF P.R. #325	PG6	4		TS	75
1165	C	17		2.4 KM E. OF P.T.H. #7	PG5			T	16
1166	C	415		0.5 KM W. OF P.T.H. #7	PG4			T	81
1167	C	518		SOUTH OF P.R. #415	PG2	16		RC	16
1168	C	415		EAST OF P.R. #518	PG4			T	81
1169	C	415		NORTH OF P.R. #518	PG5			T	81
1171	C	17		0.5 KM S.E. OF S. JCT. P.R. #229	PG2	16		T	16
1172	C	17		S. OF N. JCT. P.R. #229	PG2	16		T	16
1173	C	416		WEST OF P.T.H. #17	PG4			T	81
1174	C	17		N. OF N. JCT. P.R. #229	PG2	16		T	16
1178	C	229		20.0 KM EAST OF P.T.H. #6	PG2			T	81
1181	C	6		2.4 KM N.W. OF P.R. #229	PG3	60		TS	4
1182	C	17		NORTH OF P.R. #231	PG2	16		T	16
1183	C	419		EAST OF P.R. #512	PG2	60		RC	81
1184	C	512		NORTH OF P.R. #419	PG2	60		T	60
1185	C	419		WEST OF P.R. #512	PG2	60		RC	81
1186	C	419		2.4 KM E. OF P.T.H. #6	PG2	60		RC	81
1188	C	419		0.8 KM N.W. OF P.T.H. #6	PG2	60		RC	75
1193	C	68		3.2 KM E. OF P.T.H. #7	PG6	4		TS	4
1194	C	326		1.6 KM N. OF ARBORG	PG4			RC	16
1195	C	329		WEST OF P.T.H. # 6	PG5			RC	16
1202	C	326		NORTH OF P.R. #329	PG4			RC	16
1203	C	326		EAST OF P.R. #233	PG4			RC	16
1205	C	233		NORTH OF P.R. #329	PG6	4		RC	81
1206	C	329		EAST OF P.R. #233	PG5			RC	16
1207	C	233		SOUTH OF P.R. #329	PG6	4		RC	81
1208	C	329		WEST OF P.R. #233	PG5			RC	16
1209	C	329		EAST OF P.T.H. #17	PG5			RC	16
1210	C	17		SOUTH OF P.R. #233	PG2	16		T	16
1211	C	233		WEST OF P.T.H. #17	PG5			RC	81
1212	C	17		NORTH OF P.R. #233	PG2	16		T	16
1213	C	325		EAST OF P.R. #224	PG3	60		T	60
1214	C	325		WEST OF P.R. #224	PG3	60		T	60
1215	C	325		WEST OF P.T.H. #17	PG3	60		T	60
1218	C	68		SOUTH OF P.R. #325	PG2	49		T	49
1219	C	325		NORTH OF P.T.H. #68	PG3	60		T	60
1220	C	68		WEST OF P.R. #325	PG2	49		T	49
1221	C	328		WEST OF P.T.H. #6	PG2	60		RC	60
1222	C	645		GYPSUMVILLE - E. OF P.T.H. #6	TOWN			RC	
1223	C	34		NORTH OF U.S. BORDER	PG2	21		RC	621
1225	C	423		EAST OF P.T.H. #34	PG4	58		RC	621
1226	C	342		N. OF CLEARWATER ACCESS RD	PG4	58		T	621
1227	C	253		WEST OF P.R. #440	PG2	66		RC	58
1228	C	440		NORTH OF P.R. #253	PG4	58		RC	621
1229	C	242		0.3 KM N. OF P.T.H. #3	PG2	46		RC	58
1230	C	440		SOUTH OF P.T.H. #23	PG4	58		RC	621
1232	C	532		SOUTH OF P.R. #245	TOWN			RC	58
1233	C	245		EAST OF P.R. #532	PG4			RC	58

Abbreviations
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.*	Old TPG	Old Control Stn.
1235	C	245		EAST OF P.R. #342	PG4			RC	58
1236	C	342		NORTH OF P.R. #245	PG2	21		T	58
1239	C	442		1.6 KM N. OF P.T.H. #3	PG4	58		RC	621
1240	C	442		WEST OF P.R. #342	PG4	58		RC	621
1241	C	253		WEST OF S. JCT. P.R. #342	PG2	66		RC	58
1242	C	253		S. OF N. JCT. P.R. #342	PG2	66		RC	58
1243	C	342		EAST OF P.R. #253	PG4	58		T	621
1244	C	342		SOUTH OF P.T.H. #23	PG2	21		T	621
1245	C	342		NORTH OF P.T.H. #23	PG2	21		T	58
1246	C	5		1.6 KM N. OF P.T.H. #3	PG2	21		RC	621
1248	C	5		SOUTH OF P.R. #253	PG2	21		RC	621
1249	C	253		EAST OF P.T.H. #5	PG2	66		RC	58
1250	C	5		SOUTH OF P.T.H. #23	PG2	21		RC	621
1251	C	5		NORTH OF P.T.H. #23	PG2	21		RC	621
1253	C	458		NORTH OF P.T.H. #3	PG4	58		RC	621
1256	C	253		E. OF E. JCT. P.R. #458	PG2	66		RC	58
1257	C	253		W. OF E. JCT. P.R. #458	PG2	66		RC	58
1258	C	458		N. OF E. JCT. P.R. #253	PG4	58		RC	621
1259	C	458		SOUTH OF P.T.H. #23	PG4	58		RC	621
1260	C	618		BELMONT - NORTH OF E. JCT. P.T.H. #23	TOWN			RC	
1261	C	618		BELMONT - E. OF WEST JCT. P.T.H. #23	TOWN			RC	
1264	C	18		SOUTH OF LENA	PG2	66		T	66
1265	C	341		0.5 KM W. OF P.T.H. #18	PG2	21		T	621
1267	C	253		EAST OF P.T.H. #18	PG2	66		RC	58
1272	C	344		WAWANESA - NORTH OF P.T.H. #2	PG4	58		RC	66
1273	C	340		NORTH OF P.T.H. #2	PG4	58		RC	66
1274	C	340		NORTH OF SOURIS RIVER	PG4	58		RC	66
1279	C	675		STOCKTON - NORTH OF P.T.H. #2	TOWN			RC	
1282	C	341		EAST OF P.T.H. #10	PG2	21		T	621
1283	C	10		SOUTH OF P.R. #341	PG2	21		T	21
1285	C	346		NORTH OF P.T.H. #3	PG2	66		T	66
1286	C	346		1.6 KM N. OF P.R. #443	PG4	56		T	66
1287	C	443		3.2 KM E. OF P.T.H. #10	PG4	56		RC	21
1290	C	346		SOUTH OF P.T.H. #23	PG2	66		T	66
1292	C	346		1.6 KM N. OF P.T.H. #23	PG2	66		T	66
1293	C	346		SOUTH OF P.T.H. #2	PG4	56		T	66
1294	C	650		NESBITT - N. OF P.T.H. #2	TOWN			RC	
1296	C	453		WEST OF P.R. #340	PG4	56		T	24
1306	C	349		WEST OF P.T.H. #10	PG2	66		T	24
1308	C	232		E. OF N. JCT. P.T.H. #9	PG6	4		RC	75
1309	C	468		NORTH OF P.R. #457	PG4	24		T	24
1310	C	457		WEST OF P.R. #340	PG4	24		RC	24
1311	C	340		SOUTH OF P.R. #457	PG4	58		RC	66
1314	C	450		SOUTH OF P.T.H. #3	PG2	21		RC	21
1318	C	21		SOUTH OF P.R. #251	PG2	21		T	78
1319	C	251		EAST OF P.R. #452	PG4	56		T	56
1320	C	452		NORTH OF P.R. #251	PG4	56		T	56
1321	C	251		5.0 KM WEST OF WASKADA	PG2	40		T	56
1324	C	256		NORTH OF U.S. BORDER	PG2	21		T	56
1326	C	254		SOUTH OF P.T.H. #3	PG4	56		T	56
1327	C	254		1.6 KM N. OF P.T.H. #3	PG4	56		T	56
1328	C	452		SOUTH OF P.T.H. #3	PG2	21		T	56
1329	C	452		NORTH OF P.T.H. #3	PG4	56		T	56
1331	C	445		EAST OF P.R. #256	PG4	56		RC	56
1332	C	252		NORTH OF P.T.H. #3	PG2	40		RC	56
1336	C	452		EAST OF P.T.H. #83	PG4	56		T	56
1337	C	254		1.6 KM S. OF PR 345	PG4	56		T	56
1338	C	345		1.6 KM E OF PR 254	PG4	58		T	56
1339	C	254		NORTH OF P.R. #345	PG4	56		T	56
1340	C	345		EAST OF P.T.H. #83	PG2	40		T	56
1341	C	345		WEST OF P.T.H. #83	PG2	40		T	56
1343	C	252		SOUTH OF P.R. #345	PG2	40		RC	56
1344	C	345		WEST OF P.R. #252	PG2	40		T	56
1345	C	256		SOUTH OF P.R. #345	PG2	21		T	56
1346	C	256		NORTH OF P.R. #345	PG2	21		T	56
1347	C	345		1.6 KM W. OF W. JCT. P.R. #256	PG4	56		T	56
1356	C	541		WEST OF P.T.H. #21	PG4	56		T	40
1357	C	254		WEST OF P.R. #541	PG4	56		T	56
1358	C	254		SOUTH OF P.T.H. #2	PG4	56		T	56
1360	C	348		NORTH OF P.T.H. #2	PG2	66		T	24
1361	C	254		NORTH OF P.T.H. #2	PG2			T	56
1364	C	256		NORTH OF P.T.H. #2	PG2	21		T	56
1365	C	256		SOUTH OF P.T.H. #2	PG2	21		T	56
1367	C	349		EAST OF P.R. #250	PG2	66		T	24
1368	C	250		NORTH OF P.R. #349	PG2			RC	24
1370	C	543		EAST OF P.R. #254	PG2			T	78
1372	C	254		EAST OF OAKLAKE	PG3			T	56
1373	C	254		SOUTH OF P.R. #255	PG3			T	56
1374	C	255		EAST OF P.T.H. #83	PG2	40		T	75
1377	C	255		EAST OF P.R. #256	PG4	56		T	56
1378	C	256		SOUTH OF P.R. #255	PG2	21		T	56
1379	C	255		WEST OF P.R. #256	PG4	56		T	56
1380	C	257		EAST OF P.R. #256	PG2	40		RC	56
1381	C	256		NORTH OF P.R. #257	PG2	21		T	56
1384	C	352		NORTH OF P.T.H. #1	PG2	79		T	58
1386	C	351		S. OF E. JCT. P.T.H. #1	PG2	79		RC	79
1388	C	5		9.7 KM S. OF P.R. #351	PG2	79		T	79

Abbreviations:
PG = Prairie Group
TOWN = located within a town
*Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
1389	C	5		SOUTH OF P.R. #351	PG2	79		RC	24
1391	C	351		S. OF W. JCT. P.T.H. #1	PG2	79		RC	79
1392	C	464		NORTH OF P.T.H. #1	PG2	79		T	24
1393	C	468		NORTH OF P.T.H. #1	PG4	24		T	24
1394	C	457		3.2 KM E. OF BRANDON	PG4	24		RC	24
1395	C	629		BRANDON AIRPORT - W. OF P.T.H. #10	TOWN			RC	
1396	C	10		SOUTH OF P.T.H. #1	PG4	24		RC	24
1397	C	459		EAST OF P.T.H. #1	PG4	24		RC	24
1399	C	456		WEST OF P.R. #250	PG2			RC	24
1401	C	254		NORTH OF P.T.H. #1	PG2			T	56
1403	C	254		0.5 KM S. OF RLWY X-SING	PG3			T	56
1406	C	256		1.6 KM S. OF P.T.H. #1	PG2	21		T	56
1407	C	256		NORTH OF P.T.H. #1	PG2	21		T	56
1409	C	242		SOUTH OF P.T.H. #16	PG2	46		RC	56
1410	C	242		3.2 KM N. OF WESTBOURNE	PG6	4		RC	75
1411	C	242		12.9 KM N. OF P.T.H. #16	PG6	4		RC	75
1412	C	567		EAST OF P.T.H. #50	PG6			RES	46
1415	C	569		EAST OF P.T.H. #50	PG6			RES	46
1416	C	265		0.8 KM E. OF P.T.H. #50	PG6			RES	76
1417	C	265		1.6 KM W. OF P.T.H. #50	PG3			RC	81
1419	C	350		SOUTH OF P.T.H. #16	PG4	58		T	58
1422	C	265		EAST OF P.R. #260	PG4			RC	81
1423	C	265		1.6 KM W. OF P.R. #260	PG4			RC	81
1429	C	352		SOUTH OF P.T.H. #16	PG2	79		T	58
1430	C	352		SOUTH OF P.R. #265	PG2	79		T	58
1431	C	265		EAST OF P.R. #352	PG2	83		RC	81
1432	C	352		EAST OF BIRNIE	PG2	79		T	58
1433	C	265		1.6 KM E. OF P.T.H. #5	PG2	83		RC	81
1434	C	352		EAST OF P.T.H. #5	PG2	79		T	58
1435	C	357		WEST OF P.T.H. #5	PG3	97		RC	96
1436	C	265		WEST OF P.T.H. #5	PG2	83		RC	81
1440	C	5		SOUTH OF P.R. #353	PG2	79		T	79
1441	C	353		1.0 KM E. OF P.R. #464	PG4	28		RC	24
1442	C	464		2.4 KM S. OF P.R. #353	PG4	58		T	24
1443	C	353		W. OF P.R. #464	PG4	28		RC	24
1444	C	353		EAST OF P.R. #468	PG2	79		RC	24
1446	C	468		SOUTH OF P.R. #353	PG4	24		T	24
1447	C	353		EAST OF P.T.H. #10	PG2	79		RC	24
1449	C	465		WEST OF P.R. #464	PG2	79		T	24
1451	C	465		EAST OF P.R. #262	PG2	79		T	24
1452	C	464		SOUTH OF P.T.H. #16	PG4	58		T	24
1453	C	466		SOUTH OF P.T.H. #16	PG2	43		T	24
1454	C	573		FRANKLIN - NORTH OF P.T.H. #16	TOWN			RC	
1458	C	471		EAST OF P.R. #606 BETHANY	PG2	43		T	24
1459	C	471		WEST OF P.R. #606 BETHANY	PG2	43		T	24
1460	C	262		SOUTH OF P.R. #471	PG2	43		RC	24
1461	C	262		SOUTH OF P.R. #265	PG3	96		RC	24
1462	C	265		EAST OF P.R. #262	PG2	83		RC	81
1463	C	262		NORTH OF P.R. #265	PG3	96		RC	24
1465	C	357		EAST OF P.R. #262	PG3	97		RC	96
1466	C	262		NORTH OF P.R. #357	PG3	96		RC	24
1469	C	270		SOUTH OF P.T.H. #25	PG2	43		RC	24
1470	C	270		NORTH OF P.T.H. #25	PG2	43		RC	24
1471	C	250		3.2 KM S. OF P.R. #259	PG2			RC	24
1472	C	259		1.6 KM N. OF P.R. #564	PG4	28		RC	24
1473	C	259		WEST OF P.R. #564	PG4	28		RC	24
1474	C	564		SOUTH OF P.R. #259	PG2			RC	62
1476	C	259		EAST OF P.T.H. #21	PG4	28		RC	24
1479	C	463		WEST OF P.T.H. #21	PG2			RC	24
1480	C	254		SOUTH OF P.R. #463	PG2			T	56
1481	C	254		EAST OF P.R. #259	PG2			T	56
1482	C	259		NORTH OF P.R. #254	PG4	28		RC	24
1483	C	259		W. OF JCT. P.R. #254	PG4	28		RC	24
1484	C	270		0.8 KM N. OF P.T.H. #24	PG2	43		RC	24
1486	C	250		NORTH OF P.T.H. #24	PG2	43		RC	24
1487	C	250		SOUTH OF P.T.H. #24	PG2	43		RC	24
1488	C	354		1.6 KM S. OF P.T.H. #24	PG2	21		RC	90
1489	C	264		NORTH OF P.T.H. #24	PG4	28		T	90
1492	C	467		WEST OF P.T.H. #83	PG4	28		T	24
1493	C	467		E. OF E. JCT. P.R. #256	PG4	28		T	24
1494	C	256		NORTH OF P.R. #467	PG2	21		T	56
1495	C	256		SOUTH OF P.R. #467	PG2	21		T	56
1496	C	256		W. OF W. JCT. P.R. #256	PG2	21		T	24
1497	C	41		SOUTH OF P.R. #467	PG2	25		T	25
1501	C	354		NORTH OF P.T.H. # 24	PG2	21		RC	90
1502	C	354		SOUTH OF P.R. # 355	PG2	21		RC	90
1506	C	469		WEST OF P.T.H. #21	PG4	28		RC	24
1507	C	469		EAST OF P.R. #264	PG4	28		RC	24
1509	C	355		EAST OF P.R. #270	PG4	28		RC	24
1511	C	270		SOUTH OF P.R. #355	PG2	43		RC	24
1512	C	355		WEST OF P.R. #270	PG4	28		RC	24
1514	C	250		E. OF W. JCT. P.R. #355	PG2	43		RC	24
1515	C	464		NORTH OF P.R. #353	PG4	58		T	24
1516	C	355		W. OF W. JCT. P.R. #250	PG4	28		RC	90
1517	C	354		NORTH OF P.R. #355	PG2	21		RC	90
1518	C	354		W. OF W. JCT. P.R. #354	PG2	21		RC	90
1521	C	355		EAST OF P.T.H. #21	PG4	28		RC	90

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
1522	C	355		WEST OF P.T.H. #21	PG4	28		RC	90
1523	C	355		EAST OF P.R. #264	PG4	28		RC	90
1524	C	264		1.6 KM S. OF P.R. #355	PG4	28		T	90
1525	C	264		1.6 KM N. OF P.R. #355	PG4	28		T	90
1526	C	355		1.6 KM W. OF P.R. #264	PG4	28		RC	90
1528	C	474		1.6 KM S. OF P.R. #355	PG4	28		RC	90
1529	C	355		WEST OF P.R. #474	PG4	28		RC	90
1531	C	256		EAST OF P.T.H. #41	PG2	21		T	56
1532	C	571		WEST OF P.T.H. #41	PG2	25		T	90
1535	C	270		NORTH OF P.T.H. #16	PG2	43		RC	75
1537	C	250		NORTH OF P.T.H. #16	PG4	28		RC	75
1538	C	250		1.6 KM S. OF P.T.H. #16	PG2	43		RC	24
1540	C	354		1.6 KM N. OF P.T.H. #16	PG2	21		RC	90
1541	C	354		1.6 KM S. OF P.T.H. #16	PG2	21		RC	90
1546	C	477		WEST OF P.T.H. #21	PG4			RC	90
1547	C	264		SOUTH OF P.T.H. #42	PG2	43		T	90
1548	C	264		1.6 KM S. OF P.T.H. #16	PG2	43		T	90
1550	C	568		WEST OF P.T.H. #83	PG2	43		T	90
1551	C	568		SOUTH OF P.T.H. #42	PG2	43		T	90
1555	C	264		NORTH OF P.T.H. #16	PG2	43		T	90
1556	C	472		3.2 KM S. OF P.T.H. #16	PG4	28		T	90
1557	C	475		1.6 KM W. OF P.T.H. #16	PG4	28		T	90
1558	C	354		SOUTH OF P.T.H. #45	PG2	21		RC	90
1561	C	566		1.6 KM N. OF P.T.H. #45	PG2	43		RC	90
1564	C	262		EAST OF P.T.H. #10	PG5			RC	24
1565	C	270		0.8 KM W. OF P.T.H. #10	PG3	96		RC	24
1567	C	270		SOUTH OF P.R. #359	PG3	96		RC	75
1568	C	354		NORTH OF P.R. #262	PG3	96		RC	90
1569	C	470		WEST OF P.R. #250	PG3	96		RC	75
1570	C	354		N. OF N. JCT. P.R. #470	PG3	96		RC	90
1573	C	577		SOUTH OF P.R. #566	PG2	43		RC	90
1574	C	577		NORTH OF P.R. #566	PG2	43		RC	90
1576	C	577		EAST OF P.R. #264	PG2	43		RC	90
1577	C	264		NORTH OF P.R. #577	PG2	43		T	90
1578	C	264		NORTH OF P.T.H. #45	PG4	28		T	90
1579	C	264		0.5 KM S. OF ROSSBURN	PG2	43		T	90
1582	C	478		EAST OF P.T.H. #16	PG4	28		T	90
1583	C	478		1.6 KM W. OF P.T.H. #16	PG4	28		T	90
1585	C	478		WEST OF P.R. #579	PG2	80		T	90
1586	C	579		NORTH OF P.R. #478	PG2	80		T	90
1589	C	476		SOUTH OF P.T.H. #45	PG2	80		T	90
1591	C	476		1.6 KM N. OF P.T.H. #45	PG2	80		T	90
1592	C	478		0.5 KM S. OF P.T.H. #45	PG4	28		T	90
1593	C	478		1.6 KM N. OF P.T.H. #45	PG4	28		T	90
1595	C	264		EAST OF P.R. #476	PG2	43		T	90
1596	C	264		WEST OF P.R. #476	PG2	43		T	90
1602	C	575		WEST OF P.R. #260	PG4			RC	49
1604	C	462		10.0 KM. N. OF P.R. 265	PG2	49		T	24
1605	C	462		NORTH OF P.R. #265	PG2	49		T	24
1608	C	260		S. OF S. JCT. P.R. #261	PG2	83		RC	58
1609	C	261		NORTH OF P.R. #260	PG2	83		RC	32
1611	C	261		EAST OF P.R. #462	PG2	83		RC	32
1612	C	462		NORTH OF P.R. #261	PG4	58		T	24
1613	C	462		1.9 KM S. OF P.R. #261	PG4	58		T	24
1614	C	261		WEST OF P.R. #462	PG2	83		RC	32
1616	C	270		SOUTH OF P.T.H. #45	PG3	96		RC	75
1617	C	462		EAST OF P.T.H. #5	PG2	49		T	24
1623	C	360		EAST OF S JCT PTH 5	PG2	49		RC	49
1624	C	480		WEST OF P.T.H. #5	PG4	32		RC	32
1625	C	360		EAST OF N JCT PTH 5	PG2	49		RC	49
1631	C	276		SOUTH OF METHLEY BEACH ACCESS	PG3			RC	75
1632	C	276		NORTH OF METHLEY BEACH ACCESS	PG3			RC	75
1633	C	626		METHLEY BEACH - WEST OF P.R. #276	TOWN			RC	
1636	C	364		WEST OF RORKTON	PG6			T	32
1637	C	364		SOUTH OF P.R. #481	PG6			T	32
1638	C	481		EAST OF P.R. #276	PG2	60		RC	75
1639	C	276		2.1 KM N. OF P.R. #481	PG6			RC	75
1640	C	481		WEST OF P.R. #276	PG2	60		RC	75
1641	C	490		NORTH OF P.R. #481	PG5			RC	75
1642	C	269		SOUTH OF P.R. #276	PG3			T	32
1643	C	276		EAST OF P.R. #269	PG6			RC	75
1644	C	276		NORTH OF P.R. #269	PG6			RC	75
1645	C	328		0.5 KM E. OF P.R. #276	PG5			RC	60
1646	C	276		NORTH OF P.R. #328	PG6			RC	75
1647	C	480		SOUTH OF P.R. #582	PG2	49		RC	32
1648	C	582		WEST OF P.R. #480	PG2	49		RC	49
1649	C	480		SOUTH OF P.T.H. #5	PG2	49		RC	32
1653	C	582		SOUTH OF P.T.H. #5	PG2	49		RC	49
1654	C	362		0.5 KM N. OF P.T.H. #5-A	PG4	32		T	32
1656	C	274		S. OF E. JCT. P.T.H. #5	PG2	84		T	32
1657	C	274		1.6 KM N. OF P.T.H. #5	PG4	32		T	32
1658	C	274		S. OF W. JCT. P.T.H. #5	PG4	32		T	32
1659	C	366		SOUTH OF P.T.H. #5	PG4	41		RC	32
1660	C	584		SOUTH OF P.T.H. #5	PG2	84		RC	41
1661	C	584		NORTH OF P.T.H. #5	PG2	84		RC	41
1662	C	584		NORTH OF P.R. #366	PG2	84		RC	41
1663	C	366		EAST OF P.R. #584	PG2	84		RC	32

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
1665	C	583		SOUTH OF P.T.H. #5	PG4	41		RC	41
1667	C	583		EAST OF P.T.H. #83	PG4	41		RC	41
1668	C	484		NORTH OF P.T.H. #5	PG4	41		RC	75
1671	C	366		EAST OF P.R. #582	PG4	41		RC	41
1672	C	582		NORTH OF P.R. #366	PG4	41		RC	41
1673	C	366		EAST OF P.T.H. #83	PG4	41		RC	41
1674	C	482		WEST OF P.T.H. #83	PG6		92	RC	75
1675	C	482		0.5 KM N. OF SHELLMOUTH DAM	PG6		92	RC	75
1680	C	582		SOUTH OF P.R. #583	PG4	41		RC	41
1686	C	364		SOUTH OF P.R. #269	PG6			T	32
1687	C	269		N. OF S. JCT. P.R. #364	PG2	84		T	32
1688	C	269		WEST OF P.R. #364	PG2	84		T	32
1689	C	269		EAST OF P.R. #364	PG3			T	32
1690	C	364		NORTH OF P.R. #269	PG6			T	32
1691	C	269		0.8 KM W. OF P.T.H. #20	PG2	84		T	32
1693	C	271		EAST OF P.R. #489	PG2	84		RC	32
1694	C	489		NORTH OF P.R. #271	PG5			RC	79
1696	C	271		WEST OF P.R. #489	PG2	84		RC	32
1697	C	362		3.2 KM S. OF VALLEY RIVER	PG2	49		T	32
1700	C	362		2.0 KM S. OF P.R. #267	PG4	32		T	32
1702	C	267		WEST OF P.T.H. #10	PG2	84		T	32
1704	C	273		EAST OF P.T.H. #10	PG2	84		RC	32
1705	C	274		SOUTH WEST OF P.T.H. #10	PG2	84		T	32
1706	C	269		1.6 KM E. OF ETHELBERT	PG4	32		T	32
1707	C	613		GARLAND - EAST OF P.T.H. #10	TOWN			RC	
1711	C	366		S. OF N. BDRY. RM OF GRANDVIEW	PG2	84		RC	32
1713	C	274		S. OF P.R. #267	PG2	84		T	32
1714	C	274		N. OF P.R. #267	PG2	84		T	32
1715	C	367		E. OF W. JCT. P.R. #366	PG6			RC	41
1716	C	366		N. OF W. JCT. P.R. #367	PG2	84		RC	36
1718	C	594		SOUTH OF P.R. #584	PG5			RC	75
1719	C	487		W. OF N. JCT. P.T.H. #83	PG4			RC	36
1722	C	486		SOUTH-EAST OF DURBAN	PG4			RC	36
1723	C	366		SOUTH OF P.R. #485	PG2	84		RC	36
1724	C	485		EAST OF P.R. #486	PG4			RC	36
1725	C	488		SOUTH OF P.R. #485	PG4			RC	36
1726	C	485		WEST OF P.R. #366	PG4			RC	36
1727	C	486		NORTH OF P.R. #488	PG4			RC	36
1729	C	487		W. OF S. JCT. P.T.H. #83	PG4			RC	36
1730	C	486		SOUTH OF P.T.H. #83	PG4			RC	36
1732	C	488		SOUTH OF P.T.H. #10	PG4			RC	36
1733	C	275		1.6 KM W. OF P.T.H. #10A	PG4			RC	36
1735	C	275		WEST OF JCT. P.R. # 588	PG4			RC	36
1737	C	275		EAST OF SASK. BDRY.	PG4			RC	36
1738	C	587		EAST OF BOWSMAN	PG4			RC	36
1739	C	279		WEST OF P.T.H. #10	PG5			RC	36
1740	C	279		NORTH OF P.R. #588	PG6			RC	36
1741	C	588		SOUTH OF P.R. #279	PG5		74	RES	36
1744	C	266		1.6 KM S. OF P.R. #268	PG4			RC	36
1745	C	268		EAST OF P.T.H. #10	PG4			RC	36
1747	C	10		SOUTH OF P.R. #282	PG7	72		TS	72
1748	C	282		WEST OF P.T.H. #10	PG7	72		RC	73
1749	C	10		NORTH OF P.R. #282	PG7	72		TS	72
1750	C	39		E. OF ISKWASUM LAKE ACCESS	PG7	72		RC	73
1751	C	596		S. OF P.T.H. #39	PG7	72		RC	82
1752	C	39		E. OF JCT. P.R. # 596	PG7	72		RC	82
1753	C	393		EAST OF P.R. #392	PG7	73		RC	82
1755	C	256		NORTH OF P.T.H. #3	PG4	56		T	56
1756	C	445		3.2 KM W. OF MELITA	PG4	56		RC	56
1758	C	256		NORTH OF P.R. #445	PG2	21		T	56
1759	C	343		EAST OF P.R. #444	PG2	21		T	56
1760	C	444		NORTH OF P.R. #343	PG4	56		T	21
1762	C	343		EAST OF P.R. #448	PG4	56		T	56
1763	C	448		NORTH OF P.R. #343	PG4	56		T	56
1764	C	512		SOUTH OF P.T.H. #68	PG2	60		T	60
1765	C	68		NORTH OF P.R. #512	PG3	60		T	16
1766	C	418		SOUTH OF P.R. #417	PG2	60		RC	81
1767	C	417		WEST OF P.R. #418	PG6	76		RES	76
1771	C	250		1.6 KM N. OF P.T.H. #45	PG3	96		RC	90
1772	C	354		1.6 KM N. OF P.T.H. #45	PG4	28		RC	90
1773	C	800		MANIGOTOGAN ENTRY W. OF P.R. #304	TOWN			RC	
1775	C	352		T	PG2	79		T	79
1789	C	347		SOUTH OF P.T.H. #2	PG2	40		T	66
1792	C	10		NORTH OF P.R. #287	PG7	72		TS	72
1801	C	634		STE. GENEVIEVE - S. OF P.R. #501	TOWN			RC	
1802	C	501		EAST OF P.R. #302	PG5	12		RC	13
1804	C	406		NORTH OF P.T.H. # 15	PG5	12		RC	
1814	C	610		BRANDON - 0.8 KM E PTH 10 RICHMOND AV	TOWN			UC	
1816	C	213		EAST OF P.T.H. #59	PG1	77		UC	77
1817	C	207		SOUTH OF P.R. #213	PG1	78		UC	78
1831	C	201		1.6 KM W. OF P.T.H. #30	PG4			RC	35
1832	C	32		WEST OF P.R. #521	PG4			RC	35
1835	C	13		5.6 KM S. OF P.R. #305	PG2	81		RC	81
1836	C	83		SOUTH OF P.R. #257	PG2	40		T	40
1837	C	1		3.7 KM E. OF P.T.H. #5	PG2	79		TS	79
1838	C	1	A	EAST OF P.T.H. #10 - BDN	PG4	24		RC	24
1839	C	1	A	WEST OF P.T.H. #10 - BDN	PG4	24		UC	24

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
1640	C	5		N. OF N. JCT. P.R. #265	PG3	98		T	79
1642	C	476		SOUTH OF P.R. #264	PG2	80		T	90
1644	C	5		1.6 KM E. OF SASK. BDRY.	PG2	49		RC	41
1645	C	83		NORTH OF P.R. #363	PG2	84		RC	41
1646	C	6		E. OF W. JCT. P.R. #236	PG1			UC	2
1647	C	101		SOUTH OF P.T.H. #6	PG1	47		UC	47
1648	C	221		WEST OF P.T.H. #101	PG1			UC	2
1649	C	101		NORTH OF P.R. #425	PG1	47		UC	47
1650	C	101		SOUTH OF P.T.H. #15	PG1			UC	64
1651	C	1		W. OF E. JCT. P.T.H. #26	PG2	48		T	48
1652	C	274		1.6 KM W. OF KELD AT CAIRN	PG2	84		T	32
1653	C	12		3.2 KM N. OF P.T.H. #15	PG4	14		T	13
1654	C	12		3.2 KM N. OF LADYWOOD	PG5	12		T	61
1655	C	6		3.2 KM N. OF P.R. #227	PG3	60		TS	4
1677	C	42		SOUTH OF P.T.H. #41	PG2	43		RC	90
1678	C	59		SOUTH OF P.R. #213	PG1	77		UC	77
1680	C	3		4.0 KM E. OF P.R. #244	PG4			RC	621
1681	C	3		WEST OF P.R. #244	PG4			RC	621
1682	C	59		SOUTH OF P.R. #201	PG1	14		TS	14
1683	C	6		NORTH OF WABOWDEN ACCESS RD.	PG2			T	82
1684	C	6		SOUTH OF P.R. #375	PG2			T	82
1685	C	6		NORTH OF P.R. #375	PG2			T	82
1686	C	6		1.3 KM S. OF THOMPSON SCALE HOUSE	PG2			T	82
1687	C	6		SOUTH OF TWIN BEACH ROAD	PG3	60		TS	4
1690	C	6		SOUTH OF P.T.H. #60	PG2			T	60
1691	C	6		NORTH OF P.T.H. #60	PG2			T	60
1692	C	60		WEST OF P.T.H. #6	PG2			TS	72
1693	C	10		SOUTH OF P.R. #266	PG4			RC	36
1694	C	10		NORTH OF P.R. #266	PG4			TS	36
1695	C	10		SOUTH OF P.R. #268	PG4			TS	36
1696	C	10		NORTH OF P.T.H. #77	PG3	98		TS	36
1697	C	68		WEST OF P.T.H. #7	PG3	60		T	16
1698	C	59		1.3 KM N. OF P.R. #405	PG1	8		UC	8
1699	C	2		WEST OF P.T.H. #3	PG1	51		UC	51
1900	C	3		BETWEEN OAK BLUFF & P.T.H. #2	PG1	51		UC	51
1901	C	31		SOUTH OF P.R. #201	PG2	21		T	65
1903	C	224		24.0 KM N. OF P.R. #325	PG6	4		TS	75
1904	C	242		S. OF E. JCT. OF P.R. #245	PG2	46		RC	58
1906	C	244		N. OF S. JCT. P.R. #245	PG4	58		RC	
1908	C	302		0.5 KM N. OF P.R. #210	PG4	14		RC	12
1910	C	332		SOUTH OF P.R. #247	PG2	81		RC	35
1912	C	361		WEST OF P.T.H. #5	PG4	32		RC	49
1913	C	501		WEST OF P.R. #302	PG5	12		RC	13
1917	C	591		WEST OF P.R. #584	PG4	41			
1918	C	584		NORTH OF P.R. #591	PG4	41		RC	41
1919	C	584		EAST OF P.R. #591	PG2	84		RC	41
1920	C	593		WEST OF P.T.H. #83	PG4	41		RC	41
1922	C	2		EAST OF P.T.H. #3	PG1	51		UC	51
1923	C	59		NORTH OF P.T.H. #100	PG1	8		UC	8
1924	C	1		W. OF E. JCT. P.T.H. #100	PG1			UC	64
1925	C	1		E. OF E. JCT. P.T.H. #100	PG1			UC	64
1926	C	10		NORTH OF P.T.H. #45	PG3	98		TS	98
1927	C	302		SOUTH OF P.T.H. #44	PG4	14		RC	12
1928	C	45		4.8 KM E. OF ROSSBURN	PG2	80		RC	90
1929	C	12		SOUTH OF P.R. #205	PG4	14		UC	14
1930	C	12		SOUTH OF P.R. #215	PG4	14		T	13
1931	C	11		N. OF W. JCT. P.T.H. #44	PG5	12		RC	12
1932	C	59		SOUTH OF P.R. #319	PG6	76		RES	76
1933	C	12		NORTH OF P.R. #304	PG4	14		T	61
1934	C	25		3.2 KM EAST OF RIVERS	PG2	79		T	78
1935	C	83		SOUTH OF P.R. #482	PG2	80		RC	41
1936	C	83		NORTH OF P.R. #366	PG2	80		RC	41
1967	C	410		EAST OF P.T.H. #9	PG1	3		UC	3
1968	C	59		SOUTH OF P.T.H. #44	PG5	78		RC	78
1969	C	202		NORTH OF P.T.H. #59	PG1	78		UC	78
1970	C	304		EAST OF P.T.H. #59	PG6	76		RC	75
1971	C	415		NORTH OF P.R. #322	PG4			T	61
1972	C	12		NORTH OF P.R. #303	PG4	14		UC	14
1973	C	210		EAST OF P.T.H. #75	PG2	63		UC	8
1974	C	305		E. END RED RIVER BRIDGE	PG2	63		T	63
1975	C	246		E. END OF RED RIV. BRIDGE	PG4			RC	35
1976	C	227		E. OF E. JCT. P.R. #240	PG2	81		T	81
1977	C	227		W. OF W. JCT. P.R. #240	PG4			T	81
1978	C	20		SOUTH OF P.R. #271	PG3	60		RC	75
1979	C	20		NORTH OF P.R. #271	PG3	60		RC	75
1980	C	10		SOUTH OF P.T.H. #39	PG7	72		TS	72
1982	C	101		EAST OF P.T.H. #9	PG1	77		UC	77
1983	C	213		E. OF RD. TO PINE RIDGE GOLF COURSE	PG1	77		UC	77
2004	C	305		EAST OF P.T.H. #75	PG2	63		RC	63
2005	C	3		2.1 KM W. OF P.R. #254	PG4	58		RC	58
2010	C	366		EAST OF WILSON RIVER	PG2	84		RC	32
2011	C	391		N. END OF BURNTWOOD RIVER BRIDGE	PG2			RC	82
2012	C	545		WEST OF P.T.H. #41	PG2	80		T	90
2013	C	513		3.2 KM E. OF GYPSUMVILLE	PG4			RC	60
2014	C	305		SOUTH OF P.T.H. #2	PG2	81		T	58
2015	C	484		SOUTH OF P.R. #363	PG4	41		RC	75
2017	C	12		W. OF E. JCT. P.T.H. #44	PG5	12		TS	13

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
2018	C	394		BETWEEN LYNN LAKE & AIRPORT	PG7	73		RC	82
2019	C	398		0.2 KM E. OF P.R. #394	PG7	73		RCS	82
2020	C	399		NORTH-EAST OF CANOE ST.	PG7	73		RC	82
2021	C	397		BETWEEN LYNN LAKE & P.R. #398	PG7	73		RC	82
2022	C	398		0.2 KM S. OF P.R. #397	PG7	73		RC	82
2023	C	391		BRIDGE AT 7.2 KM E. OF LYNN LAKE	PG2			RC	82
2024	C	229		EAST OF P.T.H. #17	PG4			T	81
2025	C	7		N. OF STONY MOUNTAIN ACCESS	PG4			UC	2
2027	C	240		NORTH OF P.T.H. #1	PG4			RC	35
2028	C	577		NORTH OF P.T.H. #45	PG2	43		RC	90
2030	C	476		NORTH OF P.T.H. #16	PG2	80		T	90
2031	C	264		WEST OF P.R. #478	PG2	43		T	
2032	C	264		0.5 KM E. OF P.T.H. #83	PG2	43		T	
2033	C	83		SOUTH OF P.R. #363	PG2	80		RC	41
2034	C	216		S. OF KLEEFELD	PG4	12		RC	12
2035	C	208		N. OF N. JCT. P.R. #210	PG5	78		RC	12
2037	C	68		0.5 KM W. OF NARROWS BRIDGE	PG2	49		T	49
2038	C	313		E. OF E. JCT. P.R. #433	PG5	93		RC	93
2039	C	313		EAST OF LEE RIVER	PG5	93		RC	93
2040	C	501		EAST OF P.T.H. #12	PG5	12		RC	13
2041	C	1		S. OF E. JCT. P.T.H. #1A - PTGE	PG3	65		T	46
2042	C	1		S. OF W. JCT. P.T.H. #1A - PTGE	PG3	65		T	46
2043	C	1	A	EAST OF W. JCT. P.T.H. #1 - PTGE.	PG3	65		RC	81
2044	C	10		N. OF E. JCT. P.T.H. #16	PG4	24		RC	24
2045	C	637		WANLESS - AT RAILWAY X-SING	TOWN			RC	
2046	C	202		EAST OF P.R. #204	PG1	77		UC	77
2048	C	206		S. OF BIRDS HILL PARK ENTRANCE	PG5	78		UC	77
2049	C	3		W. OF W. JCT. P.T.H. #3A	PG2	21		RC	621
2050	C	351		EAST OF P.T.H. #5	PG4	24		RC	79
2051	C	351		2.4 KM W. OF P.T.H. #5	PG4	24		RC	79
2052	C	20		NORTH OF P.R. #287	PG3	60		RC	75
2055	C	584		EAST OF P.R. #594	PG2	84		RCS	
2056	C	392		NORTH OF P.R. #395	PG7	73		RC	
2057	C	430		NORTH OF P.R. #411	PG5	93		RC	81
2058	C	41		SOUTH OF P.R. #571	PG2	25		T	25
2059	C	41		SOUTH OF P.R. #256	PG2	25		T	25
2061	C	206		NORTH OF P.T.H. #15	PG5	78		UC	77
2062	C	67		WEST OF P.T.H. #9	PG1	3		UC	3
2063	C	2		S. OF N. JCT. P.T.H. #10	PG2	66		T	
2065	C	68		0.5 KM E. OF RD. TO CAYER	PG2	49		T	49
2066	C	6		SOUTH OF P.T.H. #39	PG2			T	82
2067	C	39		0.5 KM E. OF P.T.H. #39	PG2			RC	82
2068	C	6		SOUTH OF WABOWDEN ACCESS RD.	PG2			RC	82
2069	C	373		EAST OF P.T.H. #6	PG7	72		RC	82
2070	C	392		SOUTH OF P.R. #393	PG7	73		RC	
2072	C	482		N. OF SHELLMOUTH ACCESS RD.	PG6		92	RC	75
2074	C	236		NORTH OF P.R. #321	PG1	1		RC	2
2075	C	255		WEST OF P.R. #254	PG2	40		T	75
2076	C	250		SOUTH OF P.T.H. #1	PG2			RC	24
2077	C	16		W. OF E. JCT. P.T.H. #16A	PG4	28		T	43
2078	C	42		SOUTH OF P.T.H. #16	PG4	28		RC	90
2080	C	287		0.5 KM E. OF AIRPORT	PG7	73		RC	73
2081	C	205		WEST OF P.R. #422	PG4			RC	35
2082	C	6		NORTH OF P.R. #239	PG3	60		T	16
2083	C	325		13.7 KM W. OF PR 233	PG3	60		T	60
2084	C	508		2.4 KM N. OF P.R. #212	PG4	67		RC	67
2085	C	213		WEST OF P.R. #206	PG1	77		UC	77
2086	C	213		EAST OF P.R. #206	PG1	77		UC	77
2088	C	260		SOUTH OF P.R. #575	PG2	83		RC	58
2091	C	375		EAST OF P.T.H. #6	PG6			RES	73
2092	C	52		EAST OF KROEKER AVE. (STEINBACH)	PG4	14		UC	14
2093	C	52		0.5 KM W. OF P.R. #302	PG4	14		RC	14
2096	C	289		2.4 KM S. OF P.R. #285	PG7	72		RCS	73
2097	C	283		EAST OF SASK. BDRY.	PG7	72		RC	73
2102	C	5		SOUTH OF P.T.H. #2	PG4	58		RC	621
2104	C	242		N. OF P.R. #423	PG2	46		RC	58
2105	C	423		WEST OF P.R. #242	PG4	58		RC	621
2108	C	201		EAST OF P.R. #432	PG2	21		RC	35
2110	C	227		EAST OF P.R. #248	PG2	81		T	81
2111	C	17		NORTH OF P.R. #419	PG2	16		T	16
2112	C	220		NORTH OF P.R. #321	PG1	1		UC	1
2113	C	220		NORTH OF P.R. #409	PG1	1		UC	1
2114	C	409		NORTH OF P.T.H. #101	PG1	77		UC	
2115	C	617		LOCKPORT - EAST OF P.T.H. #9	TOWN			RC	
2117	C	12		1.3 KM N. OF N. JCT. P.R. #311	PG4	14		RC	14
2118	C	12		N. OF S. JCT. P.R. #311	PG4	14		RC	14
2120	C	10		WEST OF NORTH STAR ROAD	PG7	72		T	72
2121	C	10		S. OF E. BAKER'S NARROWS	PG7	72		T	72
2122	C	391		E. OF NELSON HOUSE ROAD	PG2			RC	82
2123	C	391		W. OF NELSON HOUSE ROAD	PG2			RC	82
2124	C	623		NELSON HOUSE - S. OF P.R. #391	TOWN			RC	
2125	C	391		2.1 KM S. OF LEAF RAPIDS	PG2			RC	82
2126	C	391		2.1 KM N. OF LEAF RAPIDS	PG2			RC	82
2127	C	396		WEST OF ROAD TO MCVEIGH	PG7	73		RC	82
2128	C	394		WEST OF P.R. #396	PG7	73		RC	82
2130	C	487		15.0 KM W. OF P.T.H. #83 (N. JCT.)	PG4			RC	36
2131	C	482		SOUTH OF P.T.H. #5	PG6		92	RC	75

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
2132	C	10		NORTH OF P.R. #349	PG2	66		T	66
2133	C	364		WEST OF P.R. #276	PG6			T	32
2135	C	424		NORTH OF P.T.H. #2	PG1	47		UC	47
2137	C	317		8.0 KM W. OF P.T.H. #11	PG3	75		RC	75
2138	C	229		EAST OF P.T.H. #7	PG6	4		T	75
2139	C	6		8.0 KM N. OF SASK. RIV. BRIDGE	PG2			T	82
2140	C	6		SOUTH OF WILLIAM RIVER	PG2			T	82
2142	C	39		WEST OF P.T.H. #6	PG2			RC	82
2143	C	238		E. OF S. JCT. P.T.H. #9	PG1	3		UC	3
2145	C	52		STEINBACH - 1.4 KM E. OF HESPELER ST.	TOWN			UC	14
2147	C	300		W. OF N. JCT. P.T.H. #59	PG1			UC	64
2149	C	221		WEST OF P.R. #334	PG1	51		UC	2
2150	C	230		SOUTH OF P.T.H. #9	PG1	3		UC	3
2151	C	391		W. OF THOMPSON AIRPORT ACCESS	PG2			RC	82
2153	C	373		SOUTH OF SIPIWESK LAKE RD.	PG5			RC	82
2154	C	279		EAST OF P.R. #586	PG3			RC	36
2155	C	588		NORTH OF P.R. #275	PG5		74	RES	
2157	C	549		SHELLMOUTH - W. OF P.R. #482	PG3			RES	41
2158	C	259		1.4 KM E. OF P.T.H. #1	PG4	28		RC	
2160	C	270		NORTH OF P.T.H. #1	PG4	24		RC	24
2161	C	347		WEST OF P.T.H. #22	PG2	40		T	
2162	C	443		1.4 KM W. OF P.R. #346	PG4	56		RC	21
2164	C	528		6.6 KM S. OF P.T.H. #3	PG4			T	35
2165	C	419		WEST OF P.R. #418	PG6			RC	75
2166	C	415		3.1 KM E. OF P.T.H. #6	PG5			T	81
2167	C	227		EAST OF P.R. #430	PG2	81		T	81
2168	C	326		SOUTH OF P.R. #329	PG4			RC	16
2169	C	304		W. OF WANIPIGOW LAKE ACCESS RD.	PG6	76		RES	56
2170	C	241		SOUTH OF P.T.H. #1	PG1	48		UC	48
2171	C	305		E. OF S. JCT. OF P.R. #330	PG2	63		T	63
2172	C	311		WEST OF P.R. #216	PG4	14		RC	8
2173	C	216		NORTH OF P.T.H. #52	PG4	12		RC	
2174	C	256		SOUTH OF P.T.H. #3	PG4	56		T	56
2175	C	365		WEST OF P.T.H. #10	PG6			RES	36
2176	C	365		1.6 KM N. OF BELL LAKE PICNIC SITE	PG6			RES	36
2177	C	210		1.9 KM N. OF P.R. #311	PG4	14		RC	12
2178	C	210		6.0 KM N. OF P.R. #311	PG4	14		RC	12
2180	C	212		NORTH OF P.R. #213	PG4	12		RC	12
2181	C	502		SOUTH OF P.R. #313	PG5	12		RCS	
2182	C	313		EAST OF P.T.H. #11	PG5	93		RC	93
2183	C	231		EAST OF NARCISSE ACCESS	PG6	4		T	75
2184	C	68		25.0 KM WEST OF P.T.H. #6	PG2	49		T	49
2185	C	434		SOUTH OF P.T.H. #3 ST. LEON ACCESS	PG4			RC	35
2187	C	431		SOUTH OF P.T.H. #23	PG4			RC	
2188	C	242		1.6 KM E. OF W. JCT. P.T.H. #16	PG6	4		RC	75
2189	C	262		2.0 KM N. OF MINNEDOSA BEACH	PG4	24		RC	24
2190	C	355		EAST OF P.T.H. #10	PG4	28		RC	24
2191	C	355		WEST OF P.T.H. #10	PG4	28		RC	24
2192	C	579		WEST OF P.T.H. #83	PG2	80		T	90
2193	C	291		WEST OF E. JCT. P.T.H. #10	PG7	72		RCS	36
2194	C	75		NORTH OF P.R. #205	PG2	63		T	14
2195	C	246		SOUTH OF P.R. #205	PG4			RC	35
2196	C	246		3.5 KM S. OF P.R. #205	PG4			RC	35
2197	C	334		SOUTH OF P.T.H. #1	PG1	47		UC	47
2198	C	262		STURGEON ROAD - S. OF P.R. #221	PG4	24		UC	
2199	C	202		NORTH OF P.R. #407	PG1	3			
2200	C	391		N. OF SUWANNEE RIV.	PG2			RC	82
2201	C	10		NORTH OF REPAP ROAD	PG7	72		RC	
2202	C	272		2.4 KM S. OF DUCK BAY	PG6			RES	76
2203	C	276		SOUTH OF P.R. #328	PG6			RC	75
2204	C	269		WEST OF P.R. #490	PG3			T	32
2205	C	591		EAST OF P.T.H. #83	PG4	41			
2206	C	278		N. OF KINOSOTA ACCESS RD.	PG3			RC	75
2211	C	256		N. OF N. JCT. P.R. #255	PG2	21		T	56
2214	C	240		20.1 KM S. OF P.R. #331	PG4			RC	
2216	C	245		W. OF W. JCT. P.R. #240	PG4			RC	58
2217	C	422		SOUTH OF P.R. #205	PG4			RC	35
2219	C	630		ST. MALO DAM - E. OF P.T.H. #59	TOWN			RC	
2220	C	506		WEST OF P.T.H. #59	PG4	67		RC	67
2221	C	416		NORTH OF P.R. #415	PG2	16		T	81
2222	C	302		2.4 KM S. OF P.T.H. #1	PG4	14		RC	12
2223	C	800		KISSISSING LAKE RD - N. OF P.T.H. #10	TOWN			RC	
2224	C	800		ATHAPAP. RD. - W. OF P.T.H. #10	TOWN			RC	
2225	C	800		NAMEW LAKE RD.- W. OF P.T.H. #10	TOWN			RC	
2226	C	800		MITCHELL LAKE RD.- E. OF P.T.H. #10	TOWN			RC	
2227	C	628		REPAP ROAD - E. OF P.T.H. #10	TOWN			RC	
2228	C	640		WALLACE LAKE - N. OF P.R. #304	TOWN			RC	
2229	C	642		WANIPIGOW LAKE - N. OF P.R. #304	TOWN			RC	
2230	C	800		STE ELIZABETH ACCESS S OF PTH 23	TOWN			RC	
2231	C	665		ROCK LAKE - S. OF P.R. #253	TOWN			RC	
2232	C	660		PLEASANT POINT - W. OF P.R. #254	TOWN			RC	
2234	C	630		NORGATE - E. OF P.T.H. #5	TOWN			RC	
2235	C	637		TIMBERTON - N. OF P.T.H. #5	TOWN			RC	
2236	C	638		TUMMEL - W. OF P.T.H. #83	TOWN			RC	
2239	C	605		BIG ISLAND LAKE - E. OF P.T.H. #10	PG2			RC	
2241	C	39		GYLES BEACH - N. OF P.T.H. #39	PG7	72		RC	
2242	C	39		REED LAKE - N. OF P.T.H. #39					

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
2243	C	633		THOMPSON AIRPORT - NE. OF P.R. #391	TOWN			RC	
2244	C	619		FAIRFORD - E. OF P.T.H. #6	TOWN			RC	
2245	C	234		S. OF PINE DOCK ACCESS ROAD	PG6	4		TS	
2246	C	645		PINE DOCK - E. OF P.R. #234	TOWN			TS	
2247	C	547		WEST OF P.R. #482	PG6		92	RES	41
2248	C	800		PLESSIS RD. WPG. - N. OF P.T.H. #1	TOWN			UC	
2249	C	481		NORTH OF P.R. #384	PG2	60		RC	75
2251	C	68		WEST OF P.R. #233	PG3	60		T	16
2253	C	250		NORTH OF P.R. #470	PG3	96		RC	90
2254	C	270		EAST OF P.R. #354	PG3	96		RC	75
2256	C	455		EAST OF P.T.H. #21	PG2			RC	24
2257	C	250		NORTH OF P.R. #259	PG4	28		RC	24
2258	C	353		WEST OF P.R. #468	PG2	79		RC	
2259	C	353		6.4 KM W. OF P.R. #464	PG2	79		RC	
2260	C	236		SOUTH OF BALMORAL	PG2	16		T	2
2262	C	403		WEST OF P.R. #216	PG5			T	
2263	C	246		SOUTH OF P.R. #200	PG4			RC	35
2265	C	210		EAST OF P.R. #200	PG1	8		UC	8
2266	C	210		WEST OF P.T.H. #59	PG1	8		UC	8
2268	C	501		W. OF STE. GENEVIEVE ACCESS RD.	PG5	12		RC	13
2269	C	302		3.2 KM S. OF P.R. #501	PG4	14		RC	12
2271	C	15		AT E. BDRY. LGD. OF REYNOLDS	PG3	13		TS	61
2272	C	15		1.0 KM W. OF P.T.H. #11	PG3	13		TS	61
2273	C	304		0.4 KM S. OF P.T.H. #11	PG5	93		RC	75
2275	C	245		WEST OF P.T.H. #34	PG4			RC	58
2276	C	261		WEST OF P.R. #280	PG2	83		RCS	
2279	C	60		EAST OF P.T.H. #10	PG2			TS	72
2280	C	60		WEST OF P.R. #327	PG2			TS	72
2281	C	327		NORTH OF P.T.H. #60	PG7	72		RC	
2282	C	60		SOUTH EAST OF P.R. #327	PG2			TS	72
2283	C	435		WEST OF P.R. #214	PG5	12		RC	12
2284	C	435		EAST OF P.T.H. #12	PG5	12		RC	12
2285	C	509		W. OF P.T.H. #59 (C.I.L. ROAD)	PG4	67		RC	67
2286	C	525		EAST OF P.R. #308	PG6			RES	
2287	C	308		NORTH OF P.R. #525	PG3	74		RES	93
2288	C	800		PELICAN RAPIDS RD-E. OF PTH. #10	TOWN			RC	
2291	C	355		EAST OF P.T.H. #83	PG4	28		RC	90
2293	C	280		NORTH OF P.R. #391	PG7	73		RC	82
2294	C	384		MOOSE LAKE RD. - S. OF P.R. #287	PG7	72		RC	
2295	C	373		1.6 KM S. OF JENPEG	PG5			RC	82
2296	C	800		RUTTAN LAKE RD. 3.2 KM E. OF P.R. #391	TOWN			RC	
2299	C	800		NORTH STAR RD - N. OF P.T.H. #10	TOWN			RC	
2300	C	287		E. OF P.R. #384	PG7	73		RCS	
2301	C	75		EAST OF P.T.H. #29	PG2	63		T	14
2302	C	246		NORTH OF P.R. #205	PG4			RC	35
2303	C	668		RUSSELL - E. OF P.T.H. #83	TOWN			RC	
2304	C	211		E. OF NUCLEAR RESEARCH ROAD	PG5	93		RC	93
2305	C	212		EAST OF P.T.H. #59	PG1	67		UC	67
2306	C	320		7.0 KM N. OF P.T.H. #4	PG4	68		UC	67
2308	C	334		WEST OF DOMAIN	PG1	47		UC	47
2309	C	332		NORTH OF P.R. #205	PG4			RC	35
2310	C	332		SOUTH OF P.R. #205	PG4			RC	35
2312	C	532		NORTH OF P.T.H. #23	PG4	58		RC	58
2315	C	444		SOUTH OF P.T.H. #23	PG4	56		T	
2316	C	448		SOUTH OF P.T.H. #23	PG4	56		T	56
2317	C	3		E. OF S. DELORAINE ACCESS ROAD	PG4	56		RC	56
2320	C	262		SOUTH OF P.R. #357	PG3	96		RC	24
2323	C	594		10.0 KM N. OF P.R. #584	PG5			RC	75
2325	C	800		THE PAS VIC-UMPHREVILLE RD-E. OF P.T.H. #10	TOWN			RC	
2326	C	800		THE PAS VIC.- D-8 RD - S. OF P.R. #283	TOWN			RC	
2327	C	800		THE PAS VIC-YOUNG'S PT. RD-W. OF P.T.H. #10	TOWN			RC	
2328	C	800		THE PAS VIC-YOUNG'S PT. RD-W. OF D-8 RD.	TOWN			RC	
2329	C	8		NORTH OF P.T.H. #27	PG1	1		UC	1
2330	C	242		3.6 KM S. OF P.T.H. #2	PG2	46		RC	58
2331	C	245		EAST OF P.T.H. #34	PG4			RC	58
2332	C	305		W. OF N. JCT. OF P.R. #330	PG2	63		T	81
2333	C	305		EAST OF P.R. #248	PG2	63		T	81
2334	C	305		WEST OF P.R. #248	PG2	63		T	81
2335	C	205		W. OF E. JCT. P.R. #332	PG4			RC	35
2336	C	513		1.0 KM W. OF ANAMA BAY	PG4			RC	60
2339	C	488		NORTH OF P.R. #485	PG4			RC	36
2340	C	336		SOUTH OF P.R. #305	PG4			T	
2341	C	285		5.0 KM E. OF THE PAS	PG7	73		RC	73
2342	C	415		EAST OF P.R. #322	PG4			T	81
2343	C	304		NORTH OF P.R. #314	PG6	76		RES	56
2344	C	304		SOUTH OF P.R. #314	PG6	76		RES	56
2345	C	314		EAST OF P.R. #304	PG6			RES	93
2347	C	200		NORTH OF P.R. #246	PG2	63		RC	35
2349	C	241		3.0 KM N. OF P.T.H. #1	PG1	48		UC	48
2352	C	430		SOUTH OF P.T.H. #26	PG4			RC	81
2353	C	26		WEST OF P.R. #430	PG2	81		RC	81
2358	C	800		THE PAS VIC-UMPHREVILLE RD-3 KM E. OF P.T.H. #10	TOWN			RC	
2359	C	241		EAST OF P.R. #424	PG1	48		UC	48
2360	C	617		FLOODWAY INLET RD. - E. OF TURNBULL DRIVE	TOWN			UC	
2361	C	607		FLOODWAY INLET RD. - W. OF ST. MARY'S RD.	TOWN			UC	
2362	C	329		EAST OF P.R. #326	PG5			RC	16
2363	C	329		WEST OF P.R. #326	PG5			RC	16

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
2369	C	317		WEST OF P.T.H. #59	PG3	75		RCS	
2371	C	210		0.7 KM N. OF SEINE RIVER BRIDGE	PG4	14		RC	12
2372	C	481		WEST OF CRANE RIVER BRIDGE	PG5			RC	75
2373	C	481		14.0 KM N.E. OF P.R. #276	PG2	60		RC	75
2374	C	384		WEST OF P.R. #481	PG6			T	32
2375	C	241		E. OF E. JCT. P.R. #334	PG1	47		UC	47
2376	C	280		80 KM N. OF P.R. #391	PG2			RC	82
2377	C	280		N OF SPLIT LAKE RES. ACCESS	PG2			RC	82
2378	C	52		WEST OF MITCHELL	PG4	14		RC	14
2380	C	251		EAST OF P.R. #254	PG2	40		T	56
2381	C	311		2.0 KM EAST OF P.R. #210	PG4	14		RC	8
2385	C	435		EAST OF P.T.H. #59	PG5	12		RCS	
2387	C	500		SOUTH OF P.T.H. #12	PG6	76		RC	76
2388	C	542		1.0 KM NORTH OF P.R. #257	PG4	56		RC	25
2389	C	542		1.0 KM SOUTH OF P.T.H. #1	PG4	56		RC	25
2391	C	359		EAST OF P.R. #476	PG2	80		T	
2392	C	359		WEST OF P.R. #476	PG2	80		T	
2393	C	359		EAST OF P.T.H. #16	PG4	28		T	
2394	C	491		WEST OF P.R. #362	PG4	32		T	32
2396	C	218		NORTH OF P.R. #201	PG4	14		RC	35
2397	C	242		5.0 KM SOUTH OF P.T.H. #16	PG2	46		RC	58
2399	C	367		EAST OF CHILDS LAKE CAMP GROUND	PG6			RC	41
2400	C	367		EAST OF P.R. #594	PG6			RC	41
2401	C	367		2.0 KM WEST OF P.R. #594	PG5			RC	41
2403	C	587		WEST OF P.R. #288	PG4			RC	36
2406	C	328		5.0 KM WEST OF PROULX CREEK	PG2	60		RC	60
2407	C	328		15.0 KM WEST OF P.T.H. #6	PG2	60		RC	60
2408	C	334		SOUTH OF P.R. #427	PG1	47		UC	47
2409	C	334		NORTH OF P.T.H. #2	PG1	47		UC	47
2410	C	427		3.0 KM WEST OF P.R. #334	PG1	47		UC	
2413	C	593		1.0 KM E. OF P.R. #484	PG4	41		RC	41
2414	C	59		SOUTH OF P.R. #212	PG5	78		RC	78
2415	C	612		ELIE - WEST OF P.T.H. #1	TOWN			RC	
2417	C	415		8.0 KM WEST OF P.T.H. #7	PG4			T	81
2419	C	604		ANGUSVILLE - EAST OF P.T.H. #45	TOWN			RC	
2420	C	237		WEST OF P.T.H. #8	PG2	60		RC	75
2421	C	237		0.8. KM E. OF LAKE MANITOBA	PG2	60		RC	75
2425	C	10		1.0 KM N. OF S. JCT. P.T.H. #10A(FLIN FLON)	PG7	72		RCS	72
2426	C	800		HERB LAKE LANDING RD.- 0.6 KM N. OF PTH. #39	TOWN			RCS	
2427	C	384		MOOSE LAKE RD. - 10.0 KM S.E. OF P.R. #287	PG7	72		RCS	
2428	C	287		4.0 KM S. OF CORMORANT	PG7	73		RCS	
2429	C	800		CROSS LAKE RD. - NE. OF P.R. #373	TOWN			RCS	
2431	C	373		SOUTH OF WHISKEY JACK JCT.	PG5			RC	82
2433	C	391		WEST OF P.R. #280	PG7	72		RC	82
2434	C	391		WEST OF NOTIGI LAKE	PG2			RC	82
2435	C	391		EAST OF HUGHES RIVER	PG2			RC	82
2436	C	397		SOUTH OF RAILWAY CROSSING	PG7	73		RC	82
2437	C	280		NORTH-WEST OF P.R. #290	PG7	73		RC	82
2438	C	280		WEST OF P.R. #290	PG7	73		RC	82
2439	C	290		EAST OF P.R. #280	PG7	72		RC	36
2440	C	290		WEST OF SUNDANCE	PG7	72		RC	36
2441	C	280		EAST OF RADISSON CONV. STN.	PG7	73		RC	82
2442	C	280		EAST OF GILLAM (N. ACC. RD.)	PG7	73		RC	82
2444	C	9		1.6 KM SOUTH OF PETERSFIELD	PG6	4		RC	75
2445	C	222		SOUTH OF P.R. #329	PG6	4		RES	
2446	C	15		WEST OF P.R. #207	PG1			UC	64
2448	C	302		NORTH OF P.T.H. #12	PG4	14		RC	12
2449	C	302		SOUTH OF P.R. #303	PG4	14		RC	12
2450	C	354		EAST OF P.R. #250	PG3	98		RC	90
2451	C	354		AT LITTLE SASK. RIVER	PG3	98		RC	90
2452	C	800		MALLARD RD. N. OF P.R. #328	TOWN			RC	
2453	C	486		WEST OF JCT. P.R. #488	PG4			RC	36
2454	C	384		EAST OF P.T.H. #20	PG6			T	32
2455	C	800		BROADLAND RD. - 1.4 KM E. OF P.R. #304	TOWN			RES	
2457	C	12		NORTH OF P.R. #210	PG4	14		RC	14
2458	C	20	A	WEST OF S. JCT. P.T.H. #20	PG4	32		RC	
2459	C	20	A	WEST OF N. JCT. P.T.H. #20	PG4	32		RC	75
2460	C	23		EAST OF P.T.H. #5	PG4	58		T	66
2461	C	23		WEST OF P.T.H. #5	PG4	58		T	66
2462	C	59		SOUTH OF P.R. #317	PG6	76		RES	76
2463	C	83		S. OF E. JCT. P.T.H. #1	PG2	40		T	40
2464	C	5		N. OF S. JCT. P.T.H. #5	PG4	32		RC	32
2465	C	5		W. OF S. JCT. P.T.H. #5A	PG4	32		RC	32
2466	C	5		E. OF N. JCT. P.T.H. #5	PG4	32		RC	32
2467	C	474		NORTH OF P.T.H. #24	PG4	28		RC	90
2468	C	800		BRANDON - VICTORIA AVE. E. OF 17TH ST. EAST	TOWN			UC	
2469	C	800		BRANDON-VICTORIA AVE E. OF HYDRO STEAM PLANT	TOWN			UC	
2470	C	459		2.5 KM W. OF P.T.H. #10	PG4	24		RC	24
2472	C	328		16 KM E. OF P.R. #276	PG5			RC	
2473	C	210		EAST OF P.T.H. #12	PG4	14		RC	12
2474	C	632		SPLIT LAKE ACCESS - S. OF P.R. #280	TOWN			RC	
2475	C	616		GIMLI - E. OF P.T.H. #8	TOWN			RCS	
2476	C	307		SOUTH OF RENNIE RIVER	PG5	93		RES	93
2477	C	270		2.2 KM S. OF S. JCT. P.T.H. #24	PG2	43		RC	
2478	C	458		S. OF W. JCT. P.R. #253	PG4	58		RC	621
2479	C	338		SOUTH OF P.R. #245	PG4			T	35
2480	C	549		SHELLMOUTH - E. OF ASSINIBOINE RIVER	PG3			RES	41

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
2481	C	520		NORTH OF P.R. #211	PG5	12		RC	93
2482	C	520		SOUTH OF P.R. #313	PG5	12		RC	93
2483	C	220		NORTH OF P.T.H. #67	PG1	1		UC	1
2484	C	233		2.3 KM WEST OF P.T.H. #17	PG5			RC	
2487	C	213		WEST OF P.T.H. #12	PG1	77		UC	77
2488	C	213		EAST OF P.R. #212	PG1	77		UC	77
2489	C	462		WEST OF GLENCAIRN	PG2	49		T	24
2490	C	800		ILE DES CHENES-MUN. RD E OF #59 & W OF #405	TOWN			RC	
2491	C	405		4.8 KM EAST OF P.T.H. #59	PG1	8		RC	
2492	C	373		1.6 KM N. OF ROSSVILLE JCT. - NORWAY HOUSE	PG5			RC	82
2493	C	373		N. OF AIRPORT TERMINAL - NORWAY HOUSE	PG5			RC	82
2494	C	354		S. OF S. JCT. P.R. #470	PG4	28		RC	90
2495	C	210		S. OF N. JCT. P.R. #302	PG4	14		RC	
2496	C	481		NORTH OF P.T.H. #68	PG2	60		RC	75
2497	C	59		NORTH OF P.T.H. #4	PG6	76		T	78
2498	C	4		WEST OF P.T.H. #59	PG2	67		T	
2499	C	4		WEST OF P.R. # 508	PG2	67		T	
2500	C	4		1.0 KM W. OF P.R. #320	PG2	67		T	
2501	C	233		SOUTH OF P.R. #325	PG2	60		RC	
2502	C	303		WEST OF P.R. #302	PG4	14		RC	14
2503	C	17		2.0 KM W. OF P.T.H. #9	PG6	4		T	16
2504	C	448		SOUTH OF P.R. #343	PG4	56		T	56
2506	C	302		10.0 KM N. OF P.T.H. #15	PG4	14		RC	12
2507	C	448		WEST OF P.T.H. #10	PG2	21		T	58
2508	C	481		20.0 KM N. OF P.T.H. #68	PG2	60		RC	75
2509	C	334		NORTH OF HEADINGLEY	PG1	47		UC	47
2510	C	340		NORTH OF P.R. #453	PG4	58		RCS	
2511	C	10		W. OF E. JCT. P.T.H. #10	PG7	72		RCS	72
2512	C	471		WEST OF P.T.H. #5	PG2	43		T	24
2514	C	475		EAST OF P.T.H. #41	PG4	28		T	
2515	C	331		WEST OF P.T.H. #13	PG4	58		RC	81
2516	C	530		NORTH OF P.T.H. #2	PG4	58		RC	
2517	C	453		EAST OF P.T.H. #10	PG4	56		T	24
2518	C	403		WEST OF P.T.H. #12	PG5			T	
2519	C	403		EAST OF P.R. #216	PG5			T	
2520	C	50		WEST OF P.R. #278	PG2	83		RC	49
2521	C	23		EAST OF P.R. #244	PG4	58		T	14
2522	C	83		NORTH OF P.T.H. # 49	PG4			RC	36
2523	C	32		N. OF S. JCT OF P.R. #201	PG4			RC	35
2524	C	23		EAST OF P.T.H. #22	PG4	58		T	66
2525	C	10		NORTH OF P.R. #365	PG3	96		TS	36
2526	C	3		WEST OF P.T.H. #14	PG4			RC	
2527	C	206		SOUTH OF P.R. #213	PG5	78		UC	77
2528	C	6		NORTH OF P.R. #415	PG3	60		TS	4
2529	C	24		WEST OF P.R. #250	PG4	28		T	78
2530	C	23		EAST OF P.R. #336	PG4			T	14
2531	C	5		EAST OF P.T.H. #10	PG2	49		T	49
2532	C	2		E. OF E. JCT P.R. #242	PG2	66		T	46
2533	C	470		EAST OF P.R. # 566	PG3	96		RCS	
2534	C	566		NORTH OF P.R. #470	PG2	43		RC	
2535	C	373		SOUTH OF SEA ISLAND FERRY	PG5			RCS	
2536	C	240		EAST OF EAST JUNCTION P.R. #227	PG5				
2537	C	21		REINFELD - SOUTH OF P.T.H. #14	TOWN				
2538	C	591		SCHANZENFELD - WEST OF P.T.H. #32	PG4	41			
2539	C	83		SOUTH OF P.T.H. #57	PG2	80			
2540	C	83		NORTH OF P.T.H. #57	PG2	80			
2541	C	10		N. OF N. JCT P.T.H. #10A (ETHELBERT)	PG2	84			
2542	C	10		NORTH OF P.R. #271	PG2	84			
2543	C	2		2.0 KM WEST OF P.T.H. #5	PG2	66			
2544	C	1		E. OF E. JCT. P.R. #468	PG4	24			
2545	C	1		W. OF W. JCT. P.R. #468	PG4	24			
2546	C	457		WEST OF P.R. #468	PG4	24			
2547	C	355		EAST OF P.R. #250	PG4	28			
2548	C	5		WEST OF P.T.H. #68	PG4	32			
2549	C	250		NORTH OF P.R. #355	PG2	43			
2551	C	304		EAST OF P.T.H. 12	PG6	76			
2552	C	1		EAST OF P.R. 257	PG2				
2553	C	247		1.6 KM EAST OF P.R. #330	PG1	51			
2554	C	247		0.5 KM WEST OF P.R. #330	PG1	51			
2555	C	247		3.2 KM WEST OF P.R. #330	PG1	51			
2556	C	330		N. OF S. JCT. P.R. #247	PG2	63			
5001	C	30		ALTONA - S. OF S. JCT. P.R. #201	TOWN			T	48
5002	C	30		ALTONA - N. OF S. JCT. P.R. #201	TOWN			T	48
5003	C	201		ALTONA - W. OF P.T.H. #30	TOWN			RC	35
5005	C	201		ALTONA - AT RAILROAD CROSSING	TOWN			RC	35
5013	C	50		AMARANTH - SOUTH OF P.R. #261	TOWN			RC	49
5015	C	50		AMARANTH - NORTH OF P.R. #261	TOWN			RC	49
5023	C	326		ARBORG - N. OF P.T.H. #68	TOWN			RC	16
5025	C	68		ARBORG - W. OF P.R. #326	TOWN			TS	4
5029	C	6		ASHERN - S. OF N. JCT. P.R. #325	TOWN			T	16
5030	C	325		ASHERN - E. OF P.T.H. #6	TOWN			RC	60
5036	C	6		ASHERN - N. OF N. JCT. P.R. #325	TOWN			T	16
5041	C	605		AUSTIN - S.W. OF P.T.H. # 1	TOWN			RC	
5042	C	605		AUSTIN - 0.2 KM EAST OF P.T.H. #34	TOWN			RC	
5049	C	215		BEAUSEJOUR - 2.2 KM W. OF P.R. #302	TOWN			RC	12
5050	C	601		BEAUSEJOUR - N. OF P.R. #215	TOWN			RC	
5051	C	215		BEAUSEJOUR - 1.3 KM W. OF P.R. #302	TOWN			RC	12

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
5055	C	44		BEAUSEJOUR - N.OF P.R. #215	TOWN			RC	12
5068	C	16		BINSCARTH - S. OF P.R. #478	TOWN			T	80
5070	C	478		BINSCARTH - W. OF P.T.H. #16	TOWN			T	90
5085	C	42		BIRTLE - S. OF W. JCT. P.T.H. #83	TOWN			RC	90
5089	C	42		BIRTLE - W. OF E. JCT. P.T.H. #83	TOWN			RC	90
5095	C	10		BOISSEVAIN - N. OF P.R. #443	TOWN			T	21
5096	C	10		BOISSEVAIN - S. OF P.R. #443	TOWN			T	21
5097	C	443		BOISSEVAIN - E. OF P.T.H. #10	TOWN			RC	21
5107	C	266		BOWSMAN - 0.3 KM E. OF P.T.H. #10(AT RLWY)	TOWN			RC	36
5119	C	10		BRANDON - S OF PR 344 RICHMOND AV	TOWN			UC	66
5120	C	10		BRANDON - N OF PR 344 RICHMOND AV	TOWN			UC	66
5121	C	610		BRANDON - EAST OF P.T.H. #10	TOWN			UC	
5122	C	610		BRANDON - S. OF P.T.H. #1A	TOWN			UC	
5123	C	1	A	BRANDON - N. OF VICTORIA AVE.	TOWN			UC	24
5124	C	1	A	BRANDON - W. OF FIRST ST. S.	TOWN			UC	24
5125	C	10		BRANDON - S. OF P.T.H. #1A	TOWN			UC	66
5127	C	10		BRANDON - N. OF P.T.H. #1A	TOWN			UC	24
5132	C	10		BRANDON - SOUTH OF P.R. #459 (S.B)	TOWN			UC	24
5134	C	459		BRANDON - W. OF P.T.H. #10	TOWN			UC	24
5135	C	1	A	BRANDON - S. OF P.R. #457	TOWN			UC	24
5136	C	457		BRANDON - E. OF P.T.H. #1A	TOWN			UC	24
5137	C	1	A	BRANDON - N. OF P.R. #457	TOWN			UC	24
5139	C	1		BRANDON - W. OF E. JCT. P.T.H. #10	TOWN			UC	24
5141	C	1		BRANDON - E. OF W. JCT. P.T.H. #10	TOWN			UC	24
5153	C	612		CARBERRY - N. OF P.T. #351	TOWN			RC	
5157	C	351		CARBERRY - W. OF P.T.H. #5	TOWN			RC	79
5164	C	3		CARMAN - EAST OF P.T.H. #13	TOWN			RC	35
5165	C	13		CARMAN - N. OF P.T.H. #3	TOWN			RC	81
5166	C	245		CARMAN - W. OF P.T.H. #3	TOWN			RC	58
5167	C	3		CARMAN - SOUTH OF P.T.H. #13	TOWN			RC	35
5174	C	3		CRYSTAL CITY - N. OF N. ACCESS ROAD	TOWN			RC	621
5175	C	616		CRYSTAL CITY - W. OF P.T.H. #3	TOWN			RC	
5177	C	616		CRYSTAL CITY - N. OF P.T.H. #3A	TOWN			RC	
5187	C	10		N. OF CRANBERRY PORTAGE	TOWN	72		T	72
5196	C	610		DARLINGFORD - N. OF P.T.H. #3	TOWN			RC	
5205	C	5	A	DAUPHIN - AT VERMILLION RIVER	TOWN			UC	32
5207	C	5	A	DAUPHIN - S. OF RAILWAY X-ING	TOWN			UC	32
5208	C	20	A	DAUPHIN - N. OF FIFTH AVE. NORTH	TOWN			UC	
5216	C	618		DELORAINE - N OF PTH 3	TOWN			RC	
5218	C	618		DELORAINE - S OF RAILWAY XING	TOWN			RC	
5220	C	618		DELORAINE - WEST OF MOUNTAIN ST.	TOWN			RC	
5222	C	618		DELORAINE - E. OF P.T.H. #3	TOWN			RC	
5229	C	200		DOMINION CITY - N. OF W. JCT. P.R. # 201	TOWN			RC	35
5234	C	604		DOMINION CITY - E. OF PR 200	TOWN			RC	
5240	C	248		ELIE - SOUTH OF P.T.H. #1	TOWN			RC	
5247	C	621		ELKHORN - W. OF P.T.H. #1	TOWN			RC	
5251	C	256		ELKHORN - S. OF P.T.H. #1	TOWN			T	56
5255	C	45		ELPHINSTONE - W. OF P.R. #354	TOWN			RC	90
5257	C	45		ELPHINSTONE - E. OF P.R. #354	TOWN			RC	90
5270	C	200		EMERSON - N. OF P.T.H. #75	TOWN			RC	35
5278	C	623		ERICKSON - N. OF OLD P.T.H. #10	TOWN			RC	
5282	C	623		ERICKSON - W. OF P.T.H. #10	TOWN			RC	
5290	C	10		ETHELBERT - 0.6 KM S. OF P.R. #269	TOWN			RC	36
5294	C	10		ETHELBERT - 0.8 KM W. OF P.R. #269	TOWN			RC	36
5307	C	10		FLIN FLON - N. OF S. JCT. P.T.H. #10A	TOWN	72		RC	72
5313	C	10		FLIN FLON - 0.3 KM N. OF W. JCT. P.T.H. #10A	TOWN			RC	72
5320	C	10		FLIN FLON - ROSS LAKE BRIDGE	TOWN			RC	72
5322	C	291		FLIN FLON - S. OF P.T.H. #10A	TOWN			RC	36
5323	C	10	A	FLIN FLON - E. OF GREEN ST.	TOWN			RC	72
5334	C	5		GILBERT PLAINS - W. OF W. JCT. P.R. #274	TOWN			RC	32
5336	C	5		GILBERT PLAINS - E. OF W. JCT. P.R. #274	TOWN			RC	32
5337	C	274		GILBERT PLAINS - N. OF W. JCT. P.T.H. #5	TOWN			T	32
5341	C	9		GIMLI - S. OF S. ACCESS ROAD (CENTRE ST)	TOWN			RC	1
5342	C	9		GIMLI - N. OF S. ACCESS ROAD (CENTRE ST)	TOWN			RC	1
5343	C	616		GIMLI - E. OF S. JCT. P.T.H. #9	TOWN			RC	
5352	C	615		GLADSTONE - N. OF P.T.H. #16	TOWN			RC	
5362	C	2		GLENBORO - W. OF ACCESS ROAD	TOWN			RC	66
5364	C	627		GLENBORO - S. OF P.T.H. #2	TOWN			RC	
5373	C	462		GLENELLA - S. OF P.R. #261	TOWN			T	24
5377	C	615		GRAND RAPIDS - S. OF P.T.H. #6	TOWN			RC	
5384	C	366		GRANDVIEW - N. OF RLWY X-SING	TOWN			RC	32
5385	C	617		GRANDVIEW - N.E. OF P.T.H. #5	TOWN			RC	
5395	C	30		GRETNA - S. OF N. ACCESS ROAD	TOWN			RC	48
5396	C	620		GRETNA - W. OF N. JCT. P.T.H. #30	TOWN			RC	
5401	C	205		GRUNTHAL - 0.3 KM S. OF MAIN ST.	TOWN			RC	35
5404	C	205		GRUNTHAL - W. OF CHURCH AVE.	TOWN			RC	35
5408	C	21		HAMIOTA - 0.5 KM N. OF P.R. #469	TOWN			RC	78
5417	C	634		HARTNEY - N. OF PTH 21	TOWN			RC	
5423	C	634		HARTNEY - E. OF P.T.H. #21	TOWN			RC	
5427	C	635		HOLLAND - S. OF P.T.H. #2	TOWN			RC	
5429	C	635		HOLLAND - W. OF P.T.H. #34	TOWN			RC	
5431	C	2		HOLLAND - WEST OF P.T.H. #34	TOWN			RC	58
5434	C	621		KELWOOD - E. OF P.T.H. #5	TOWN			RC	
5440	C	638		KILLARNEY - N. OF PTH #3	TOWN			RC	
5441	C	638		KILLARNEY - N OF PTH 3	TOWN			RC	
5443	C	18		KILLARNEY - S. OF PARK ST.	TOWN	66		T	66
5446	C	638		KILLARNEY - S. OF FINLAY ST.	TOWN			RC	

Abbreviations
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.*	Old TPG	Old Control Stn.
5447	C	638		KILLARNEY - N. OF FINLAY ST	TOWN			RC	
5448	C	638		KILLARNEY - E. OF BROADWAY AVE	TOWN			RC	
5450	C	3		KILLARNEY - E. OF ACCESS ROAD	TOWN			RC	56
5451	C	502		LAC DU BONNET - E. OF S. JCT. P.T.H. #11	TOWN			RC	
5455	C	502		LAC DU BONNET - 0.2 KM N. OF FIRST ST.	TOWN			RC	
5456	C	11		LAC DU BONNET - S. OF ACCESS ROAD	TOWN			RC	12
5458	C	50		LANGRUTH - 0.8 KM S. OF P.R. #265	TOWN			RC	46
5474	C	618		LORETTE - AT SEINE RIVER BRIDGE	TOWN			RC	
5475	C	207		LORETTE - 0.5 KM E. OF ACCESS ROAD	TOWN			RC	
5477	C	419		LUNDAR - EAST OF P.T.H. #6	TOWN			RC	81
5479	C	631		LUNDAR - E. OF P.T.H. #6	TOWN			RC	
5490	C	633		MACGREGOR - WEST OF ACCESS ROAD	TOWN			RC	
5499	C	635		MANITOU - NORTH OF P.T.H. # 3	TOWN			RC	
5506	C	50		MCCREARY - E. OF P.T.H. #5	TOWN			RC	49
5509	C	625		MCCREARY - S. OF P.T.H. #50	TOWN			RC	
5518	C	644		MELITA - W. OF P.T.H. #83	TOWN			RC	
5523	C	644		MELITA - N. OF P.R. #445	TOWN			RC	
5528	C	637		MIAMI - SOUTH OF NORTON AVE	TOWN			RC	
5530	C	637		MIAMI - E. OF P.R. #338	TOWN			RC	
5537	C	366		MINITONAS - SOUTH OF P.T.H. #10	TOWN			RC	36
5539	C	628		MINITONAS - W. OF P.R. #366	TOWN			RC	
5548	C	16		MINNEDOSA - AT MINNEDOSA RIVER	TOWN			RC	90
5551	C	262		MINNEDOSA - W. OF THIRD ST. EAST	TOWN			RC	24
5556	C	638		MORDEN - S. OF P.T.H. #3	TOWN			UC	
5559	C	3		MORDEN - E. OF SEVENTH ST.	TOWN			UC	621
5560	C	638		MORDEN - W. OF FOURTEENTH ST.	TOWN			UC	
5561	C	432		MORDEN - 0.3 KM S. OF P.T.H. #3	TOWN			UC	35
5569	C	75		MORRIS - N. OF S. JCT. P.T.H. #23	TOWN			T	14
5570	C	75		MORRIS - S OF JAMES ST (N OF PTH 23)	TOWN			T	14
5572	C	23		MORRIS - W. OF P.T.H. #75	TOWN			T	14
5574	C	5		NEEPAWA - W. OF MOUNTAIN AVE.	TOWN			RC	24
5577	C	649		NEEPAWA - N. OF P.T.H. #16	TOWN			RC	
5581	C	649		NEEPAWA - N. OF CPR. CROSSING	TOWN			RC	
5589	C	5		NEEPAWA-EAST OF MOUNTAIN	TOWN			RC	24
5599	C	245		NOTRE DAME DE LOURDES - W. OF P.R. #244	TOWN			RC	58
5606	C	655		OAKBURN - W. OF P.T.H. #21	TOWN			RC	
5626	C	643		OAKVILLE - E. OF P.T.H. #13	TOWN			RC	
5632	C	632		OCHRE RIVER - E. OF P.T.H. #20	TOWN			RC	
5653	C	658		PILOT MOUND - W OF PTH 3	TOWN			RC	
5673	C	271		PINE RIVER - E OF PTH 10	TOWN			RC	32
5683	C	306		PLUM COULEE - N. OF P.T.H. #14	TOWN			RC	35
5687	C	646		PLUM COULEE - EAST OF PTH 14	TOWN			RC	
5695	C	240		PORTAGE LA PRAIRIE - S. OF P.T.H. #1A	TOWN			UC	35
5697	C	240		PORTAGE LA PRAIRIE - N. OF P.T.H. #1A	TOWN			UC	35
5698	C	1	A	PORTAGE LA PRAIRIE - E. OF THIRD ST. W.	TOWN			UC	24
5701	C	1	A	PORTAGE LA PRAIRIE - E. OF THIRD ST. E.	TOWN			UC	81
5710	C	24		RAPID CITY - @ LITTLE SASKATCHEWAN RIVER	TOWN			T	78
5719	C	662		RESTON - S. OF P.T.H. #2	TOWN			RC	
5720	C	662		RESTON - S. OF P.T.H. #2	TOWN			RC	
5734	C	663		RIVERS - S. OF SECOND AVE	TOWN			RC	
5736	C	250		RIVERS - N. OF P.T.H. #25	TOWN			RC	24
5741	C	651		RIVERTON - E. OF P.T.H. #8	TOWN			RC	
5753	C	634		ROBLIN - N.W. OF W. JCT. P.T.H. #5	TOWN			RC	
5758	C	634		ROBLIN - N. OF E. JCT. P.T.H. #5	TOWN			RC	
5760	C	5		ROBLIN - W. OF E. JCT. P.T.H. #83	TOWN			RC	41
5767	C	652		ROLAND - N. OF S. JCT. P.T.H. #23	TOWN			RC	
5774	C	652		ROLAND - E. OF N. JCT. P.T.H. #23	TOWN			RC	
5780	C	666		ROSSBURN - W. OF P.T.H. #45	TOWN			RC	
5784	C	264		ROSSBURN - S OF PTH 45	TOWN			T	90
5790	C	668		RUSSELL - N. OF P.T.H. #16	TOWN			RC	
5799	C	669		SANDY LAKE - N. OF P.T.H. #45	TOWN			RC	
5802	C	45		SANDY LAKE - W. OF P.R. #250	TOWN			RC	90
5819	C	632		STE. ANNE - NW. OF P.R. # 210	TOWN			RC	
5820	C	210		STE. ANNE - SW. OF ACCESS ROAD # 622	TOWN			RC	12
5831	C	2		ST. CLAUDE - W. OF P.R. #240	TOWN			T	46
5839	C	246		ST. JEAN BAPTISTE - E. OF P.T.H. #75	TOWN			RC	35
5853	C	629		ST. MALO - W. OF P.T.H. #59	TOWN			RC	
5854	C	59		ST. MALO - S. OF ACCESS ROAD	TOWN			RC	14
5871	C	276		STE. ROSE - N. OF P.T.H. #5	TOWN			RC	75
5881	C	506		EAST SELKIRK - N. OF P.R. #212	TOWN			UC	67
5882	C	212		EAST SELKIRK - N. OF P.R. #204	TOWN	67		UC	67
5883	C	204		EAST SELKIRK - E. OF P.R. #212	TOWN			UC	77
5886	C	9		SELKIRK - E. OF RLWY CROSSING	TOWN	3		UC	3
5887	C	320		SELKIRK - N. OF MORRIS AVE.	TOWN			UC	67
5889	C	204		SELKIRK - W. END SELKIRK BRIDGE	TOWN			UC	77
5890	C	9	A	SELKIRK - N. OF PACIFIC AVE.	TOWN	3		UC	3
5897	C	670		SHOAL LAKE - E. OF P.T.H. #42	TOWN			RC	
5939	C	22		SOURIS - S. OF P.T.H. #2	TOWN			RC	
5942	C	2		SOURIS - WEST OF P.T.H. #22	TOWN			T	40
5943	C	2		SOURIS - EAST OF P.T.H. #22	TOWN			T	40
5947	C	12		STEINBACH - S. OF P.T.H. #52	TOWN			UC	14
5948	C	12		STEINBACH - N. OF P.T.H. #52	TOWN			UC	14
5953	C	52		STEINBACH - E. OF P.T.H. #12	TOWN			UC	14
5954	C	52		STEINBACH - W. OF P.T.H. #12	TOWN			UC	14
5961	C	67		STONEWALL - S. OF N. JCT. P.R. #236	TOWN			T	18
5964	C	664		STONEWALL - W. OF P.T.H. #67	TOWN			RC	
5969	C	665		STONY MOUNTAIN - EAST OF P.T.H. #7	TOWN			RC	

Abbreviations:
PG = Prairie Group
TOWN = located within a town
*Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
5973	C	676		STRATHCLAIR - W. OF P.T.H. #16	TOWN			RC	
5979	C	354		STRATHCLAIR - S. OF P.T.H. #16	TOWN			RC	90
5984	C	83		SWAN RIVER - W. OF P.T.H. #10A	TOWN			RC	36
5985	C	10		SWAN RIVER - N. OF P.T.H. #83	TOWN			RC	32
5993	C	668		TEULON - S. OF P.T.H. #17	TOWN			RC	
6000	C	10		THE PAS - S. OF THIRD ST.	TOWN			TS	72
6001	C	285		THE PAS - W. OF ROSS AVE	TOWN	73		RC	73
6013	C	391		THOMPSON - S. OF THOMPSON DRIVE SOUTH	TOWN			RC	82
6014	C	391		THOMPSON - N. OF THOMPSON DRIVE SOUTH	TOWN			RC	82
6016	C	391		THOMPSON - S. OF THOMPSON DRIVE NORTH	TOWN			RC	82
6017	C	391		THOMPSON - N. OF THOMPSON DRIVE NORTH	TOWN			RC	82
6021	C	670		TREHERNE - S. OF W. JCT. P.T.H. #2	TOWN			RC	
6027	C	670		TREHERNE - S. OF E. JCT. P.T.H. #2	TOWN			RC	
6032	C	257		VIRDEN - W. OF ACCESS ROAD	TOWN			RC	56
6035	C	257		VIRDEN - E. OF SEVENTH AVE.	TOWN			RC	56
6038	C	678		VIRDEN - S.W. OF SEVENTH AVE	TOWN			RC	
6039	C	678		VIRDEN - S.E. OF KING ST.	TOWN			RC	
6041	C	678		VIRDEN - S.W. OF P.T.H. #1	TOWN			RC	
6045	C	259		VIRDEN - N. OF P.T.H. #1	TOWN			RC	24
6050	C	636		WABOWDEN - W. OF LAKE ST.	TOWN			RC	
6052	C	671		WARREN - E. OF PTH 6	TOWN			RC	
6054	C	671		WARREN - W OF PTH 6	TOWN			RC	
6061	C	681		WAWANESA - S. OF P.R. #344	TOWN			RC	
6068	C	673		WINKLER - MAIN ST. S. OF PTH 14	TOWN			UC	
6069	C	32		WINKLER - CENTENNIAL ST. SOUTH OF PTH 14	TOWN			UC	35
6078	C	672		WINNIPEG BEACH - E. OF S. JCT. P.R. #232	TOWN			RC	
6081	C	672		WINNIPEG BEACH - W. OF RLWY X-SING	TOWN			RC	
6087	C	640		WINNIPEGOSIS - E. OF P.T.H. #20	TOWN			RC	
6102	C	1		ALEXANDER - E. OF P.R. #250	TOWN			T	62
6108	C	601		ALEXANDER - S. OF P.T.H. #1	TOWN			RC	
6109	C	250		ALEXANDER - N. OF P.T.H. #1	TOWN			RC	24
6110	C	1		ALEXANDER - W. OF P.R. #250	TOWN			T	62
6127	C	45		ANGUSVILLE - E. OF P.R. #476	TOWN			RC	90
6128	C	476		ANGUSVILLE - N. OF P.T.H. #45	TOWN			T	90
6129	C	45		ANGUSVILLE - W. OF P.R. #476	TOWN			RC	90
6320	C	614		CARTWRIGHT - N. OF P.T.H. #3	TOWN			RC	
6338	C	9		SOUTH OF CLANDEBOYE	TOWN			RC	75
6379	C	342		CYPRESS RIVER - S. OF P.T.H. #2	TOWN			T	58
6388	C	1		DOUGLAS - E. OF P.R. #340	TOWN			TS	79
6419	C	15		DUGALD - W. OF P.R. #206	TOWN			UC	64
6421	C	206		DUGALD - S. OF P.T.H. #15	TOWN			RC	12
6422	C	15		DUGALD - E. OF P.R. #206	TOWN			UC	64
6428	C	619		DUNREA - N. OF P.T.H. #23	TOWN			RC	
6479	C	613		ELM CREEK - E. OF P.T.H. #13	TOWN			RC	
6482	C	613		ELM CREEK - W. OF GLADY'S ST.	TOWN			RC	
6501	C	68		ERIKSDALE - EAST OF P.T.H. #6	TOWN			T	16
6503	C	417		ERIKSDALE - W. OF P.T.H. #6	TOWN			RES	76
6518	C	800		FALCON LAKE - SOUTH OF P.T.H. #1	TOWN			RES	
6553	C	625		FOXWARREN - S. OF P.T.H. #16	TOWN			RC	
6593	C	608		GARSON - W. OF E. JCT. P.T.H. #44	TOWN			RC	
6600	C	608		GARSON - E. OF W. JCT. P.T.H. #44	TOWN			RC	
6601	C	608		GARSON - S. OF CENTER JCT. P.T.H. #44	TOWN			RC	
6609	C	615		GLADSTONE - E. OF P.T.H. #16	TOWN			RC	
6666	C	621		GROSSE ISLE - N.W. OF P.R. #322	TOWN			RC	
6671	C	321		GROSSE ISLE - E. OF P.T.H. #6	TOWN			RC	1
6673	C	621		GROSSE ISLE - S.E. OF P.T.H. #6	TOWN			RC	
6679	C	622		GUNTON - W. OF P.T.H. #7	TOWN			RC	
6706	C	623		HAYWOOD - EAST OF GOVN. RD. ALLOWANCE	TOWN			RC	
6712	C	623		HAYWOOD - S. OF P.T.H. #2	TOWN			RC	
6756	C	627		HOCHFELD - WEST OF P.T.H. #32	TOWN			RC	
6786	C	405		ILE DES CHENES - E. OF P.T.H. #59	TOWN			RC	
6790	C	612		ILE DES CHENES - W. OF STE. ANNE'S ROAD	TOWN			RC	
6801	C	620		INGLIS - S. OF P.R. #366	TOWN			RC	
6827	C	21		KENTON - S. OF P.R. #259	TOWN			T	78
6831	C	637		KENTON - S. OF P.R. #259	TOWN			RC	
6885	C	317		LAC DU BONNET - 0.8 KM S. OF P.T.H. #11	TOWN			RC	75
6957	C	238		LOCKPORT - SOUTH OF P.T.H. #44	TOWN	3		UC	3
6959	C	44		LOCKPORT - WEST OF LOCKPORT BRIDGE	TOWN			T	
6962	C	204		LOCKPORT - S. OF P.T.H. #44	TOWN			UC	77
6978	C	23		LOWE FARM - WEST OF P.R.# 332	TOWN			T	14
7005	C	242		MACGREGOR -S. OF P.T.H. # 1	TOWN			T	56
7010	C	633		MACGREGOR - SOUTH OF P.T.H. #1	TOWN			RC	
7057	C	641		MARIAPOLIS - E. OF P.T.H. #23	TOWN			RC	
7083	C	643		MCAULEY - W. OF P.T.H. #41	TOWN			RC	
7124	C	645		MINIOTA - E. OF P.T.H. #83	TOWN			RC	
7126	C	645		MINIOTA - W. OF P.T.H. #83	TOWN			RC	
7143	C	627		MOOSEHORN - EAST OF P.T.H. #6	TOWN			RC	
7168	C	647		NAPINKA - E. OF P.R. #452 (S. ACCESS)	TOWN			RC	
7170	C	647		NAPINKA - E. OF P.R. #452 (N. ACCESS)	TOWN			RC	
7212	C	250		NEWDALE - W. OF P.T.H. #16	TOWN			RC	
7217	C	250		NEWDALE - S. OF P.T.H. #16	TOWN			RC	24
7244	C	653		OAK LAKE - SOUTH OF P.T.H. #1	TOWN			RC	
7249	C	653		OAK LAKE - WEST OF 4TH AVENUE	TOWN			RC	
7262	C	654		OAK RIVER - NORTH OF MCKINNET ST	TOWN			RC	
7269	C	623		OTTERBURNE - W. OF GOVT. RD. ALLCE.	TOWN			RC	
7280	C	624		PETERSFIELD - E. OF P.T.H. #9	TOWN			RC	
7286	C	657		PIERSON - S. OF P.T.H. #3	TOWN			RC	

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

Table D-1 (continued)

Stn.	Dir'n	Hwy. No.	Hwy. Alt.	Location	New TPG	New Control Stn.	Sask. Control Stn.^	Old TPG	Old Control Stn.
7305	C	659		PIPESTONE - S. OF P.T.H. #2	TOWN			RC	
7358	C	302		RICHER - N. OF DAWSON ROAD	TOWN			RC	12
7494	C	656		SANFORD - NW. OF P.R. #247	TOWN			RC	
7516	C	671		SIDNEY - E. OF P.R. #352	TOWN			RC	
7584	C	2		STARBUCK - E. OF P.R. #332	TOWN			T	48
7614	C	667		SWAN LAKE - N. OF P.T.H. #23	TOWN			RC	
7686	C	680		WASKADA - E. OF P.R. #251	TOWN			RC	
7714	C	643		WHITEMOUTH - N. OF S. JCT. P.T.H. #11	TOWN			RC	
7719	C	643		WHITEMOUTH - E. OF N. JCT. P.T.H. #11	TOWN			RC	
7729	C	674		WOODLANDS - E. OF RLWY X-SING	TOWN			RC	
7732	C	674		WOODLANDS - S. OF P.R. #518	TOWN			RC	

Abbreviations:
PG = Prairie Group
TOWN = located within a town
^Control Station located in Saskatchewan

APPENDIX E

Cluster Analysis Results

Results of Cluster Analysis

The following program shows the SAS program code used for performing cluster analysis on the permanent counter data based on its' monthly traffic patterns. This program requires the input variables to be the 12 monthly factors for each permanent counter for grouping.

```
DATA MGROUP;
  INFILE 'C:\SAS\SASDATA\CM95MADT.PRN' LRECL=200;
  INPUT STNNO $ M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12;
  CARDS;
PROC PRINT DATA=MGROUP;
PROC CLUSTER METHOD=WARD;
  VAR M1 M2 M3 M4 M5 M6 M7 M8 M9 M10 M11 M12;
  ID STNNO;
PROC TREE HORIZONTAL SPACES=2;
  ID STNNO;
RUN;
```

(The output from this program is shown below).

The SAS System
Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	0.168202	0.139933	0.672321	0.67232
2	0.028268	0.007380	0.112992	0.78531
3	0.020888	0.010333	0.083492	0.86880
4	0.010555	0.001444	0.042190	0.91099
5	0.009111	0.003427	0.036417	0.94741
6	0.005683	0.002738	0.022717	0.97013
7	0.002946	0.001314	0.011775	0.98190
8	0.001632	0.000247	0.006525	0.98843
9	0.001386	0.000459	0.005539	0.99397
10	0.000927	0.000494	0.003706	0.99767
11	0.000433	0.000284	0.001731	0.99940
12	0.000149	.	0.000596	1.00000

Ward's Minimum Variance Cluster Analysis

Root-Mean-Square Total-Sample Standard Deviation = 0.14439
Root-Mean-Square Distance Between Observations = 0.707362

Number of Clusters	--Clusters Joined--		Frequency of New Cluster	Semipartial R-Squared	R-Squared	Tie
83	S20	S75	2	0.000123	0.999674	
82	S1	S4	2	0.000128	0.999547	
81	M25	S22	2	0.000134	0.999412	
80	M41	S28	2	0.000141	0.999271	
79	M49	CL82	3	0.000152	0.999120	
78	S38	S41	2	0.000155	0.998965	
77	M1	M70	2	0.000157	0.998808	

76	S3	S10	2	0.000165	0.998643
75	M8	M28	2	0.000188	0.998455
74	M32	S39	2	0.000203	0.998252
73	CL76	S5	3	0.000219	0.998033
72	CL75	M14	3	0.000264	0.997768
71	M9	S2	2	0.000285	0.997483
70	S11	CL83	3	0.000319	0.997164
69	M67	M68	2	0.000345	0.996819
68	M56	S34	2	0.000355	0.996465
67	M24	M81	2	0.000360	0.996105
66	CL71	CL79	5	0.000393	0.995712
65	CL74	S44	3	0.000409	0.995303
64	M13	M96	2	0.000412	0.994891
63	CL77	M60	3	0.000419	0.994472
62	M12	M78	2	0.000431	0.994041
61	CL80	S15	3	0.000468	0.993573
60	CL66	CL73	8	0.000492	0.993081
59	M59	S42	2	0.000494	0.992587
58	M21	M72	2	0.000518	0.992069
57	M97	S91	2	0.000519	0.991550
56	M40	S9	2	0.000535	0.991015
55	CL84	CL67	4	0.000577	0.990438
54	M51	CL59	3	0.000590	0.989848
53	M84	CL78	3	0.000597	0.989251
52	CL60	M66	9	0.000628	0.988623
51	M46	CL70	4	0.000639	0.987985
50	M7	CL68	3	0.000659	0.987325
49	CL65	S45	4	0.000677	0.986648
48	M43	CL85	3	0.000726	0.985922
47	S18	S21	2	0.000802	0.985120
46	M94	S46	2	0.000803	0.984317
45	CL61	S36	4	0.000821	0.983496
44	CL52	S13	10	0.000832	0.982664
43	M75	CL57	3	0.000905	0.981758
42	CL63	CL55	7	0.000941	0.980817
41	CL54	S43	4	0.000979	0.979838
40	CL50	CL72	6	0.001004	0.978834
39	CL49	S16	5	0.001400	0.977434
38	CL81	M80	3	0.001427	0.976007
37	CL51	M58	5	0.001456	0.974551
36	CL62	CL43	5	0.001501	0.973050
35	M47	S7	2	0.001508	0.971542
34	CL56	CL48	5	0.001707	0.969835
33	CL40	CL45	10	0.001723	0.968112
32	CL37	CL53	8	0.001909	0.966203
31	CL64	M74	3	0.002073	0.964130
30	CL41	M83	5	0.002089	0.962041
29	CL38	S8	4	0.002403	0.959638
28	CL42	CL39	12	0.002532	0.957107
27	M76	CL46	3	0.002610	0.954496
26	M73	CL47	3	0.002766	0.951730
25	CL30	S17	6	0.003002	0.948728
24	CL36	M93	6	0.003495	0.945233
23	M16	CL32	9	0.003500	0.941733
22	CL25	S40	7	0.003800	0.937933
21	CL35	CL69	4	0.003919	0.934014
20	CL33	CL44	20	0.003934	0.930080
19	CL23	CL34	14	0.004654	0.925426
18	CL28	CL20	32	0.004724	0.920703
17	CL24	CL58	8	0.005869	0.914833
16	CL21	M63	5	0.006542	0.908291
15	CL31	CL26	6	0.006558	0.901733
14	CL19	CL29	18	0.010809	0.890925
13	CL18	CL22	39	0.011545	0.879379
12	CL14	CL16	23	0.012931	0.866449
11	CL17	M65	9	0.017101	0.849347
10	M4	CL27	4	0.018519	0.830829

9	CL10	CL15	10	0.022065	0.808764
8	CL13	S74	40	0.023013	0.785750
7	CL9	S92	11	0.027868	0.757883
6	CL11	S71	10	0.034974	0.722908
5	CL6	CL12	33	0.045785	0.677123
4	CL7	S47	12	0.049733	0.627390
3	CL8	S14	41	0.058013	0.569377
2	CL3	CL5	74	0.108896	0.460481
1	CL2	CL4	86	0.460481	0.000000