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Canada

Development of Province-Wide Commodity Flow Tables and Forecast Models from Truck Survey Data

Antoine Chemali

A Thesis

in

The Department

of

Civil Engineering

Presented in Partial Fulfilment of the Requirements
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To NAZEK and MARK.

ABSTRACT

Development of Province-Wide Commodity Flow Tables and Forecast Models from Truck Survey Data

Antoine Chemali

Recent truck deregulation policies have brought sweeping changes to the structure of this industry. This thesis attempts to provide a better understanding of the nature of truck commodity movements in the province of Ontario, based on a truck survey conducted by the Ministry of Transportation of Ontario in 1988.

The methodology described in this thesis involves two major stages. In the first stage a unique approach is followed for the development of the Commodity Flow Tables (CFTs); based on information obtained at 57 different locations on the major highway network in Ontario. Commodities were aggregated into 15 groups based on similar characteristics. Multiple counted records were eliminated and a province-wide commodity flow table for each group was developed.

In the second stage of this thesis a Commodity Flow Model (CFM) is developed to forecast future flows in the province. The CFM is a *Fratar* type model which uses a base year commodity flow table and appropriate growth factors to forecast future year flows.

A set of comprehensive computer programs were developed in this project. This has produced a structured program called MATRIX which is capable of developing the CFTs starting from the original data.

Discussions on the practical applications of the CFTs and the CFM are provided. The Commodity Flow Model presented in this thesis has useful applications for planning of transportation facilities.

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Finally, I would like to convey my great appreciation and love to my wife, whom this thesis is dedicated, for her patience and support throughout this work.

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LIST OF SYMBOLS

SYMBOL		DESCRIPTION
C_j	=	Total consumption (tonnes) at destination j
CFM	=	Commodity Flow Model
CFT	=	Commodity Flow Table
CW	=	Commodity Weight per shipment
d_{ij}	=	Spatial separation factor between zones i & j
EF4	=	Expansion factor # 4
f_i, f_j	=	Growth factors of zones i & j respectively
GVW	=	Gross Vehicular Weight of Truck
k	=	Commodity group variable (from 1 to 15)
L_i, L_j	=	Locational factors of zones i & j respectively
NCG	=	New Commodity Group
NOR	=	Station's Number of Records
NZD	=	Destination field in the New Zone system
NZO	=	Origin field in the New Zone system
O-D	=	Origin-Destination
P_i	=	Total Production (tonnes) at origin i
R^2	=	Coefficient of determination
S_e	=	Standard error

Continued

T_{ij} = Tonnage interchange between zones i & j

TW = Tare Weight (empty weight) of truck

V1 = Record number field in the original data file

V33 = Origin field in the original data file

V40 = Field of EF4 in the original data file

V41 = Station's number field in the original data file

V51B = Estimated Tare Weight field in original data file

V55B = Field of commodity types in original data file (1 to 99)

V70 = Field of Gross Vehicular Weight in original data file

W_{ij} = Weight of commodity shipped between i & j (tonnes per day)

CHAPTER 1

INTRODUCTION

1.1 TRANSPORTATION OF COMMODITIES

The transportation industry is a critical component of any given economy. Commodity transportation in particular, is a vital sector within the overall transportation scenario. Commodity transportation has a direct bearing not only on the price and availability of products sold at the market, but also on national defense matters, energy usage, and the environment [7].

The study of provincial commodity movements in particular is a study of a closed economy. It emphasizes regional economic developments and also identifies those economic regions which are being either well served or neglected. It also provides a profile of the nature and type of commodities moving on the province's network. The transportation authorities in the provinces have come to understand that their responsibilities are not solely confined to the provincial highway network system only, but also include the broad spectrum of commodity transport services provided by the different modes used for this purpose [14].

Recent deregulations along with the Free Trade Agreement between Canada and the USA have brought sweeping changes to the commodity transport industry. These

changes have created a need for broader and more comprehensive data collection approaches. The changes also created a need to develop sophisticated models to provide more understanding of this industry and the effect of its related changes.

1.2 TRUCK COMMODITY FLOWS IN ONTARIO

In 1988, there were 1,059,092 trucks and tractors registered in Ontario [19]. The movement of those trucks and tractors is attributed to the economic activities of commodity interchanges between different regions in the province. While trucking represents the major mode for transporting commodities, its activities are being monitored by two government agencies; Statistics Canada, and the Ministry of Transportation of Ontario (MTO).

Statistics Canada has been surveying commodity movements since 1973. Information obtained from their 1988 survey suggests that Ontario continued to dominate the Canadian trucking industry. Ontario contributed to approximately 58% of the total tonnage shipped by trucks in Canada. Metro Toronto alone accounted for more than 33% of the total tonnage in Canada [20].

The Ministry of Transportation of Ontario, (MTO), is also actively involved in surveying trucks travelling on its highway network since 1978. Its 1988 commercial vehicle survey revealed that approximately 852,500 tonnes per day of commodities were shipped by trucks in Ontario. The survey also suggested that an estimated 45,800

commodity shipments per day occurred in 1988 carrying all type of commodities.

1.3 OBJECTIVES OF THE STUDY

The primary objective of this study is to provide a better understanding of the truck commodity flow patterns in Ontario. Beyond the primary objective, the study is specifically aimed at establishing the following:

1) To develop province wide commodity flow tables for Ontario by commodity type and weight based on a truck survey conducted by the Ministry of Transportation of Ontario.

2) To develop a commodity flow model aimed at forecasting the intercity commodity flows in the province using the obtained tables and appropriate growth factors.

3) To review the data requirements and application of model for commodity transportation planning and to evaluate the importance of the developed tables and model.

1.5 STRUCTURE OF THE THESIS

Chapter 2 of this report outlines the literature review related to the distribution and forecasting of commodity. It describes several previous models considered important for the present study [6,8,14,17,21].

Chapter 3 describes the data base used in this research. It explains in detail the methodology used by the Ministry of Transportation of Ontario in conducting the 1988 Commercial Vehicle Survey.

Chapter 4 explores the theoretical framework used for the development of the Commodity Flow Tables using the above survey. It describes the sequential process followed emphasizing the elimination of multiple counted records in the original file.

In chapter 5, a Commodity Flow Model (CFM) is developed. The CFM is a *Fratar* type model which uses the obtained commodity flow tables and population growth factors of selected cities to generate a future year (1996) intercity commodity flow in Ontario. An example of the 1996 intercity commodity flow for one commodity group is illustrated in this chapter.

Chapter 6 illustrates the comprehensive computer work applied in this research . The computational algorithm performed to develop the tables is illustrated in detail. The sub-sections in this chapter focus on the approach followed using two softwares (dBASEIII+ and BASIC). Descriptions of programs written in both languages leading up to the development of the structured program "MATRIX" is provided. Finally, chapter 7 represents the summary and conclusions of this study. Suggestions for further research is also provided in this chapter. Appendices A, B, and C contain respectively; tables/figures, computer programs, and additional information about the survey.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The economical and spatial interactions system that exist between producers and consumers of goods, who are normally scattered across different regions of an economy, triggers the com nodity flow system. This system consists of three basic components; (i) producers, (ii) consumers, and (iii) shippers [7].

Producers are the economic agents who produce commodities. Normally, producers manufacture or process finished or semi-finished products to be distributed to other economic regions. Consumers are those agents who consume products produced at different regions. Consumers represent the population of the region. Shippers, are the agents who move the commodities between the producers and the consumers. They are characterized by several modes such as; Trucks, rail, ships, cargo planes, and pipelines.

Moving a commodity from its point of production to its point of consumption at an economical price requires an efficient transportation system. Numerous studies have been conducted on modelling of freight flows covering many aspects of this industry [1,2,4,9,11,14,17]. The overall focus of this study however, is on the third component of the commodity flow system; shippers, particularly the truck mode.

2.2 TRUCK ORIGIN-DESTINATION (O-D) SURVEYS

Trucking is a major mode of land commodity transport. The movement of trucks is of direct consequence to the economical activities of production and consumption. While the system of commodity flow is not well understood yet, several recent surveys have provided some understanding [8].

Predictive models are sometimes developed to predict information about commodity flow where no such data is available [7]. Truck O-D surveys however, provide a sound source of information about many aspects of trucking activities such as; truck type, carrier type, driver characteristics, nature of commodity, weight origin and destination of commodity. The National Research Council indicates in its TRB report #260 that: *"the use of existing data is preferable to approximating freight generation and distribution using simulating techniques, because such techniques generally cannot replicate effectively local conditions"*.

A number of government agencies in Canada routinely collect data on commodity flow through commercial vehicle surveys [5,8,13]. Critical information such as intercity freight flow pattern by products, route, and type of shipper, needs to be developed for modes that use the public right-of way (especially highways and rail) [15]. Such surveys assist the decision makers in terms of planning and policies/regulations elaboration.

2.3 COMMODITY FLOW FORECAST MODELS

A literature research on commodity distribution revealed information on the analysis and the theoretical frame work for modelling. The first major work on commodity flow analysis was conducted by E. L. Ullman [21]. Using the 1950 commodity data, he developed flow diagrams for the U.S.A depicting origins and destinations of several commodity groups. His work was the first break-through in this field, and the data base he produced was useful for testing models and theories done by other researchers after him. A few major works on forecasting distribution of commodity flows are reviewed in the following sections.

In 1982, B. Hutchinson and K. Wilkinson [8], used the 1979 Statistics Canada for hire truck commodity suvrey to estimate future highway truck volumes in Ontario. In this report, the authors obtained tables for six commodity groups but only three of them were analyzed for statistical reliability. The tables indicated the annual tonnage moved by trucks between ten major cities in Ontario plus Montreal. Using different statistical methods to analyze the tables, they identified four broad approaches to estimate truck volumes; (1) The use of an input-output model to predict commodity flows which are then converted to truck volumes; (2) An adaption of the multi-stage approach used in transportation planning, (3) A growth factor approach in which the existing spatial interaction structure is used as the basis for estimating future demand; (4) A growth factor approach which used information on link volumes to estimate future demands. The four approaches were assessed with respect to a number of criteria with scientific

integrity, and their conclusion was that the growth factor approach which relies on a sample of truck origin to destination movements was the most appropriate at that time. The work described in [8] has provided more understanding of the structure of commodity flow in Ontario.

A comprehensive study of commodity flows in the province of Alberta was conducted by A.S.N Murthy in 1988 [14]. The study was based on a Shippers-Consignees survey conducted by Alberta transportation in Edmonton. The author developed models for commodity distribution and modal split.

His initial task was to construct Origin-Destination tables by commodity group from the original survey records. The work was done in stages. First, analysis of the shipment size and mode was done to determine that commodity flow by truck and rail. Second, O-D pairs across the province were reviewed and the annual tonnage moving between the selected ones were allotted to them. Finally, the commodity classes were grouped into six major groups. Six commodity flow tables for truck and rail modes in Alberta were obtained. Then using the above tables, an "Optimized Gravity" distribution model for each commodity group. The Optimized Gravity model is defined as follows:

[2.1]

$$(T_{ij})_1 = P_j \frac{C_j d_{ij}^{\lambda_1}}{\Sigma_j C_j d_{ij}^{\lambda_1}}$$

Where:

$(T_{ij})_l$ = Tonnage of commodity moved between zones i & j at optimum condition *(l)*.

P_i = Production of commodity at zone (i).

C_j = Consumption of commodity at zone (j).

$d_{ij}^{\lambda_l}$ = Optimum (*l*) spatial separation factor.

A unique "optimum" spatial separation factor was obtained for each commodity category. The optimized factors were determined by applying a power function and the least square method. The impedance or friction factors were based on trip distance and the commodity category. Murthy tested his results using standard statistical tests and commodity haul frequency diagrams, and he concluded that his results were acceptable when compared with previous calibrations of this nature.

The second stage of his work was the development of modal split models to estimate the modal share between trucks and rail in the province. His models relied on Log-Linear and Logit models based on a number of variables like commodity type, volume of load (full or less than full load), type of carrier (private or for hire), and trip distance. Murthy's Modal split models is a useful tool in analyzing the commodity data and his work has application for improving commodity transportation planning in Alberta.

2.4 THE FRATAR GROWTH FACTOR METHOD

The *Fratar Growth Factor Method* was developed by Thomas J. Fratar in 1954 [6]. While planning a county wide highway system for the Cleveland area, Fratar et al developed what was called then "*Forecasting Distribution of Interzonal Vehicular Trips by Successive Approximations*". His objective was the determination of the most logical distribution of trips expected to be made in a given area under known conditions of regional development. This method needs two types of data input. a regional economic development plan which can be used to generate future growth factors of zones, and an O-D data for a given date. The *Fratar* technique uses the following mathematical expression:

$$T_{ij}^{h} = t_{ij}^{b} \times f_i \times f_j \frac{(L_i + L_j)}{2} \qquad [2.2]$$

Where:

T_{ij}^{h} = horizon year(h) trip interchange between zones i & j.

t_{ij}^{b} = bases year (b) trip interchange between zones i & j.

f_i, f_j Growth factors for zones i & j respectively.

L_i, L_j Locational factors for zones i & j.

The basic assumption of this procedure is that future trips are proportional to base year trips modified by growth factors. This process does not need calibration but an iterative procedure is required.

The *Fratar* technique has been used consequently in forecasting commodity flows. The Florida Department of Transportation, (FDOT), has sponsored a project for a state wide multimodal freight forecasting procedure [17]. The commodity flow in the state was projected from base year 1975 to years 1985 and 2000 using the *Fratar* technique. In this project, base year O-D tables were synthesized from a large number of secondary sources of data (state and federal agencies). These sources are produced periodically by the above agencies. Separate tables were obtained for each mode of transportation; truck, rail, and water. A separate growth factors for production and consumption of each commodity group was developed using unpublished information. The above tables and growth factors were used as input to Fratar Model and forecast figures were obtained for the horizon years (1985, and 2000) separately.

The *Fratar* technique assumes that growth factors will remain stable over the projection term: an assumption that is not always true in many regions. Then, the interpolation of commodity flow over 10 and 25 years into the future may produce questionable results. Its known that this technique is most effective when used to interpolate over a relatively short period of time: 4 to 6 year normally. [16].

2.5 DISCUSSION

It is interesting to notice that in each of the above studies [8,14,& 17] the approach used to develop the Commodity Flow Tables was different. In [8]; Statistics Canada developed them based on a for-hire truck survey which excluded private trucks.

In [14]: the tables were constructed from a shippers-consignees survey which requires a different approach from the previous one, and in [17]; the tables were synthesized from a large number of secondary sources. A different approach is used in this study where tables are developed from truck O-D survey data.

CHAPTER 3

DATA BASE

3.1 BACKGROUND

The Ministry of Transportation of Ontario (MTO) is actively involved in various types of data gathering processes. To make informative decisions in planning, delivery, and evaluation of the ministry programs, the MTO periodically conducts commercial vehicle roadside surveys on its major highway network every five years. The first of such surveys was undertaken in 1978. Another one was conducted in 1983, and the third survey was undertaken in 1988 to continue the provision of trend information and identification [13].

3.2 THE 1988 ONTARIO COMMERCIAL VEHICLE SURVEY (CVS)

The 1988 Commercial Vehicle Survey (CVS) is believed to be the most comprehensive so far. Compared to previous surveys, this one involved more surveying locations (stations) and its sample size was about 45% larger than the 1983 survey. The results of this survey was obtained from the Department of Municipal Transportation Planning Branch, Transportation Demand Research Office at the MTO, the prime organizer of the survey.

The survey was conducted at 57 stations situated on the major highway network in Ontario. The location of stations included 40 inspection stations, 8 inspection areas (laybys), 3 interprovincial border crossings, and 6 international border crossings. The survey was carried out over a 23-week period spanning from March to November of 1988. Trained university students helped in executing the interviews. Data was collected through the use of a questionnaire which was handed out to drivers during the interview period. Among other possible ways of data gathering procedures, the questionnaire approach provides a broader profile about the trucking activities in the province.

3.2.1 The questionnaire

Carefully designed to capture the widest possible range of information about the trucking activities in Ontario, the questionnaire was composed of two major components; observations completed by crew members, and questions applied to drivers. The questionnaire covered the following aspects.

(A) Observations

Once the truck is in the survey station, part of the crew members observe and record the following characteristics:

1. Plate number, base province/state of registration, name of power unit, vehicle configuration, tractor style, trailer/body style.
2. Features of vehicle/trailers, sidefairings, sleepers,etc.
3. Weigh scale data, vehicle configuration, number of axles, weight by axle, base length, etc.

(B) Questions

The second part of the survey questionnaire consisted of 29 questions about the following aspects:

1.Vehicle:

- Registered gross vehicular weight, tare weight, fuel type.
- Features of cabin, logbook, on board computer.

2.Carrier:

- Carrier type, for hire, private, on contract.
- Driver employment and method of pay.

3.Commodity:

- Waybill existence.
- Commodity type, commodity weight, payload volume, number of shipments on board.

4.Origin/Destination:

- Origin and destination of trip (by place name). Later, the O/D's were coded into two zone systems, The Ontario Wide Travel Simulation (O.W.T.S) 284 zones, and the Toronto Area Regional Municipal Simulation (TARMS) 3037 zones.
- Type of establishment at origin and destination.

5. Driver:

- Driving experience, hours worked per day, driving hours per day.

- Driving educational programs.

A copy of this Questionnaire is provided in Appendix C.

3.3 METHODOLOGY

A number of departments in the ministry joined the effort in carrying out the survey. Interviews were taken on 100 days but were not necessarily conducted for the whole day. Although the 57 surveying stations were geographically scattered across the province, some of them were located on the same corridor (highway). For example, there were six stations along the 401 corridor, between Cornwall and Windsor. The locations of the survey stations are shown in figure 3.1. In some cases, interviews were conducted at more than one station on the same day. Attempts were made to route as many trucks as possible through the weigh scales platform of the station, depending mainly on the station's accommodation capacity and size of crew.

During the duration of the survey, a classification count of vehicles passing by the station was being taken to help develop an expansion factor that would be used to expand the sample to represent an average daily truck traffic. Attempting to capture the true hourly and daily variations in trip travel, a 7-day, 24-hour classification count was also conducted at some major stations west of Toronto (Trafalgar North and South inspection stations).

A total of 19225 truck drivers were originally interviewed at all the locations over a period of 1855 hours. The average sampling rate was 18%, ranging from a low of 2.4% for busy stations near Toronto to a high of 100% for more remote stations [13]. Information collected from each interview was coded and placed into one record (row) representing a single trip and all records collected from all locations were combined to form one file. In addition to the information collected from the survey, expansion factors had to be developed and added to each record in the file.

The MTO found it necessary to perform minor adjustments to some records and to eliminate completely some others which were considered unreliable. Finally, each record contained 91 fields of information. Hence, the data file actually represented a matrix of 19225 x 91. A sample of the original layout of data is listed in table A.1. The following is a brief explanation of the expansion factors used in this file.

3.4 EXPANSION FACTORS

In order to expand the sample to represent daily traffic volume, a set of four different expansion factors was developed at the MTO and were considered to be fairly reliable. For each record a related expansion factor was developed, depending on the surveying station, its location, time and date of the interview, length of surveying period and the traffic volume passing by the station. The following expansion factors were added to each record in the original data file.

A. Expansion Factor # 1 (EF1):

This factor was developed to expand the number of surveys conducted to the number of trucks passing the station simply by dividing the number of trucks passing the station by the number of trucks interviewed.

B. Expansion Factor # 2 (EF2):

This factor was developed to average the duplicated survey hours. At the main stations, the interviews were conducted for 36 and sometimes 48 hours. The total trucks passing and interviews for the repeated hours were averaged. This process smooths out the fluctuation in the repeated survey hours.

C. Expansion Factor # 3 (EF3):

This factor combines the seasonal data and a 24 hour factor is calculated. Four seasons are defined throughout the time span of the survey; 1.March, 2.May/June, 3.July/August, 4.September to November.

D. Expansion Factor # 4 (EF4):

This factor is calculated on the four season stations only. Each season is added and the magnitude of it remained in the factoring process. Stations without four seasons, simply expansion factor number three was carried over to be number four. This factor was the most comprehensive one and therefore, was used in developing the Commodity Flow Tables.

3.5 DATA QUALITY

Given the large size of the geographic area covered in this survey, the quality of the obtained data is considered both comprehensive and reliable. This survey provides valuable information on the inter-city trucking activities. Suitable adjustments however, were made to estimate approximately 30% of missing commodity weight data item in original records.

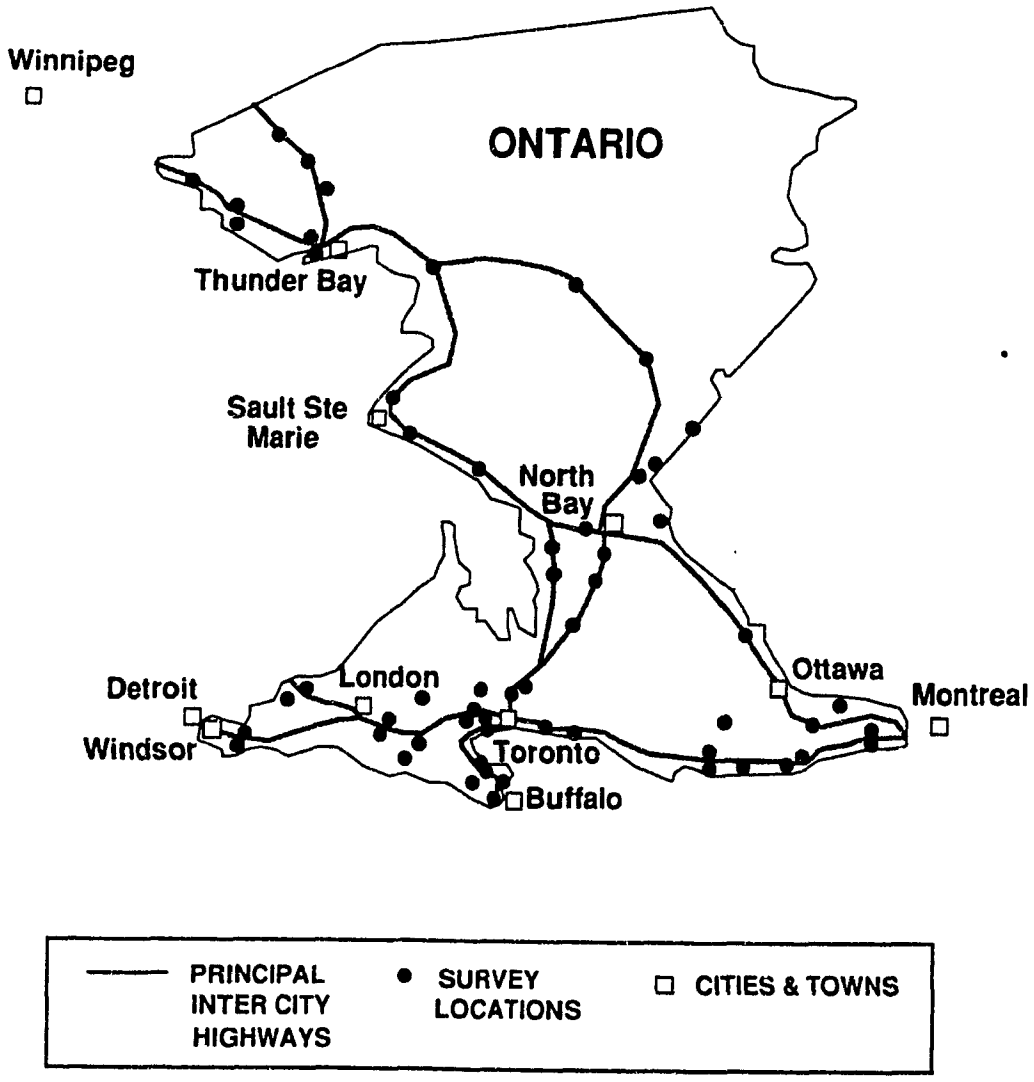


Figure 3.1 Locations of survey stations

Source: The 1988 Ontario Commercial Vehicle Survey (CVS)

CHAPTER 4

DEVELOPMENT OF COMMODITY FLOW TABLES

4.1 INTRODUCTION

A Commodity Flow Table (CFT) is basically an origin-destination (O-D) matrix for each commodity type. This table shows the amount of any particular commodity shipped (transported) between the source (point of production) and the sink (point of consumption). The development of CFTs is time consuming and a difficult task due to its special nature. Unlike any (O-D) table for persons or cars trips, the CFT tables are more difficult to construct due to the diversity of commodity types that have to be treated separately. To reduce the level of difficulty in handling this issue, commodities had to be grouped into a manageable size of distinct groups based on similar characteristics.

A CFT is composed of four dimensions;(i) Commodity group (k), (ii) origin (O), (iii) destination (D), and (iv) commodity weight (CW) expressed in tonnes per day. Once these tables are developed, they can be used for a variety of planning purposes.

4.2 DEVELOPMENT OF CFTS

Developing province-wide commodity flow tables from a truck survey is totally a unique approach. Unlike tables constructed from other kinds of surveys, (for hire truck or shippers-consignees types of surveys), the tables developed here required a different approach. Data collected from each of the 57 stations had to be expanded to a 24-hour volume. Then information from all stations had to be assembled together and multiple counted records had to be adjusted. This process required a systematic procedure starting from the original survey records.

4.2.1 The procedural flow chart

The multi-step approach adopted to develop the tables is outlined in figure 4.1. Detailed explanation of every step in the process is discussed in this chapter.

4.2.2 Identification of relevant information

Following the initial inspection of the original data, it was decided that only 22 out of 91 fields were needed for the development of the CFT's and were copied to a new file. Such information was mainly about the record identification, time of survey, origin destination of trips, trucks types and characteristics, commodity type, commodity weight, volume of payload, expansion factors, tare weight of truck (TW), gross vehicular weight (GVW), and registered gross vehicular weight (RGVW). The initial attention of data analysis was on the four dimensions that characterizes the tables. It was found that the critical commodity weight (CW) field was missing in 31% of the total number of records.

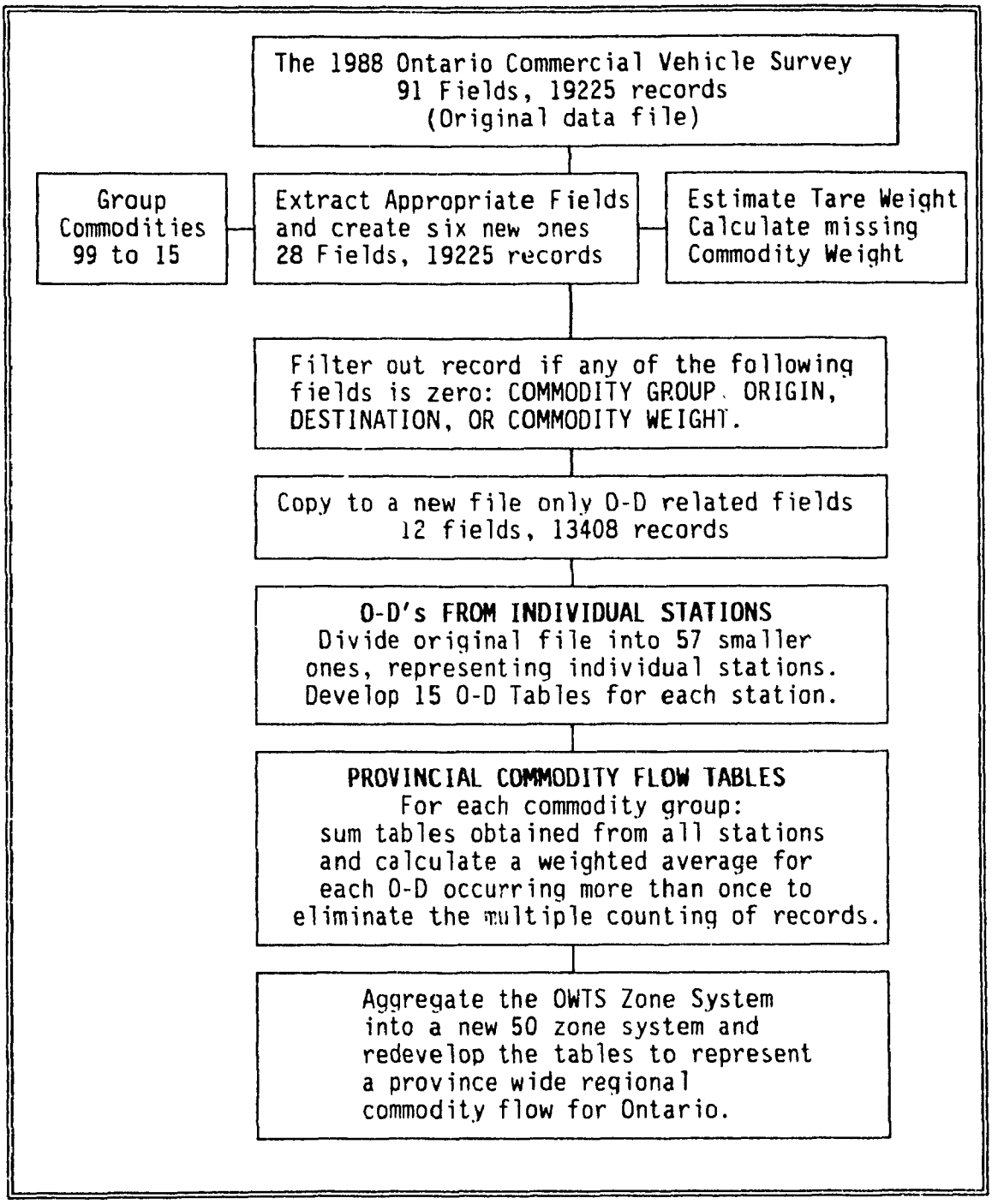


Figure 4.1: The Procedural Flow Chart.

4.2.3 Estimation of missing values of commodity weight

For each record of the missing 31% of CW, it was assumed that the difference between the Gross Vehicular Weight of the truck on the scale (GVW), and the Tare Weight (empty weight) of truck (TW), was equal to the Commodity weight (CW).

|4.1| $$CW = GVW - TW$$

The GVW was considered fairly accurate since it is the actual weight of the truck measured by the surveying staff at the station and it was rarely missing from the file. The tare weight information was not always available from the driver surveyed. In all, 43% of all records did not show a value for the TW. Further analysis of the file indicated that figures provided by drivers about the TW's were not also reliable. Thus, it was decided that the tare weight field had to be estimated prior to the calculation of the commodity weight.

Three variables relating to the trucks characteristics were used to make a reliable estimation of the TW. These variables were: truck configuration, body style, and axle configuration. Crosschecking the payload against the TW, it was considered that the GVW of the truck, when empty, was equal to its TW.

|4.2| $$GVW(\text{empty truck}) = TW$$

Estimating the tare weight (TW) for several types of trucks was obtained in several steps. First, all records showing empty trucks, (V59=1), were selected. Second, for each group of records with the same combination of the above characteristics, an average value for GVW was calculated. Third, using formula |4.2| the TW for truck was obtained. Finally, after having estimated the TW's, commodity weight (CW) was obtained by formula |4.1|.

4.2.4 Aggregation of commodities

Information on commodity flows was obtained from two sources in this survey: sample of waybills photocopied by the crew members, together with information collected directly from drivers hauling commodities without waybills. CommodiHxes were coded to the 2 digit level, according to the Statistics Canada version of the standard commodity classification (SCC) which consists of six major groups and 99 commodities. A list of the Statistics Canada SCC is found in table A.2.

Careful considerations were applied to group the SCC's 99 classes into new 15 distinct groups (k) based on similar characteristics. Four of those groups were formed to emphasize materials which might be considered as hazardous (groups # 11, 12, 13, & 14). The 15 new groups developed in this study are illustrated in table 4.1.

4.2.5 (O - D) Matrices for individual stations

After performing the above alterations to the file, strictly O-D related data was transferred to a new file (T04.DBF) which had 13408 records, each containing 12 fields

only. T04.DBF was then subdivided into 57 smaller files each representing an individual station. Then, for each station, a set of CFT's by commodity weight was developed using individual stations files.

To convert the weight of commodity on board into a 24-hours volume, the weight of commodity shipped between i and j (W_{ij}), expressed in tonnes per day. was expanded by the following formula:

[4.3] $$W_{ij} = CW_{ij} \times EF4$$

where.

W_{ij} weight of commodity shipped between zones i & j. (tonnes per day).

CW_{ij} - commodity weight shipped between zones i & j, (tonnes per shipment).

EF4 = expansion factor # 4 (to convert to daily volumes).

A computer program was written in BASIC to develop the CFTs by commodity group (k) for every individual station.

4.2.6 Elimination of multiple counting of trips

Perhaps the most difficult task of this study was the elimination of the multiple counts of trips from the records. Any trip between the same O-D pair occurring more than once at adjacent stations along the same path was considered to be a multiple count and had to be adjusted.

Building a set of CFT's based on information obtained from various surveying stations across the province is not achieved by simply adding the tonnage of the same commodity moved between the same O-D pair and accumulated from several stations. The application of expansion factors to records of all stations is performed in an effort to obtain uniformity among stations. The objective of the expansion factors is to convert the traffic generated from each surveying location to a per day truck traffic volume. All stations located on the same path have 24-hour traffic volumes. Thus, any commodity group travelling between the same O-D pair could be represented several times depending on the number of stations it is occurring in. This process resulted in multiple counting of trips. In some cases, these trips were reported as many as six times. The process of building a set of CFT's without multiple counted trips required several sequential stages.

First, a set of 15 commodity-group matrices were generated 57 times representing all stations in the survey (in stage 4.5). At this stage, the multiple counting problem had not existed mainly because each station represented its localized daily traffic volume Second, for each commodity group, matrices generated had to be carefully examined and multiple counts were identified. In numerous cases, the daily tonnage moved between many O-D's were over estimated due to the contribution of more than one station situated on the same path. Consider commodity group (k = 4) General Freight, for example, the total daily tonnage moved between the Montreal-Windsor O-D pair was originally reported to be 754 tons (see table 4.2). This total was due the contribution of four different stations along the same path (highway 401). There was 55 tons from station 411 located near Gananoque, 72 tons from station 242 located just east of Oshawa, 598 tons

from station 222 just south west of Toronto, and 29 tons from station 321 on the eastern edge of Windsor. Logically, the total daily tonnage for any commodity group moved between any O-D pair must not exceed its tonnage produced from any of the participating stations. Third, to come to a close estimation, the concept of weighted average was then introduced to be applied to all O-D pairs in question. As the name implies, the weighted average method is used to calculate a more meaningful average. The formula took into consideration all the participating stations and assigned to each station its share of daily tonnage based on its degree of reliability. A station with larger number of records was assumed to be more reliable and thus contributed more to the results.

The weighted average formula is expressed mathematically as follows:

$$W_{ij} = \frac{\sum_n (w_{ij})_n \times (NOR)_n}{\sum_n (NOR)_n} \qquad |4.4|$$

Where:

W_{ij} = Weighted average of commodity moved between zones i and j in tons per day.

$(w_{ij})_n$ = Weight of commodity moved between zones i and j from station (n).

$(NOR)_n$ = Number of records for station (n).

Subscript n is the number of participating stations.

Applying formula 4.4 to values shown in table 4.2, a new estimated average daily tonnage for group # 4, from zone 195 to zone 1 (Montreal/Windsor), ($W_{195,1}$), was calculated as follows:

$$W_{195,1} = \frac{598(1707) + 72(284) + 29(284) + 55(1220)}{3495} = 320\ tonnes.$$

This example demonstrates the significance of the weighted average concept. Comparing the new estimated weighted average (320 tonnes) to the total tonnage reported from all stations in the original file (754 tonnes), a reduction of 434 tonnes (57%) was obtained. Among all records there were a total of 1156 (O-D) pairs that occurred more than once and each one of them had to be treated as reported. Most of the multiple counts occurred from stations situated on the three major highways of the province; 401, QEW, 400/11. There were six stations on highway 401, three stations on QEW west bound and two stations on its east bound, four stations on each bound of the 400/11 corridor. Fewer incidents of multiple counts were reported from stations located along the 417/17 corridor.

4.2.7 Province-wide commodity flow tables (CFT's)

After taking care of the multiple counting problem, development of CFTs became rather simple. A set of tables (15) representing all groups was obtained.

A Commodity flow table for any group is an O-D matrix. It is represented by origin zones (i) destination zones (j) and commodity flows given by commodity weight (W_{ij}). The sum of W_{ij} in a given row (i) represents the production P_i for the origin zone (i). The sum of W_{ij} in a given column (j) represents the consumption C_j for the destination zone (j). Each table indicates the daily tonnage of its respective commodity

group shipped between the O-D pairs (ij's). The dimension of each table is directly related to the number of existing (O-D) pairs. The maximum dimension could reach 284x284 since all trips were coded to the OWTS. This zone system contains 284 zones covering Ontario and the rest of North America.

4.3 CFTs FOR AGGREGATED ZONES

Origins and destinations of all trips were coded into two systems of zones. The Toronto Area Regional Municipal System (TARMS) with 3037 zones, and the Ontario Wide Travel Simulation (OWTS) with 284 zones. Both zone systems were too large to handle especially for generating the tables. The OWTS zone system was aggregated to a new 50 zone system. The 184 zone in the province of Ontario was grouped into 35 zones, 30 zones covering southern Ontario and 5 zones covering the northern regions. Nine zones covering Quebec and Eastern Canada were grouped into 5 zones and the 9 zones for western Canada were grouped to 2 zones, and finally the 75 U.S zones were aggregated to 8 zones.

The new aggregated zone system, shown in table A.3, took into consideration the geographical and natural border lines; such as rivers, lakes, rail lines, highways, and of course national and international border lines. Special attention was drawn to grouping of zones around the major urban areas in the province. Efforts were made as to make those urban areas the centroids of their respective zones. Around the Metro Toronto area however, the new grouping remained as coded in the OWTS zone system (from zone 9

to zone 16). This is due to population density and heavy economical activities in and around this area. The new developed zone system was aggregated to the same level of (Counties/ Districts/Regional Municipalities) system adopted by the government of Ontario for population statistics, (shown in Table A.5).

A new set of CFTs is developed to represent the commodity flow on regional bases in Ontario. Origins and destinations of all trips were coded to the new zone aggregation system when developing the new tables. The extraction of the intercity commodity flow tables, later in this report, is based on these tables.

An example of the new O-D tables is provided in table 4.3. All existing origins (i's) are shown as columns but only the first 10 destinations (j = 1 to 10) are shown due to lack of space. The remaining destinations, zones 11 to 50, are summed in one column just before the total (in the right hand side of the table). The rest of these tables are listed in A.4.

4.4 DISCUSSION OF RESULTS

Information obtained from this study about freight traffic is useful for a number of reasons. First, it outlines the nature and type of commodity transported in, to, or from Ontario which is a basic component of the province's economy. Second, It identifies flows of commodities whose density and weight characteristics have direct implications on the pavements and bridges of the province and in some cases the environment. Third,

it provides helpful information about major commodities transported within the province and identifies their origins and destinations. Fourth, it helps in continuing the trend of information on this particular matter for the future.

4.4.1 Characteristics of commodities shipped within Ontario

In 1988, over 45,000 daily truck shipments were believed to have occurred on Ontario's highway network. The average weight per shipment is estimated at 19 tonnes. This 45,000 truck trips resulted into a total weight of approximately 853,000 tonnes of all types of commodities. Table 4.4 outlines the average weight per shipment by commodity group. Crude materials and petroleum & coal products were the top two in the rank. Both groups are bulk materials and are normally moved in large quantities. Table 4.5 illustrates the rank of commodity groups in terms of their number of daily shipments that occurred in 1988. The top five groups combined represent over 64% of total daily shipments. General freight had the highest daily trips within Ontario. This is due to the fact that the group combines the largest number of commodity classes (36 out of 99). The ranking of the groups in terms of their weights is illustrated in table 4.6. The first five groups combined represented 62% of the total tonnage of all commodities shipped per day. Forest products ranked first averaging 23 tonnes per shipment.

Table 4.1 Commodity groups

GROUP #	GROUP NAME
01	Live animals
02	Foodstuff (perishables)
03	Foodstuffs (non-perishables)
04	General freight
05	Metal products
06	Non-metal products
07	Fabricated products
08	Crude materials (except petroleum)
09	Forest products
10	Heavy machinery
11	Crude coal & petroleum
12	Petroleum & coal products
13	Chemical & materials products
14	Arms & explosives
15	Others

Table 4.2: Original Trips between zones 195 & 1.

Record=	NCG	V31	V33	V40	V41	V57B	$(w_{ij})_n$	(NOR)n
221	4	195	1	29.64	222	11275	334.0	1707
1500	4	195	1	9.36	222	28168	264.0	1707
7979	4	195	1	13.00	242	5547	72.0	284
8736	4	195	1	10.17	321	2878	29.0	284
55	4	195	1	1.14	411	3810	3.6	1220
10499	4	195	1	4.28	411	12002	51.4	1220
TOTAL							754.0	3495

Legend:

NCG = New Commodity Group.
V31 = Origin of trip.
V33 = Destination of trip.
V40 = Expansion Factor (e4).
V41 = Survey station.
V57B = Commodity weight.
$(w_{ij})_n$ = weight of commodity group (4) moved between zones 195 & 1.
$(NOR)_n$ = Number of records for station (n).

Table 4.3 (O-D) table for General Freight (group # 4)

O D	ZN01	ZN02	ZN03	ZN04	ZN05	ZN06	ZN07	ZN08	ZN09	ZN10	(11,50)	TOTAL
ZN01	8	339	37	0	162	0	376	78	62	0	2193	3255
ZN02	0	0	0	0	0	0	0	0	0	0	653	653
ZN03	0	139	0	0	30	0	137	63	0	0	2517	2886
ZN04	82	0	0	32	123	0	6	25	0	0	1567	1835
ZN05	371	0	101	46	0	0	87	213	0	86	3140	4044
ZN06	0	0	0	0	0	0	7	0	0	0	11	18
ZN07	102	0	328	2	348	0	179	180	0	0	6131	7270
ZN08	398	23	37	67	100	0	332	159	236	63	2834	4249
ZN09	36	0	0	0	397	0	31	331	21	17	2601	3434
ZN10	0	0	0	0	0	0	0	49	0	0	680	729
ZN11	0	0	83	0	18	0	0	86	0	173	1028	1388
ZN12	562	59	77	51	594	0	723	131	157	35	3422	5811
ZN13	225	33	98	0	201	0	381	194	19	0	2726	3877
ZN14	404	0	176	59	399	39	604	550	0	0	5033	7264
ZN15	0	77	6	0	109	0	194	21	0	0	1636	2043
ZN16	123	0	40	0	138	0	251	16	0	0	1150	1718
ZN17	90	0	0	20	291	0	138	268	101	0	4102	5010
ZN18	0	0	4	0	0	0	49	23	0	0	403	479
ZN19	188	297	248	177	167	0	399	636	29	18	3608	5767
ZN20	741	11	117	0	115	0	553	268	0	0	1571	3376
ZN21	0	0	0	0	2	0	0	55	0	0	332	389
ZN22	24	0	0	0	128	0	151	0	0	0	554	857
ZN23	0	0	0	0	157	0	0	0	271	21	532	981
ZN24	36	0	0	0	0	0	157	0	105	0	2035	2333
ZN25	1	0	0	0	9	0	0	0	0	0	1387	1397
ZN26	135	0	0	0	0	0	49	6	260	0	1415	1865
ZN27	0	0	0	0	16	22	41	0	22	0	456	557
ZN28	0	0	0	0	0	0	0	0	0	0	467	467
ZN29	0	0	0	0	0	0	0	0	142	0	166	308
ZN30	0	0	0	0	46	0	5	185	5	0	292	533
ZN31	0	0	0	0	102	0	0	65	303	0	1468	1938
ZN32	0	0	0	0	15	0	0	0	0	0	438	453
ZN33	0	0	0	0	0	0	0	0	0	0	965	965
ZN34	0	0	0	0	19	0	0	0	0	0	664	683
ZN35	0	0	0	0	9	0	0	0	0	0	377	386
ZN36	28	0	25	0	38	0	130	0	0	0	966	1187
ZN38	320	89	87	25	99	0	206	174	164	17	5522	6703
ZN40	0	0	1	0	0	0	33	0	0	0	767	801
ZN41	28	0	0	0	21	0	105	82	84	0	1595	1915
ZN42	0	0	0	17	58	0	65	21	224	0	1250	1635
ZN43	0	0	0	63	22	0	96	0	0	0	2025	2206
ZN45	17	0	0	49	102	0	51	255	0	4	2343	2821
ZN46	87	313	65	39	82	0	280	119	45	0	2857	3887
ZN47	0	128	88	42	71	0	779	83	141	0	5198	6530
ZN49	0	156	18	70	6	0	0	41	0	0	1089	1380
ZN50	0	0	1	0	0	0	0	0	0	0	764	765
TOTAL	4006	1664	1637	759	4194	61	6595	4377	2391	434	82930	109048

Table 4.4 Average weight per shipment

Group name	Average weight*
Live animals	14.0
Foodstuffs (perishables)	17.0
Foodstuffs (non-perishables)	20.0
General freight	11.0
Metal products	22.0
Non-metal products	25.0
Fabricated products	12.5
Crude materials (except petroleum)	39.0
Forest products	23.0
Heavy machinery	13.3
Crude coal & petroleum products	21.0
Petroleum & coal products	28.6
Chemicals & materials products	18.4
Arms & Explosives	6.4
Others	13.4

* expressed in metric tonnes.

Table 4.5 Estimated daily shipments by commodity group

Commodity Group(NCG)	Estimated # of shipments	Percentage of total shipments	Rank
General freight	9,864	21.52	1
Metal products	5,807	12.67	2
Forest products	5,794	12.64	3
Foodstuffs (perishables)	4,728	10.32	4
Chemicals & materials products	3,217	7.01	5
Heavy machinery	3,184	6.95	6
Foodstuffs (non-perishables)	2,786	6.08	7
Others	2,700	5.89	8
Non-metal products	2,558	5.58	9
Crude materials(except petroleum)	2,033	4.43	10
Petroleum & coal products	1,449	3.16	11
Fabricated products	924	2.01	12
Live animals*	398	.87	13
Crude coal & petroleum*	372	.81	14
Arms & explosives*	17	.00	15
TOTAL	45,831	100%	

* Obtained from a sample size less than 100 records.
- Percentage may not add to 100 due to rounding.

Table 4.6 Estimated daily tonnages by commodity group

Commodity Group	Estimated daily tonnage	Percentage of total tonnage	Rank
Forest products	132,979	15.60	1
Metal products	126,503	14.84	2
General freight	109,048	12.79	3
Foodstuffs (perishables)	80,059	9.40	4
Crude materials(except petroleum)	79,949	9.37	5
Non-metal products	63,749	7.50	6
Chemicals & materials products	59,249	6.95	7
Foodstuffs (non-perishables)	55,975	6.56	8
Heavy machinery	42,417	4.97	9
Petroleum & coal products	41,411	4.86	10
Others	36,178	4.20	11
Fabricated products	11,572	1.36	12
Crude coal & petroleum*	7,812	.91	13
Live animals*	5,571	.65	14
Arms & explosives*	109	.00	15
TOTAL	852,588	100%	

* Obtained from a sample size less than 100 records.
- Percentage may not add to 100 due to rounding.

CHAPTER 5

DEVELOPMENT OF MODELS

5.1 THE FORECASTING FRAMEWORK

A forecasting framework is developed and illustrated in Figure 5.1. The sequence of the activities involved in the framework is explained in detail in the following steps.

1) The most feasible way of providing a good profile of the nature of commodity flows in a proposed area of study is by undertaking commodity O-D surveys. Such surveys are normally based on three major components: (A) The demand and supply of commodities will generate a flow from points of origins (sources) to points of destinations (sinks). (B) These flows will have to be shipped through a certain network (highways) which serve as a link between the supply and the demand points. (C) The study area must have a zonal system so that demographic data such as population is available for the zones.

2) O-D type survey, such as the one conducted by the MTO,is necessary to gather information on all aspects of the flow of commodities in the province.

3) Commodity flow tables (matrices) are then developed from the survey using information such as origin, destination, commodity type and weight as described in chapter 4.

4) Using the developed tables as base year commodity flows and developing appropriate growth factors, a Fratar type forecasting model is proposed to interpolate the base year flow into a horizon year; normally 5 to 6 years to the future.

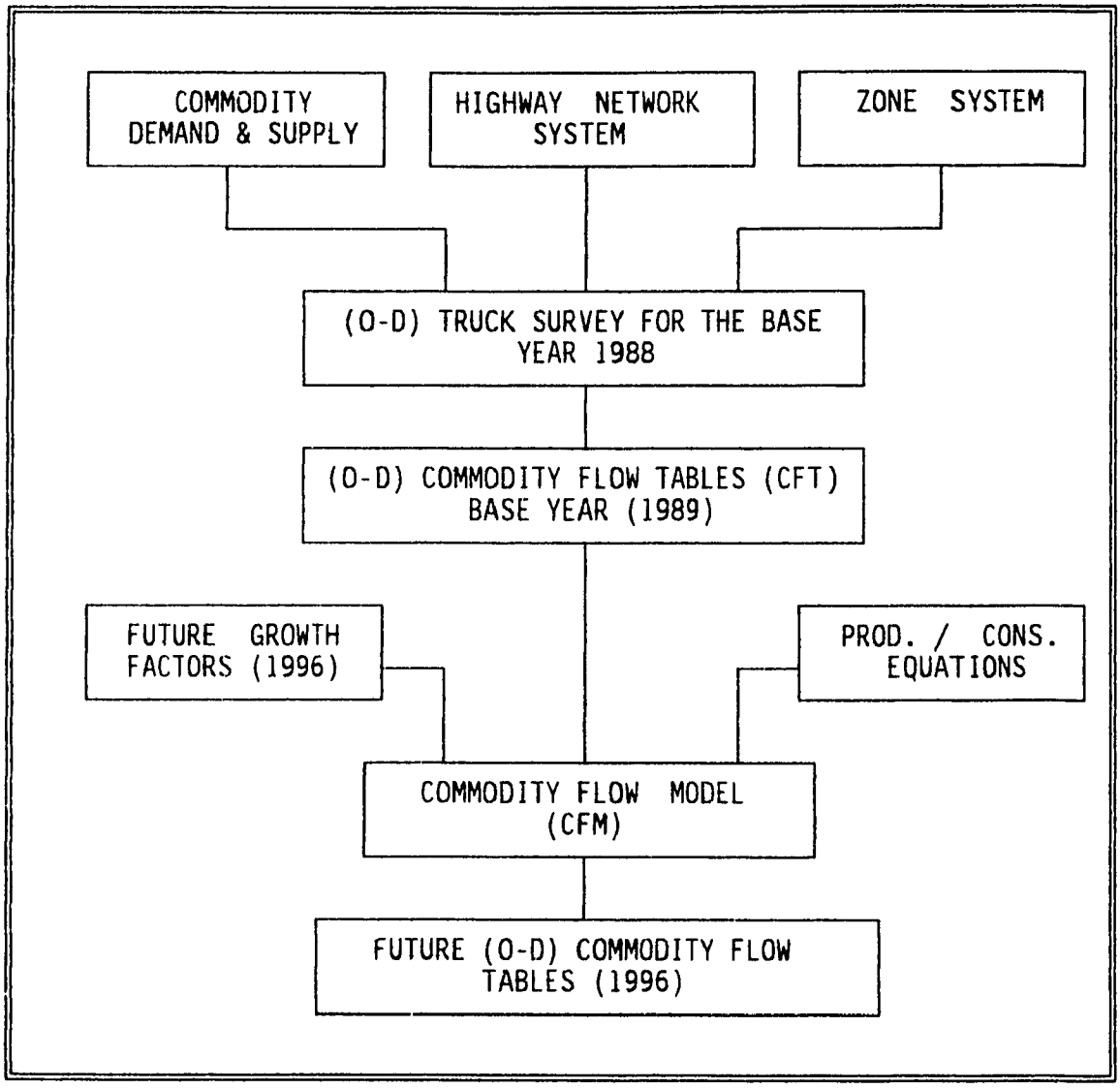


Figure 5.1 The Forecasting Framework.

Following the sequence of this framework, a commodity flow Model (CFM) is developed based on *Fratar Growth Factor Method* to forecast future commodity flows in Ontario.

5.2 FORMULATION OF THE CFM

The *Fratar Growth Factor Method* is considered as one of the original approaches of forecasting interzonal trip distributions. This technique has been used before in forecasting the distribution of commodity flows [17]. Formulation for *Fratar Method*, shown in Hutchinson (1974), is the basis for the model developed here. The commodity flow model (CFM) is expressed in mathematical terms as follows:

[5.1]

$$W_{ij}^{h} = W_{ij}^{b} f_i f_j \frac{(L_i + L_j)}{2}$$

Where:

W^h_{ij} = weight of commodity flow between the zones i and j in the horizon (future) year.

W^b_{ij} = weight of commodity flow between the zones i and j in the base year.

f_i and f_j are growth factors of zones i and j respectively.

L_i and L_j are locational factors.

[5.2] $f_i = P^h_i / P^b_i$ and $f_j = P^h_j / P^b_j$

$$L_i = P_i^b / \Sigma_j W_{ij}^b f_j$$

[5.3]

$$L_j = C_j^b / \Sigma_i W_{ij}^b f_i$$

[5.4]

$$P_i^h = \Sigma_j W_{ij}^h \, , \, , \, C_j^h = \Sigma_i W_{ij}^h$$

P_i = Total production of commodity in zone i.

C_j = Total consumption of commodity in zone j.

Superscripts b and h are for base and horizon years.

The fundamental assumption in this model is that future commodity flows are proportional to base year commodity flows, modified by growth factors. The locational factors (L_i , L_j) are reciprocals of the average attracting forces of all surrounding zones. An iterative procedure is required to satisfy the constraints stated in formula [5.4].

5.3 PREPARATION FOR THE CFM

Two sets of data are essential when using the CFM for forecasting freight flows. (1) A set of growth factors based on growth of each zone or city in terms of economic development and population growth, and (2) commodity flow tables for the base year. In this research, reliable O-D tables are developed from a truck O-D survey, and unpublished census and projected population data is used to derive growth factors of selected cities.

A. Growth Factors:

Growth factors are dimensionless figures which indicate the rate of growth of zones between the base and the horizon years. Since commodities are of different types, so are the growth factors. Different commodities are related to different growth factors. Unpublished data about population in Ontario, aggregated to the level of county/district/regional municipality were obtained for the base year 1989 along with projected figures for 1996, [3]. The population figures of the 49 zone system are shown in table A.5. Population of zones for the new (50 x 50) zone system developed in this study were computed using these population statistics. Growth of population of a zone from base year 1989 to forecast year 1996, expressed as a ratio, is called the population growth factor. Population of the zone in 1996 is divided by the population of the same zone in 1989 gives the growth factor. Three commodity groups, namely Foodstuffs (#2, and # 3) and General freight (#4), were chosen for forecasting since they were considered as population based groups.

B. Origin - Destination matrices

A commodity flow table (CFT) for any given commodity group (k) represents an Origin - Destination matrix with its rows (i) as origins and its columns (j) as destinations and commodity flow given by commodity weight, (W_{ij}). The total of commodity consumption (C_i) for any given zone is represented by its last row. Likewise, the total of commodity production (P_i) for any given zone is represented by its last column. CFTS for 15 commodity groups, like the one described here, were generated earlier in this study representing the base year flows.

C. Production and consumption equations

Regression analysis is a tool used to predict values of one or more response(s). The dependent variable is predicted from either a single or a set of predictors (independent variables) [12]. Regression models are widely used in transportation planning studies.

In this research, regression models were developed to predict the rate of production or consumption of commodity for the three chosen groups (2, 3, & 4). Using production as a dependent variable and population (1989) as an independent variable, the commodity flow for any given zone was predicted. This analysis was performed on each of the above groups. Similar regression analysis was done for consumption versus population of zones. For example, the prediction equations for general freight (#4) are listed in figure 5.2.

[5.5]	Production (P) = 206 + 8.57 population R^2 = 88%, S_e = 2200
[5.6]	Consumption (C) = 685 + 7.61 population R^2 = 89%, S_e = 1808

Figure 5.2 Production and consumption equations for group 4.

Results in figure 5.2 indicate that there exists a strong relationship between the dependent and the independent variables; signifying that the amounts of productions and consumptions of the selected commodity groups can be predicted by population.

The statistical quality of the developed equations is considered high. The values of R^2 for both equations are both over 85%. The relatively high values of the S_e's (2200, & 1808 tonnes) are associated with the fact that key estimations were performed relating to the amount of daily tonnage when developing the CFTs. Similar results were obtained for the remaining two groups. foodstuffs (2, & 3). Equations with selected statistical indicators are shown in table 5.1.

5.4 APPLICATION OF THE MODEL

To represent an intercity commodity flow in Ontario, twelve major urban centers in the province were selected. New commodity flow tables were extracted from the obtained CFTs (50 x 50). These cities along with their total production and consumption for the three chosen groups are give in table 5.2. Population of 1989 is also available in this table.

In addition to the cities listed in the above table, only Montreal was included from outside Ontario since its a major trading partner with the province. A total of three intercity O-D tables were obtained representing three commodity groups (2, 3, & 4). These O-D tables represent a form of Fratar type model for base year 1988. Population growth factors are derived from projected population for 1996 and the base year 1989 population.

Since the production and consumption of a zone are closely related to its population, the growth factors for the production and consumption are assumed to be the same as population growth factors. Another assumption was made here that the population change between the years 1988 and 1989 is insignificant so that the population figures of 1989 can be used on the tables of the base year 1988.

The application of the developed CFM on the anticipated base year commodity flow tables (1988); using growth factors of table 5.3 have resulted in the generation of three 1996 commodity flow tables for the anticipated commodity groups. CFTs of the base year and the forecast year for general freight (#4) is shown in tables 5.4 and 5.5 respectively while the rest of the obtained tables are given in tables A.6 & A.7.

A computer program in BASIC was written to interpolate the base year O-D matrices into a future year as required by formula 5.1. Then the iterative procedure is applied on the table (matrices) and its corresponding growth factors to satisfy the constraints listed in formulas 5.4 or until all the growth factors converge to a value of 1.00. The resulting matrix is the forecast year commodity flow.

The same forecasting procedure can be extended to include other commodity groups provided that appropriate growth factors are available.

5.5 DISCUSSION OF THE CFM AND RESULTS

Every developed model is associated, to a certain degree with advantages and disadvantages. The overall performance of the CFM developed here depends on the quality of the O-D tables and their anticipated zones growth factors. Quality O-D commodity flow tables table are developed in chapter four and statistically credible growth factors are establised in this chapter. Thus, the quality of the obtained results can be considered good.

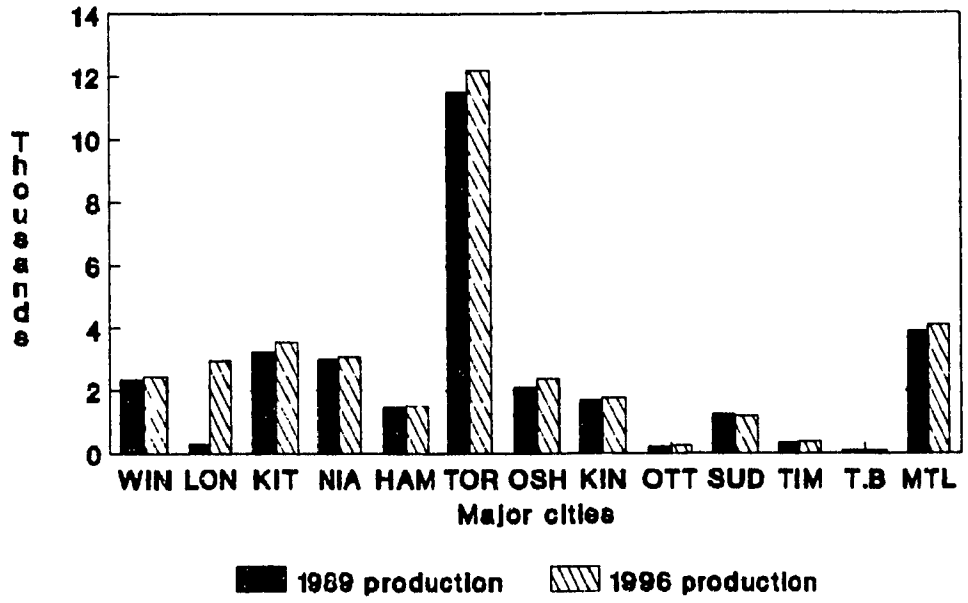
Since this model is a *Fratar* based model, its strength and advantages can be outlined as follows; (1) the model is well stated, simple and easy to understand and apply. (2) it requires no calibration process, it uses an iterative procedure instead. (3) no distance parametres are involved in this approach. (4) this technique is very useful in forecasting CFTs over a relatively short period of time (usually 4 to 6 years).

A number of North American highway departments use the *Fratar* method in their planning studies [10]. Its principle deficiency however, is its inability to account adequately for major economic changes and interzonal activities, since it does not contain explicit terms relating to any form of hauling cost, time, or other travel impedances.

5.5.1 Comparison between base and forecast years

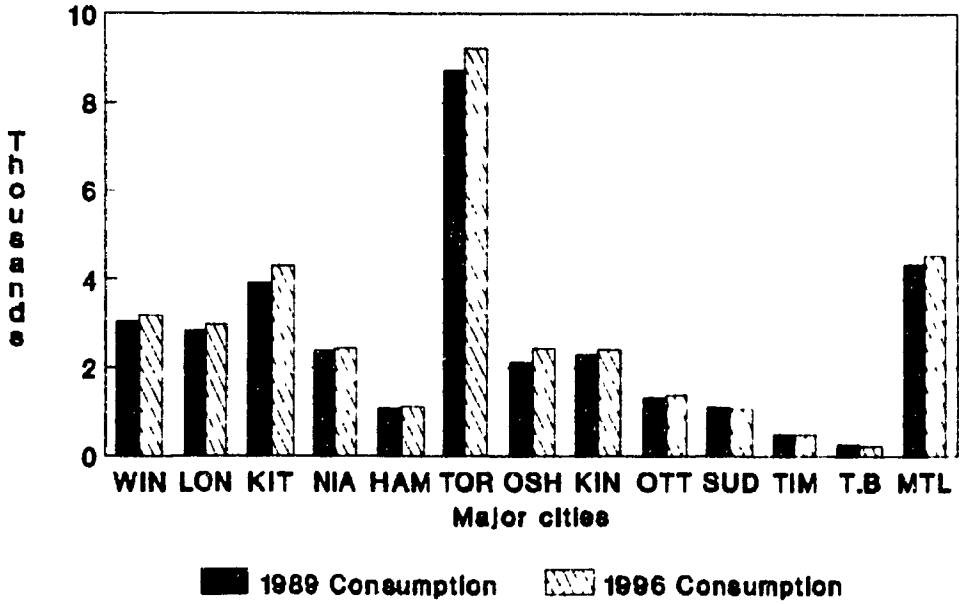
One of the advantages of the developed O-D tables is that they measure the amount of commodity produced or consumed by any given city in Ontario for any given commodity group. The amount of general freight produced by all 13 other cities for base and future years (1988 and 1996) is shown in figure 5.3. Analysis of this figure suggests that Toronto alone accounted for approximately 34% of the total production of the intercity flows in Ontario in 1989. Montreal ranks a distant second accounting for 11.5% of the total production. Analysis of the 1996 production figures suggested as expected, that the growth of production in every city is proportional to its growth rate (factor). The amount of consumption of general freight by the 13 cities is given in figure 5.4. Similar analysis was conducted for the consumption of general freight. Again Toronto alone represented about 26% of the total consumption of this group. Montreal had the second largest share (13%) followed by Kitchener (12%).

Figure 5.3
Production of General Freight (#4).



Expressed in tonnes per day.

Figure 5.4
Consumption of General Freight (#4)



Expressed in tonnes per day.

Table 5.1 Production and Consumption equations of selected groups.

		EQUATION	R^2	S_e
Group	Production	- 87 + 6.96 POP89	80.3%	2404
# 2	Consumption	- 1237 + 9.76 POP89	96.3%	1338
Group	Production	- 254 + 5.57 POP89	85.3%	1702
# 3	Consumption	145 + 5.08 POP89	89.3%	1227
Group	Production	206 + 8.57 POP89	88.1%	2200
# 4	Consumption	685 + 7.61 POP89	89.6%	180

Table 5.2 Production and Consumption of commodity groups[1] 2, 3, & 4.

	Group # 2		Group # 3		Group # 4		Population [2]
City	prod.	cons.	prod.	cons.	prod.	cons.	in 000's
Windsor	7017	1933	225	2227	3255	4006	327.8
London	3380	3332	5088	4022	4044	4194	349.2
Kitchener	5123	3802	2498	4011	7270	6595	351.0
Niagara	3125	2250	3352	2018	4249	4377	377.2
Hamilton	985	2870	1020	1851	3434	2391	433.3
Metro Toronto	18281	24380	15263	13237	22831	20684	2561.7
Oshawa & East.	233	485	269	160	3376	3725	374.9
Kingston	1134	724	1377	547	2333	2798	120.8
Ottawa Carlton	665	2228	556	2622	557	1932	650.3
Sudbury & N.Bay	713	1223	490	231	1938	1747	264.1
Timmins	110	562	15	621	453	974	93.8
Thunder Bay	383	538	376	978	693	918	159.0

1. Figures are expressed in tonnes per day.
2. Population figures of 1989

Table 5.3 1996 Population growth factors of selected cities

CITY NAME	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.
GROWTH FACTOR	1.05	1.06	1.09	1.03	1.05	1.06	1.14	1.05	1.06	0.98	1.02	0.97	1.05

Table 5.4 Base year (1989) Commodity flow for General Freight (#4)

	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.	TOTAL
WINDSOR	0	162	376	78	62	983	404	94	0	0	0	0	183	2342
LONDON	371	0	87	213	0	1612	224	0	0	31	72	0	190	280
KITCHENER	102	348	0	180	0	1831	327	73	70	0	13	7	285	3236
NIAGARA	398	100	332	0	236	1387	346	0	0	0	0	0	178	2977
HAMILTON	36	397	31	331	0	164	239	0	32	34	0	7	194	1465
METRO TORONTO	1314	1459	2153	1047	176	0	369	1367	630	987	248	107	1653	11510
OSHAWA	741	115	553	268	0	0	0	0	22	0	0	0	379	2078
KINGSTON	36	0	157	0	105	246	9	0	55	0	0	0	1069	1677
OTTAWA	0	16	41	0	22	87	24	23	0	0	0	0	0	213
SUDBURY	0	102	0	65	303	521	0	0	0	0	32	8	183	1215
TIMMINS	0	15	0	0	0	215	0	0	0	15	0	97	0	342
T. BAY	0	19	0	0	0	48	0	0	0	0	0	0	9	76
MONTREAL	32	99	206	174	164	1630	179	728	502	41	132	24	0	3911
TOTAL	3030	2832	3936	2356	1068	8724	2121	2285	1311	1108	497	250	4324	33842

Table 5.5 Forecast year (1996) Commodity flow for General Freight (#4)

	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.	TOTAL
WINDSOR	0	166	396	77	65	1027	453	95	0	0	0	0	187	2467
LONDON	380	0	94	215	0	1721	257	0	0	30	73	0	198	2968
KITCHENER	108	376	0	187	0	2012	386	78	76	0	14	7	306	3549
NIAGARA	392	101	344	0	244	1424	382	0	0	0	0	0	178	3065
HAMILTON	37	413	33	332	0	174	272	0	33	33	0	7	200	1532
METRO TORONTO	1372	1558	2361	1078	192	0	431	1444	673	973	257	106	1753	12198
OSHAWA	832	132	652	297	0	0	0	0	25	0	0	0	432	2371
KINGSTON	7	0	168	0	112	261	10	0	57	0	0	0	1108	1754
OTTAWA	0	17	44	0	23	92	27	24	0	0	0	0	0	226
SUDBURY	0	99	0	61	302	517	0	0	0	0	30	7	178	1195
TIMMINS	0	16	0	0	0	227	0	0	0	14	0	93	0	350
T. BAY	0	18	0	0	0	47	0	0	0	0	0	0	9	74
MONTREAL	33	103	221	175	175	1733	204	752	524	40	134	23	0	4118
TOTAL	3191	2999	4313	2422	1113	9235	2423	2393	1388	1090	508	243	4549	35867

CHAPTER 6

COMPUTER PROGRAMS

6.1 INTRODUCTION

The original data file received from the MTO had an extremely large size, and it required a lot of memory storage space. A total of 9.8 mega bites of information was transferred on seven high density diskettes. The file was installed on the hard disk of a personal computer.

Two different approaches of computer programming were applied in pursuing the work objective. The software dBASE III+, which is a data management software, was used initially to process, clean, and sort the data to the desired form. Then, a set of BASIC programs were written to achieve special goals and objectives.

6.2 DEVELOPMENT OF CFTS; THE ALGORITHMIC APPROACH

The theoretical multi-step procedure had to be supported by a computational algorithm in which both of the pertinent languages were used interactively.

6.2.1 dBASEIII+ Programming

This software was mainly used for data processing, i.e, to create new files, append information from one file to another, and sort the fields in any desired way. A considerable amount of data processing and analyses was performed using this software.

At the initial stages of the work, dBASE was used to extract only relevant information out of the original file and copy it to a smaller file (3 megabytes). This new file (T05.DBF) contained only 22 fields out of the original 91. Six new fields were then created and added to T05.DBF to be filled at a later stage, these new fields were:

V51B = reserved for the new estimated tare weights of the trucks.

V55B = a revised copy of V55, the commodity types fields.

V57b = reserved for estimated commodity weights, (when missing).

NCG = reserved for New Commodity Groups, (NCG).

NZO = reserved for zonal aggregation, origin, (New Zone Origin).

NZD = reserved for zonal aggregation,destination,(New Zone Destination).

The process of estimating the field V51B was explained earlier in this report, (chapter 4). A program in Basic was developed to compute the tare weight based on the GVW of trucks. The program filters the records when the truck was reported empty, V51 = 1, (no payload on board). Then it identifies all records with similar combination of the following three fields: (1) truck configuration, (2) body style, (3) axle

configuration. An average value of the GVW is calculated for records of the same combination. The new obtained tare weights were then copied to a transitional DBF file to be copied into V51B in T05.DBF.

The field V55 in the original data file contained two different types of variables, a letter variable (A) for commodity class Live Animals and numeric variables for the rest of the classes. This has caused some inconvenience when using dBASEIII+. Thus the field V55B was created with a uniform structure (all fields are of numeric type) and all data in V55 was transferred to it changing only the character A for 100.

The commodity weight field V57 was not full in the original data file. In an attempt to keep the original data unchanged, a new field V57B was created to keep not only a copy of the existing values of V57 but also the estimated weights when missing. The procedures of estimating the missing commodity weights were also addressed earlier.

A new DBF file (COMGRP) was created to handle the commodity grouping process. Existing commodity classes and proposed commodity groups were compiled into one file then data was appended from this file to (T05.DBF). Likewise, the fields NZO and NZD were filled in a similar procedure.

After filling all the new fields in (T05.DBF), a new file (T04.DBF) was then created containing 12 fields namely; Record Number (V1), Origin (V31), Destination (V33), Expansion Factor # 4 (V40), Station Number (V41), reported Commodity Weight

Commodity Weight (V57B), New Commodity Group (NCG), New Zone Origin (NZO) and New Zone Destination (NZD). This file represented in essence an O-D commodity survey.

In total, eight dBASE programs were written which led to the production of four DBF files: 1- (T05.DBF), 2- (MXAVG.DBF), 3- (T04.DBF), 4- and the final data base file (AVGWT.DBF), which contained 7763 records after the elimination of the repeating records (multiple counts). Each record lists the following fields: Commodity group (C), Origin (O), Destinatin (D), Tonnage (T) per day, survey Station (S), New Origin (NO), and New Destination (ND). The following two tables illustrate sample of the files T04.DBF, and the final data base file AVGWT.DBF.

6.2.2 BASIC programming

In all, 12 programs were written in BASIC (language) to achieve different objectives. The first program was written to estimate the tare weights of the trucks which led to the computation of the missing values of the commodity weights. The second program was used to separate the file into 57 smaller "*TXT*" files, each representing an individual station. The third and most comprehensive program was written to eliminate the multiple counting, by calculating the weighted average of the repeated (O-D) pairs. The output of this program is a *TXT* file called (AVGWT.TXT) signifying the concept of average weight. This file was copied later to be the final DBF file (AVGWT.DBF). The rest of the programs (HEADER.BAS, MXPSTN.BAS) were written to develop the O-D tables. The last two programs were slightly modified in each run to achieve different

purposes. Each run had a serial name such as (MXPSTN.BAS), (MX2PSTN.BAS), (HEADER.BAS) and (HEADER2.BAS). They were used to develop the tables at three different stages. Many text files were created in the process to be used as inputs or as outputs for both languages.

6.3 THE STRUCTURED PROGRAM "MATRIX"

The nineteen programs, eleven Basic and eight dBASE (listed in the above sections), were combined to form a structured program called MATRIX. In this program, the individual programs are called in the right order. The program allows the user to execute the work described above in ten separate stages through the use of its menu. The menu of this program is shown in Figure 6.1. The program includes ten executable steps. Any step of the work can be executed separately, simply by pressing its corresponding number from the menu. A detailed description of every step is provided later. A copy of MATRIX is provided in Appendix B while the flow chart is shown at the end of this chapter.

Step one of the menu is the creation of the file (T05.DBF) and takes up to 45 minutes of execution time. It appends relevant fields of information from the original data file. Step two, which takes around 30 minutes of execution time, creates six new fields and filled them with required information (explained previously). It will then call other programs to create new files such as; MXAVG.DBF, T04.DBF and other sorted copies of it. This stage will also estimate the tare weights and commodity weights. Step three

will create two files for each station, one to keep the (O-D) information in it and the other to identify and memorize the existing (O-D) pairs. Step four is to print the CFTs using files obtained from step three. Step five eliminates the multiple counts from records using the previously described procedure. Step six prints the clean tables obtained from individual stations after removing the multiple counts. Step seven prints the province wide CFT's. Step eight will group the OWTS zone system into a new 50 zone system and re-identify the existing O-D pairs based on the new zone system. Step nine re-prints the tables (15) for the grouped zones. And finally, step 0 is to exit the user from the program.

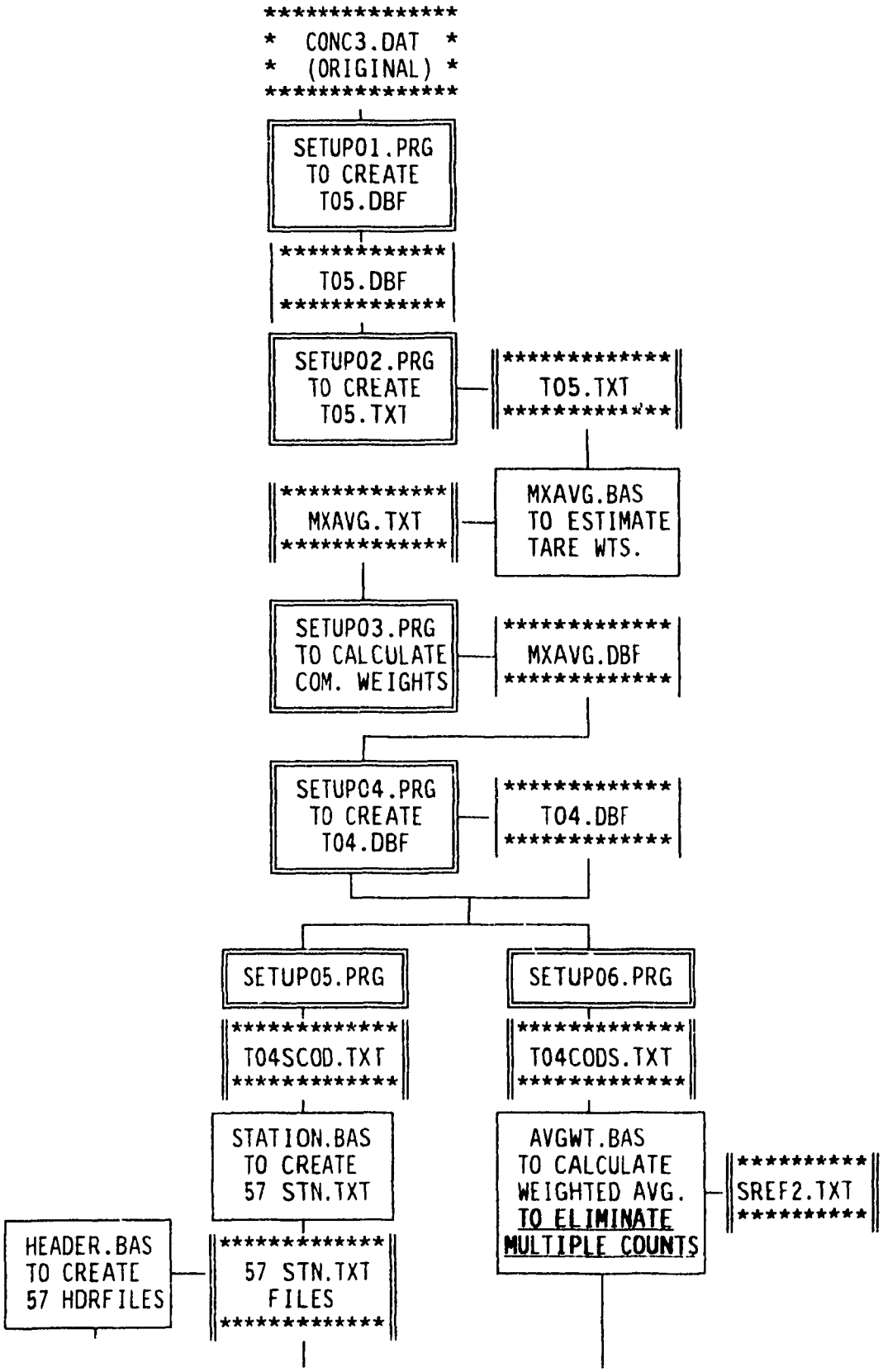
```
MATRIX, A SEQUENTIAL PROCESS TO DEVELOP COMMODITY FLOW
TABLES

1> Create the file T05.DBF
2> Create the fields: V55B, NCG, V51B, & V57B
   Create the files : MXAVG.DBF, T04.DBF, T04SCOD &
   T04CODS.TXT
3> Create a 'TXT' and a 'HDR' for every station
   and/or for all stations combined
4> PRINT O/D commodity tables for any station
   and/or for all stations combined
5> Eliminate multiple counts from the tables
6> PRINT cleaned stations' commodity tables
7> PRINT the sum of cleaned tables
8> Group the OWTS zone system to a new 50 zone system
9> PRINT O/D's for new zone system (50 x 50)
0> END
```

Figure 6.1 The menu of MATRIX

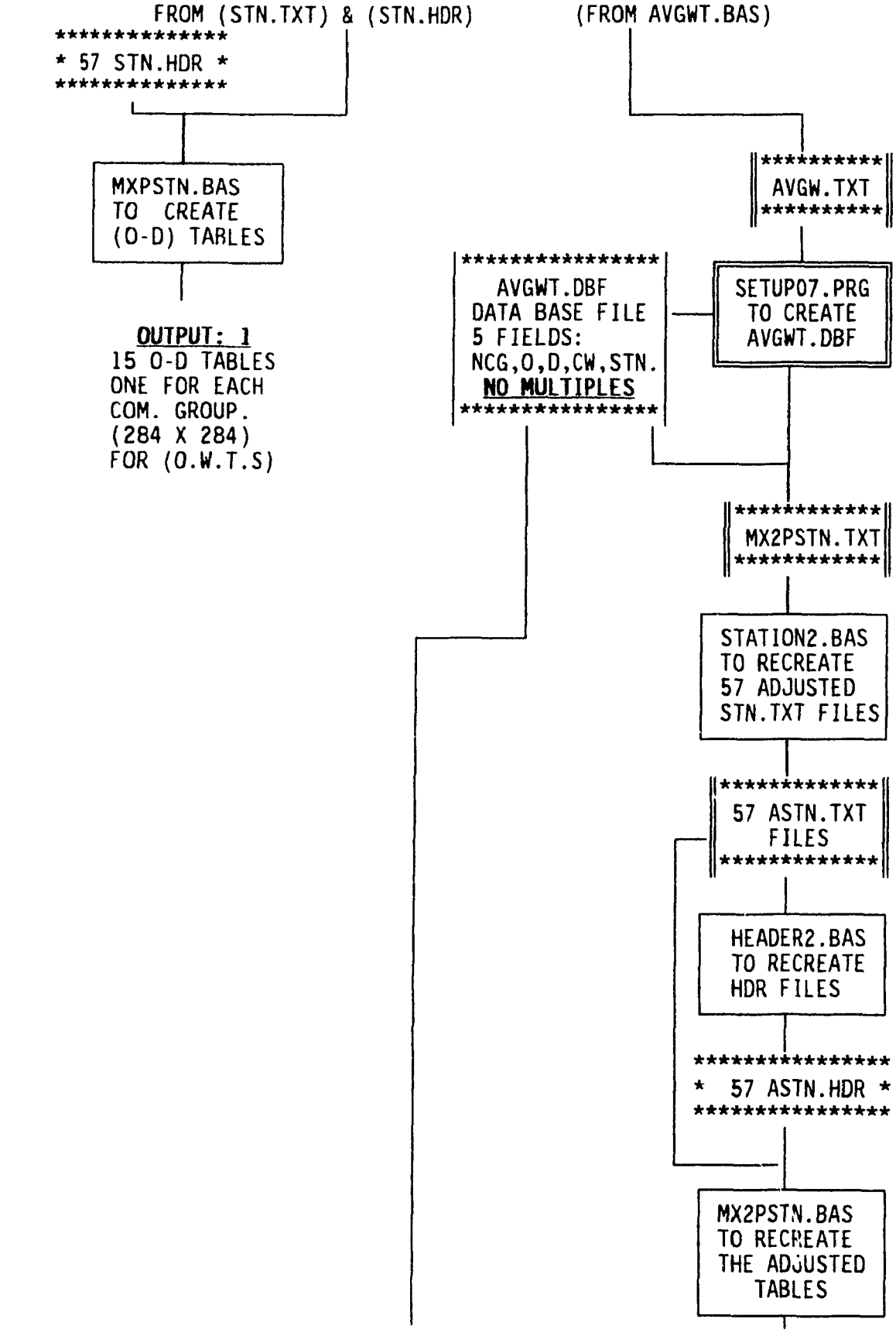
6.4 THE COMMODITY FLOW MODEL PROGRAM

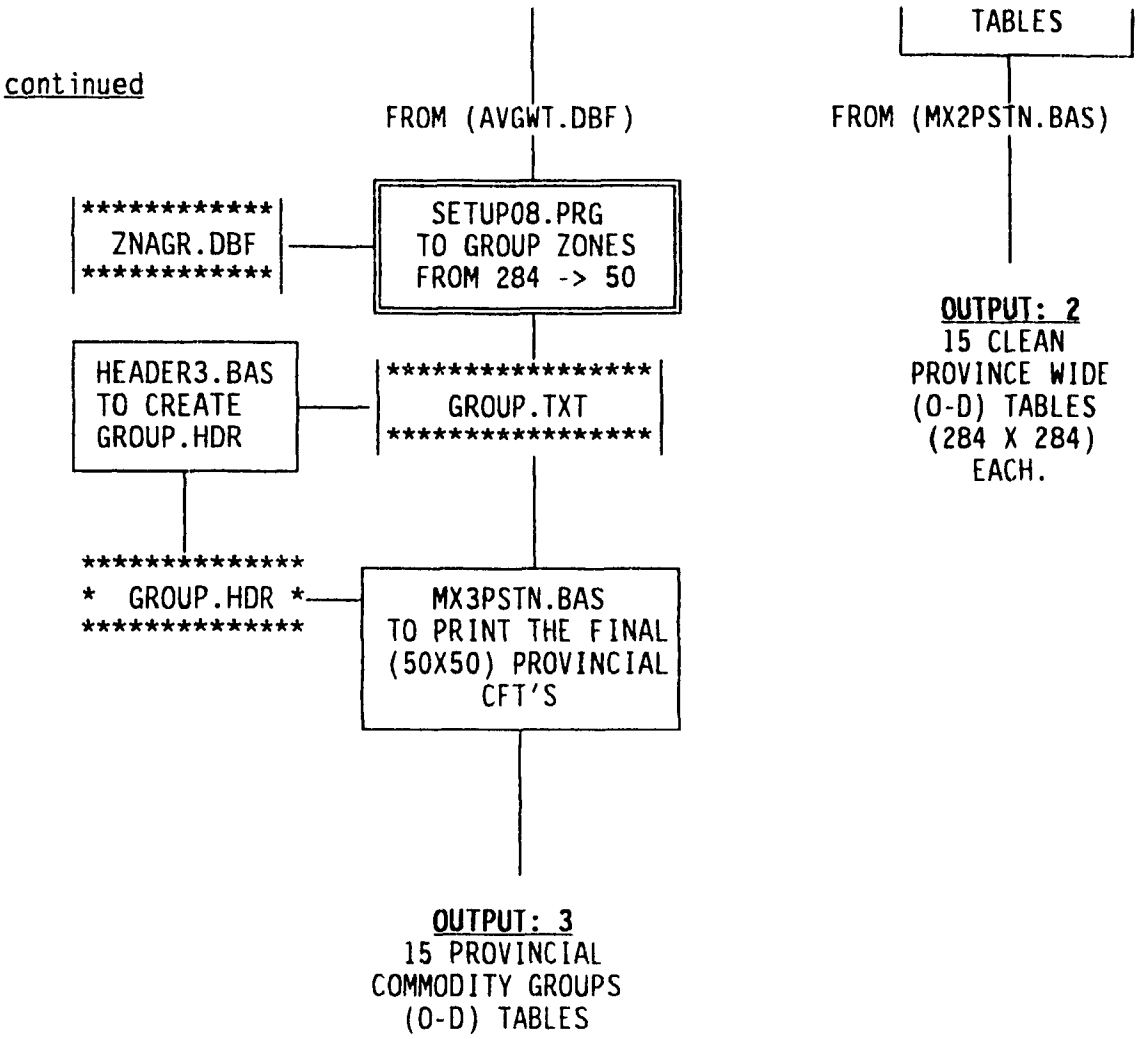
A computer program was written in BASIC to execute the Commodity Flow Model (CFM), using an iterative procedure. This program (FRATAR.BAS) reads the base year O-D matrix along with the expected future growth factors and performs the iterations as required by the governing formula (chapter 5) to satisfy the constraints. It will stop when all growth factors converge to the value of one (1.00). This program was run on three selected O-D tables. Computations showed that new obtained tables converged rather quickly due to the fact that the growth factors were already near unity. The largest increase from the base year to the horizon year was obtained for the Halton regional municipalities (9.1% increase). The input for this program was: (1) the commodity flows between 13 cities (O-D matrices extracted original tables), for selected groups in the base year 1989, and (2) the expected growth factors of cities. The output was a set of three representing the 1996 commodity flows between the 13 cities for the selected groups. A copy of this program is listed in Appendix B.

FLOW CHART FOR MATRIX PROGRAM



Continued


FROM (STN.TXT) & (STN.HDR)
(FROM AVGWT.BAS)
* 57 STN.HDR *
MXPSTN.BAS TO CREATE (O-D) TABLES
OUTPUT: 1
15 O-D TABLES ONE FOR EACH COM. GROUP. (284 X 284) FOR (O.W.T.S)
AVGW.TXT
AVGWT.DBF DATA BASE FILE 5 FIELDS: NCG,O,D,CW,STN. NO MULTIPLES
SETUP07.PRG TO CREATE AVGWT.DBF
MX2PSTN.TXT
STATION2.BAS TO RECREATE 57 ADJUSTED STN.TXT FILES
57 ASTN.TXT FILES
HEADER2.BAS TO RECREATE HDR FILES
* 57 ASTN.HDR *
MX2PSTN.BAS TO RECREATE THE ADJUSTED TABLES



Legend:

********* Input or output file (It can be a DBF, a TXT, or a HDR file)
———————— BASIC programs
═══════════ dBASEIII+ programs
Output files or printed tables

O = Origin zone.
D = Destination Zone.
CW = Commodity Weight.
STN = Station
OWTS= Ontario Wide Travel Simulation zone system
COM = Commodity group
NCG = New Commodity Group

Figure 6.2: Computational flow chart for MATRIX.

Table 6.1 Sample of data layout in file T04.DBF.

V1	V31	V33	V40	V41	V70	V55B	NZO	NZD	NCG	V57B	V51B
4	74	27	6.98	222	45340	47	19	5	6	26000	19760
6	190	22	6.98	222	29200	44	36	7	5	14813	14387
8	195	41	6.98	222	24780	52	38	7	10	8224	16556
10	125	21	6.98	222	51010	44	26	5	5	31570	0
15	60	21	8.05	222	19490	61	12	5	4	3088	16402
17	195	257	8.05	222	28120	50	38	47	5	13607	15824
21	213	44	8.05	222	20840	45	45	4	5	6232	15824
26	195	258	6.00	222	33870	46	38	47	5	18052	15824
28	73	255	6.00	222	25720	61	19	47	4	12243	15824
32	74	18	7.56	222	35900	17	19	5	3	15865	20035
33	80	43	7.56	222	8350	95	16	7	4	1800	0
43	119	1	3.96	222	20850	65	26	1	4	6463	14387
59	109	58	2.94	222	50840	41	25	17	13	33031	20176
60	78	42	2.94	222	25260	94	15	7	4	13607	15824
66	195	43	3.27	222	50870	44	38	7	5	30418	25200
68	80	18	3.27	222	33070	17	16	5	3	17246	15824
73	18	82	3.34	221	27230	94	5	20	4	6645	18752
76	277	90	3.34	221	35320	7	50	23	2	20452	17212
77	42	77	3.34	221	21940	94	7	13	4	6389	15824
78	18	79	3.34	221	12710	94	5	14	4	1676	11034
79	43	117	3.34	221	25590	94	7	27	4	7190	20077
84	279	77	1.88	221	34510	7	50	13	2	18686	15824
85	221	80	1.88	221	25280	61	46	16	4	4944	15824
87	11	70	1.88	221	61700	43	3	19	12	41281	20419
88	221	61	1.88	221	18070	61	46	17	4	4477	15824
89	1	89	1.88	221	35800	9	1	22	2	18650	19760
91	263	77	1.88	221	33050	1	50	13	2	17181	17212
92	221	82	1.88	221	19720	61	46	20	4	7119	15284
94	16	195	1.92	221	38080	9	2	38	2	21465	15824
95	279	79	1.92	221	33780	9	50	14	2	16568	17212
96	244	77	1.92	221	24770	65	47	13	4	10245	15824

Legend:

V1 Record number.
V31 Origin zone (OWTS 284 zones).
V33 Destination zone (OWTS 284 zones).
V40 Expansion factor # 4.
V41 Station number.
V70 Gross Vehicular Weight (GVW) in Kilograms.
V55B Commodity type, SCC (form 1 to 99).
NZO New Zone, Origin (50 zones)
NZD New Zone, Destination (50 zones).
NCG New Commodity Group, (from 1 to 15).
V57B Weight of commodity on board, in Kilograms.
V51B Estimated tare weight of trucks, in Kilograms.

Table 6.2: Data layout in the final data base file (AVGWT.DBF).

C	O	D	T	S	NO	ND
4	195	1	320	222	38	1
4	195	9	28	222	38	3
4	195	10	59	222	38	3
4	195	15	89	242	38	2
4	195	18	99	222	38	5
4	195	22	22	222	38	7
4	195	38	35	424	38	18
4	195	41	6	222	38	7
4	195	42	57	222	38	7
4	195	43	121	222	38	7
4	195	45	25	411	38	4
4	195	50	31	235	38	8
4	195	52	36	235	38	8
4	195	53	107	235	38	8
4	195	55	164	411	38	9
4	195	56	17	225	38	10
4	195	60	462	411	38	12
4	195	61	163	411	38	17
4	195	63	6	411	38	18
4	195	69	6	411	38	21
4	195	70	41	411	38	19
4	195	71	46	213	38	19
4	195	74	159	411	38	19

Legend:

C = Commodity group (NCG).
O = Origin of trip (OWTS zone system).
D = Destination of trip (OWTS zone system).
T = Tonnage shipped per day (metric).
S = Survey station.
NO= New origin of trip (for aggregated zones).
ND= New destination of trip (for aggregated zones).

CHAPTER 7

CONCLUSIONS

The broad aim of the research work described in this thesis is to develop a better understanding of the nature and patterns of commodity flows in Ontario. This chapter summarizes the principal conclusions developed during the study and suggests some recommendations for further research in this area.

7.1 CONCLUSIONS

The major conclusions of this study are as follows:

1) A comprehensive and reliable Origin-Destination (O-D) data base is established from the original truck survey data. Multiple counted records have been adjusted and so are the unreliable records.

2) A set of province-wide commodity flow tables (CFTs) one for each commodity group, have been developed based on the O-D data established above.

3) Productions and consumptions equations with high explanatory powers have been developed for certain groups (2, 3, & 4). These equations proved that population of zones can fairly predict the production and consumption of the above groups.

4) A Commodity Flow Model (CFM) is developed to forecast commodity flows in Ontario for a future year and for any given study area in the province.

5) Intercity commodity flows in Ontario for the year 1996 have been established using the CFM.

6) A structured program called MATRIX is written in BASIC and dBASEIII + to develop the commodity flow tables starting from the original records.

7) Another program is written in BASIC to execute the CFM using CFTs developed earlier and population growth factors for selected cities.

In conclusion, the development of the province-wide commodity flow tables from a road side truck survey data is a significant accomplishment of this study. Normally such tables are constructed using other approaches such as the ones discussed in chapter 2 of this thesis. In addition, the developed CFM is a useful tool for planning transportation studies.

7.2 RECOMMENDATIONS FOR FURTHER RESEARCH WORK

Long range planning is essential in transportation studies. Models capable of forecasting future transportation activities are of particular importance. Such models assist transportation agencies in terms of planning and policy regulation and evaluation. Truck

movements have been growing rapidly in Ontario. Deregulations of the trucking industry along with the Free Trade Agreement have brought major changes to it. Considering these facts, there is a need for further research in the following areas:

1) It is necessary to develop a standard commodity data collection procedure for better understanding the commodity movements and for developing reliable forecast models.

2) Reliable information on the Origin and Destination of the movements of each commodity type or group within the province should established so that the commodity flow tables developed from such data can be compared to it.

3) Zone systems with established demographic and economic data should be used in future surveys on a routine basis.

4) A procedure must be developed to convert the forecast commodity payloads into equivalent truck volumes.

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APPENDIX - A

TABLES

This Appendix contains the remaining of the tables developed during the research work which were mot included in the body of this thesis.

The tables listed here includes:

1. A.1 Sample of the original data layout
2. A.2 Commodity aggregation
3. A.3 Aggregation of the OWTS zone system
4. A4.1 to A4.15 Commodity flow tables for all groups
5. A.5 Census and projected population in Ontario
6. A.6 Population growth factors of selected cities in Ontario
7. A.7 Commodity flows for base year 1989, Foodstuffs (perishables) group # 2
8. A.8 Commodity flows for forecast year 1996, Foodstuffs (perishables) group # 2
9. A.9 Commodity flows for base year 1989, Foodstuffs (non-perishables) group # 3
10. A.8 Commodity flows for forecast year 1996, Foodstuffs(non-perishables) group# 3

Table A.1 Sample of the original data layout

```
  o.  oJ-U-   JU-U- -U- -U-        29.09        29.09        29.96        6.982221700 322342 1 22-0-   0  30
1620  6510  4100     0     0     0     0    0 5 15230 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
6 6-0 0  161    0    OVAU       -0-     HURON PARK-0-       -0-       -0-     740-0- 1785-0- -0- -0- 11010110
  7.  74-0-   27-0- -0- -0-        29.09        29.09        29.96        6.982221700 322342 1 21-0-   0
1200 19390  6340 15410     0     0     0    0 6 45340 OSDSD  -0-            -0-          -0-          -0-
     -0-          -0-                6-0-     -0- 2###2-0- 2-0-     -0-     -0-
7 6-0 0  880    0    OQUEBEC    -0-     WOODSTOCK -0-       -0-       -0-    1504-0- 1771-0- -0- -0- 110102-0
  6. 190   0  22    0   0   0        29.09        29.09        29.96        6.982221700 322342 1 21-0-   0 260
1580 16720  7900     0     0     0     0    0 4 29200 1SDS   -0-            -0-          -0-          -0-
     -0-          -0-                4-0-     -0- 2###2-0- 2-0-     -0-     -0-
3 5-0 0  633    0    OMONTREAL  -0-     PUSLINCH  -0-       -0-       -0-    1503-0- 1851-0- -0- -0- 12010212
 10. 195   0  41    0   0   0        29.09        29.09        29.96        6.982221700 322342 1 92-0-   0 365
1640 11580  8560     0     0     0     0    0 5 24780 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
6 6-0 0  670    0    OL'ORIGNAL -0-     INGERSOLL -0-       -0-       -0-    2014-0- 1769-0- -0- -0- 120101-0
 11. 125   0  21    0   0   0        29.09        29.09        29.96        6.982221700 322342-0 61  81191 260
390 17820 10180 17620      0     0     0    0 6 51010 OSDSD  -0-            -0-          -0-          -0-
     -0-          -0-                6-0-     -0- 2###2-0- 2-0-     -0-     -0-
6 5-0 0  125    0    OMIS       -0-     INGERSOLL -0-       -0-       -0-     842-0- 1769-0- -0- -0- 13010123
  8.  60   0  21    0   0   0        33.55        33.55        34.56        8.052221800 322342 1 52  81641 500
670  9720  7100     0     0     0     0    0 5 19490 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
6 6-0 0  910    0    OMONTREAL  -0-     DETROIT   -0-       -0-       -0-    1503-0- 1529-0- -0- -0- 120101-0
 10. 195   0 221    0   0   0        33.55        33.55        34.56        8.052221800 322342 1 71  70001 201
390  8220  7510     0     0     0     0    0 5 20120 1SDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
5 6-0 0 1061    0    OST THERESE-0-     ILLINOIS  -0-       -0-       -0-    1503-0- 1533-0- -0- -0- 110101-0
 10. 195   0 257    0   0   0        33.55        33.55        34.56        8.052221800 322342 1 22  78501
320 12640 11160     0     0     0     0    0 5 28120 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
6 6-0 0  416    0    ONEW YORK  -0-     WATERLOO  -0-       -0-       -0-    1554-0- 1893-0- -0- -0- 120102-0
  8. 213   0  44    0   0   0        33.55        33.55        34.56        8.052221800 322341 1 22  74841 150
790 11130  4920     0     0     0     0    0 5 20840 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
4 7-0 0 1884    0 1841MARIEVILLE-0-     IOWA      -0-      ROUGEMOUNTIOWA    1503-0- 1535-0- 1504153512020138
  7. 195   0 258    0 190 258        25.          25.          25.75         6.2221900 322342 1 22  79351 2041
350 14080 14940     0     0     0     0    0 5 33870 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
 6-0 0 1197    0    ONEWMARKET -0-     KENTUCKY  -0-       -0-       -0-     636-0- 1537-0- -0- -0- 130101 5
 10.  73   0 255    0   0   0         25.          25.          25.75        6.2221900 322342 1 22  72571 3628
 40 10860 10720     0     0     0     0    0 5 25720 OSDD    -0-            -0-          -0-          -0-
     -0-          -0-                5-0-     -0- 2###2-0- 2-0-     -0-     -0-
 6-0 0  160    0    OVAU       -0-     LONDON    -0-       -0-       -0-     740-0- 1757-0- -0- -0- 12010127
  8.  74   0  18    0   0   0         31.5         31.5         32.45        7.562222000 322342 1112-0-   0 6100
20 10030 21550     0     0     0     0    0 6 35900 OSDT    -0-            -0-          -0-          -0-
     -0-          -0-                6-0-     -0- 2###2-0- 2-0-     -0-     -0-
 6-0 0  122    0    OSCA       -0-     CAMBRIDGE -0-       -0-       -0-     372-0- 1852-0- -0- -0- 12010218
 10.  80   0  43    0   0   0         31.5         31.5         32.45        7.562222000 322341 5-02-0-   0 1500
50  4700     0     0     0     0     0    0 2  8350 OSS     -0-            -0-          -0-          -0-
```

Table A2: Commodity aggregation

NEW COMMODITY GROUP (NCG)	STANDARD COMMODITY CLASSIFICATION (SCC)
01. LIVE ANIMALS	A0-All live animals
02. FOODSTUFFS (PERISHABLES)	01-Meat & meat preparations 03-Fish 04-Other marine products 05-Dairy products,eggs,honey 07-Fruits & fruits preparations 09-Vegetables & vegetables preparations 12-Margarine,shortening,lard 14-All other foods.
03. FOODSTUFFS (NON-PERISHABLES)	06-Cereal grains,seeds,flour 08-Nuts (except oil nuts) 10-Sugar & sugar preparations 11-Cocoa,coffee,tea,& spices 15-Fodder & feed 17-Beverages 18-Tobacco.
04. GENERAL FREIGHT	24-Textile & related fibres 30-Leather 31-Furs,dressed 61-Miscellaneous vehicles 62-Rubber tires & tubes 63-Communication equipments 65-Heating,AC's,refrigeration equipments 66-Cooking equipments for food 67-Plumbing & fitting equipments 68-Electric lighting,dist'n & control eq. 69-Other electronic equipments 70-Measuring,control,lab equipments 71-X-Rays & related equipments 72-Safety & sanitation equipments 73-Service & industry equipments 74-Furniture & fixture 75-Hand tools & cutlery(except cable/kit) 76-Other equipments 77-Office machines & equipments 78-Apparel & equipments 79-Footwear 80-Toiletries,cleaning preparations 81-Jewellery & silverware 82-Watches & clocks 83-Other recreational equipments 84-Household furniture 85-Kitchen utensils 86-Other household & personal equipments 87-Medical,pharmaceutical products 88-Medical,ophthalmic,& orthopaedic tools

Table A2 (Continued)...

NEW COMMODITY GROUP (NCG)	STANDARD COMMODITY CLASSIFICATION (SCC)
04. GENERAL FREIGHT (Cont'd)	90-Stationers,office supplies 91-Photographic goods 92-Musical instruments 94-Miscellaneous end products 95-Containers & closures 96-Remaining end products.
05. METAL PRODUCTS	29-Other waste & scrap materials 44-Iron,steels, & alloys 45-Non-Ferrous metals 46-Metal fabricated basic products 50-Machinery not elsewhere specified.
06. NON-METAL PRODUCTS	47,48-Non-metallic mineral basic products
07. FABRICATED PRODUCTS	32-Rubber & plastic fabricated products 36,38-Textile fabricated materials 49-Miscellaneous fabricated products.
08. CRUDE MATERIALS (Except Petroleum)	20-Crude animal products (except fibres) 21-Crude vegetable products(excp.tobacco) 25-Metal ores,metal in ores,concentrates 27-Crude non-metallic minerals.
09. FOREST PRODUCTS	13-Logs, woods 23-crude wood materials 33-Wood fabricated materials 34-Pulp 35-Paper & paperboard 89-Printed matters (including Mail).
10. HEAVY MACHINERY	51-Conveying & elevating materials 52-Special industry machinery 54-Agricultural machinery equipments 55-Tractors 57-Railway rolling stocks 58-Road & motor vehicles 59-Sips & boats 60-Aircrafts.
11. CRUDE COAL & PETROLEUM	26-Coal,petroleum,& related crude prod.
12. PETROLEUM & COAL PRODUCTS	43-Petroleum & coal products.
13. CHEMICAL & MATERIALS PRODUCTS	39-Oil,fat,waxes,extracts,derivatives 40,42-Chemicals & related products.
14. ARMS & EXPLOSIVES	93-Fire arms, weapons, & ammunition.
15. OTHERS	99-Do not know.

Table A.5: Aggregation of the OWTS zone system.

#	O.W.T.S	N.Z.S.	PLACE NAME
1.	01,07	01	SOUTH WEST
2.	08,08	02	ONTARIO
3.	14,16	02	
4.	09,13	03	
5.	17,17	03	
6.	20,20	04	NIAGRA
7.	44,48	04	
8.	49,54	08	
9.	18,19	05	LONDON &
10.	21,21	05	KITCHENER
11.	23,23	05	
12.	27,27	05	
13.	28,34	06	
14.	22,22	07	
15.	24,26	07	
16.	41,43	07	
17.	40,40	17	NORTH OF
18.	58,59	17	G.T.A
19.	61,62	17	
20.	35,39	18	
21.	63,65	18	
22.	66,66	19	
23.	70,76	19	
24.	67,69	21	
25.	87,87	21	
26.	95,95	21	
27.	94,94	30	
28.	96,98	30	
29.	140,141	30	
30.	55,55	09	METRO
31.	56,56	10	TORONTO
32.	57,57	11	
33.	60,60	12	
34.	77,77	13	
35.	79,79	14	
36.	78,78	15	
37.	80,80	16	
38.	81,86	20	OSHAWA &
39.	88,88	20	EAST
40.	89,89	22	
41.	92,93	22	
42.	90,91	23	
43.	99,102	23	
44.	104,108	24	EASTERN ONTARIO
45.	109,112	25	
46.	120,120	25	
47.	119,119	26	
48.	121,126	26	
49.	116,118	27	

Table A3 Continued.

O.W.T.S		N.Z.S.	PLACE NAME
50.	113,115	28	EASTERN ONTARIO
51.	127,127	28	
52.	103,103	29	
53.	129,132	29	
54.	139,139	29	
55.	142,145	31	NORTHERN
56.	152,154	32	ONTARIO
57.	157,160	32	
58.	146,151	33	
59.	155,156	33	
60.	161,166	33	
61.	167,176	34	
62.	177,185	35	
63.	190,190	36	QUEBEC &
64.	192,193	37	MARITIMES
65.	194,196	38	
66.	197,198	39	
67.	191,191	40	
68.	199,202	40	
69.	203,203	41	WESTERN
70.	204,208	42	CANADA
71.	212,212	43	U.S.A
72.	217,217	43	
73.	230,243	43	
74.	209,211	44	
75.	213,216	45	
76.	220,223	46	
77.	219,219	47	
78.	224,224	47	
79.	255,259	47	
80.	244,245	47	
81.	255,259	47	
82.	225,228	48	
83.	246,254	49	
84.	260,261	49	
85.	268,284	50	

REGION	OWTS	N.Z.S
ONTARIO	185 zones	35 zones
QUEBEC & EAST	9 zones	5 zones
WESTERN CANADA	9 zones	2 zones
U.S.A	75 zones	8 zones
TOTAL	284 ZONES	50 ZONES

Table A4.1 Origin - Destination Commodity Flow Table for group # 1 (Live Animals)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z013	others	TOTAL
z005	0	0	0	0	0	0	0	0	0	0	0	91	91
z006	0	0	0	0	0	0	0	0	0	56	0	104	160
z007	0	0	0	0	0	0	111	12	16	21	0	624	784
z008	0	0	0	0	0	0	0	0	0	0	59	4	63
z009	0	0	0	0	19	0	0	15	0	0	0	50	84
z012	0	41	0	0	0	0	0	0	0	0	0	0	41
z014	0	0	0	0	178	0	60	2	0	0	0	181	421
z015	0	0	23	0	0	0	0	0	0	0	0	0	23
z018	0	0	0	0	0	0	0	0	25	0	0	75	100
z019	0	0	0	0	0	0	0	0	0	0	0	10	10
z020	0	0	0	0	0	0	304	0	0	0	0	74	378
z021	0	0	0	0	0	0	0	0	0	0	0	22	22
z022	0	0	0	0	0	0	3	0	0	0	0	153	156
z023	0	0	0	0	0	0	0	0	0	0	0	94	94
z024	0	0	0	0	237	0	20	0	0	0	0	66	323
z025	0	0	0	0	0	0	14	0	0	0	0	24	38
z026	0	0	0	0	0	0	0	0	0	0	0	22	22
z027	0	0	0	0	0	0	0	0	0	168	0	208	376
z028	0	0	0	0	0	0	0	0	0	39	0	0	39
z029	0	0	0	0	0	0	0	0	0	0	0	256	256
z030	0	0	0	27	0	0	0	0	0	0	0	0	27
z031	0	0	0	0	0	0	0	0	0	0	0	4	4
z034	0	0	0	0	0	0	0	0	0	0	0	69	69
z035	0	0	0	0	0	0	0	0	0	0	0	14	14
z036	0	0	0	0	16	0	0	0	0	0	0	1	17
z038	0	0	0	0	0	0	43	0	109	0	0	33	185
z041	55	0	191	0	0	18	44	0	474	247	0	29	1058
z042	0	0	0	0	27	0	36	0	0	0	0	394	457
z045	0	0	0	14	0	0	0	0	0	0	0	0	14
z046	0	0	0	0	0	0	102	0	0	0	0	0	102
z047	0	0	0	53	0	0	0	0	0	0	0	67	120
z049	0	0	0	0	0	0	0	0	0	0	23	0	23
TOTAL	55	41	214	94	477	18	737	29	624	531	82	2669	5571

Table A4.1 (Continued)

O\D	z014	z017	z018	z019	z020	z025	z027	z030	z036	z038	z041	others	TOTAL
z005	0	0	0	0	0	0	0	0	0	12	0	79	91
z006	0	0	0	0	0	0	0	0	73	31	0	56	160
z007	99	22	0	0	0	0	0	0	141	126	29	367	784
z008	0	0	0	4	0	0	0	0	0	0	0	59	63
z009	0	0	0	0	0	0	0	0	50	0	0	34	84
z012	0	0	0	0	0	0	0	0	0	0	0	41	41
z014	0	0	0	19	0	0	0	0	26	0	41	335	421
z015	0	0	0	0	0	0	0	0	0	0	0	23	23
z018	49	0	0	0	0	0	0	0	0	0	0	51	100
z019	10	0	0	0	0	0	0	0	0	0	0	0	10
z020	0	0	0	0	0	0	1	0	0	73	0	304	378
z021	22	0	0	0	0	0	0	0	0	0	0	0	22
z022	0	0	0	0	0	0	0	0	0	0	0	156	156
z023	94	0	0	0	0	0	0	0	0	0	0	0	94
z024	0	0	0	0	0	0	0	0	0	0	0	323	323
z025	0	0	0	0	0	0	0	0	0	0	0	38	38
z026	0	0	0	0	0	0	0	0	0	22	0	0	22
z027	71	0	0	0	0	0	0	0	137	0	0	168	376
z028	0	0	0	0	0	0	0	0	0	0	0	39	39
z029	256	0	0	0	0	0	0	0	0	0	0	0	256
z030	0	0	0	0	0	0	0	0	0	0	0	27	27
z031	3	0	0	0	0	0	0	1	0	0	0	0	4
z034	0	0	0	0	69	0	0	0	0	0	0	0	69
z035	0	0	0	0	14	0	0	0	0	0	0	0	14
z036	0	0	0	0	0	1	0	0	0	0	0	16	17
z038	0	0	32	0	0	0	0	0	0	1	0	152	185
z041	4	25	0	0	0	0	0	0	0	0	0	1029	1058
z042	89	0	305	0	0	0	0	0	0	0	0	63	457
z045	0	0	0	0	0	0	0	0	0	0	0	14	14
z046	0	0	0	0	0	0	0	0	0	0	0	102	102
z047	0	0	67	0	0	0	0	0	0	0	0	53	120
z049	0	0	0	0	0	0	0	0	0	0	0	23	23
TOTAL	697	47	404	23	83	1	1	1	427	265	70	3552	5571

Table A4.1 (continued)

O\D	z042	z043	z045	z049	others	TOTAL
z005	79	0	0	0	12	91
z006	0	0	0	0	160	160
z007	165	42	0	0	577	784
z008	0	0	0	0	63	63
z009	0	0	0	0	84	84
z012	0	0	0	0	41	41
z014	11	0	0	84	326	421
z015	0	0	0	0	23	23
z018	26	0	0	0	74	100
z019	0	0	0	0	10	10
z020	0	0	0	0	378	378
z021	0	0	0	0	22	22
z022	0	0	153	0	3	156
z023	0	0	0	0	94	94
z024	66	0	0	0	257	323
z025	0	24	0	0	14	38
z026	0	0	0	0	22	22
z027	0	0	0	0	376	376
z028	0	0	0	0	39	39
z029	0	0	0	0	256	256
z030	0	0	0	0	27	27
z031	0	0	0	0	4	4
z034	0	0	0	0	69	69
z035	0	0	0	0	14	14
z036	0	0	0	0	17	17
z038	0	0	0	0	185	185
z041	0	0	0	0	1058	1058
z042	0	0	0	0	457	457
z045	0	0	0	0	14	14
z046	0	0	0	0	102	102
z047	0	0	0	0	120	120
z049	0	0	0	0	23	23
TOTAL	347	66	153	84	4921	5571

Table A4.2 Origin - Destination Commodity Flow Table for group # 2 (Foodstuffs- Perishables)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	16	0	25	0	0	0	839	4	0	0	0	6133	7017
z002	0	0	0	0	0	0	0	0	0	0	0	758	758
z003	271	0	0	0	20	0	0	0	0	0	0	3941	4232
z004	0	0	0	0	105	0	0	18	687	35	0	1167	2012
z005	0	0	1	329	0	0	0	0	710	0	0	2340	3380
z006	0	0	0	0	0	0	0	0	0	0	0	506	506
z007	0	0	27	10	83	0	0	616	0	0	854	3533	5123
z008	29	47	0	0	4	0	0	27	40	11	0	2967	3125
z009	0	0	0	0	0	0	0	163	0	0	0	822	985
z010	0	0	0	0	0	0	0	39	0	0	0	546	585
z011	0	192	0	0	0	0	0	0	27	36	0	489	744
z012	230	65	255	52	573	28	562	308	0	0	0	1787	3860
z013	67	16	44	97	402	43	1016	381	131	0	0	2758	4955
z014	139	35	587	58	347	13	243	148	25	5	0	4101	5701
z015	0	0	0	373	254	0	69	12	72	0	0	358	1138
z016	0	0	34	0	94	0	0	11	107	0	0	1052	1298
z017	65	0	76	69	589	0	307	28	45	28	0	808	2015
z018	0	0	0	0	0	0	7	73	0	0	0	503	583
z019	113	62	0	62	161	37	46	11	84	0	6	1402	1984
z020	0	0	0	0	0	0	32	0	0	0	0	201	233
z021	0	0	0	0	0	0	0	0	0	0	0	29	29
z022	0	0	0	32	0	0	0	1	0	0	0	952	985
z023	98	0	0	0	40	0	0	24	351	0	42	1558	2113
z024	0	0	0	0	104	0	0	0	0	0	0	1030	1134
z025	0	0	0	0	0	0	33	0	0	0	0	410	443
z026	0	0	0	0	0	0	0	0	0	0	0	1926	1926
z027	221	0	0	0	0	0	63	0	34	0	0	347	665
z028	0	0	0	0	0	0	22	0	0	0	0	0	22
z030	0	0	0	0	0	0	7	14	0	0	0	134	155
z031	0	0	0	3	0	0	50	0	0	0	0	660	713
z032	0	0	0	44	0	0	0	0	0	0	0	66	110
z033	0	0	0	0	0	0	0	0	0	0	0	166	166
z034	0	0	0	0	0	0	0	0	0	0	0	383	383
z035	0	0	0	0	0	0	0	0	0	0	0	82	82
z036	95	0	0	0	300	0	0	0	0	0	0	1392	1787
z038	449	0	0	64	137	0	206	85	0	74	51	3432	4498
z040	0	0	0	32	0	0	0	134	0	0	0	558	724
z041	0	0	0	0	0	0	49	153	0	147	35	1888	2272
z042	0	0	0	0	0	0	0	0	0	0	0	1283	1283
z043	0	0	0	213	0	0	36	0	0	0	0	1184	1433
z045	0	0	0	0	0	0	215	0	0	0	0	562	777
z046	0	0	0	0	0	0	0	0	315	0	0	1012	1327
z047	0	0	0	0	0	0	0	0	0	0	0	1556	1556
z049	0	0	0	229	0	0	0	0	242	0	0	1632	2103
z050	140	0	0	0	119	0	0	0	0	0	0	2880	3139
TOTAL	1933	417	1049	1667	3332	121	3802	2250	2870	336	988	61294	80059

Table A4.2 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	591	688	740	500	159	465	0	732	225	0	35	2882	7017
z002	0	0	0	0	93	0	273	0	0	0	0	392	758
z003	672	74	1194	0	0	0	0	0	0	0	0	2292	4232
z004	34	98	45	0	105	0	0	43	14	0	0	1673	2012
z005	156	600	669	195	0	59	0	54	0	0	0	1647	3380
z006	20	154	287	0	0	0	0	45	0	0	0	0	506
z007	355	30	1119	231	24	20	180	340	77	70	79	2598	5123
z008	3	678	456	19	327	153	0	1	3	29	0	1456	3125
z009	20	211	0	0	0	9	10	39	0	0	0	696	985
z010	0	89	106	52	0	0	0	17	0	0	0	321	585
z011	0	0	29	0	0	0	0	0	0	0	0	715	744
z012	0	0	0	0	0	0	0	191	0	64	258	3347	3860
z013	0	0	571	0	0	32	93	167	0	36	0	4056	4955
z014	0	0	0	0	0	9	192	108	0	55	854	4483	5701
z015	0	0	0	0	0	10	15	62	0	0	0	1051	1138
z016	0	0	0	0	0	0	137	0	0	0	0	1161	1298
z017	0	0	57	24	0	21	0	0	0	12	0	1901	2015
z018	0	175	0	60	0	0	0	0	0	0	0	348	583
z019	50	264	235	46	0	0	10	26	18	0	0	1335	1984
z020	0	0	0	0	0	0	0	37	0	0	0	196	233
z021	1	0	0	0	0	0	0	0	0	24	0	4	29
z022	592	0	0	0	0	0	10	0	111	0	0	272	985
z023	45	0	296	0	0	332	24	0	0	0	0	1416	2113
z024	0	0	22	407	0	0	0	0	0	0	0	705	1134
z025	0	65	107	40	0	0	0	0	0	0	0	231	443
z026	0	0	821	0	0	0	0	0	0	0	0	1105	1926
z027	25	0	41	0	0	0	0	0	25	0	16	558	665
z028	0	0	0	0	0	0	0	0	0	0	0	22	22
z030	2	0	0	0	0	0	13	23	0	0	0	117	155
z031	22	0	36	0	0	22	0	0	5	9	0	619	713
z032	0	0	0	0	0	0	0	0	0	0	0	110	110
z033	0	10	85	0	0	0	0	0	0	0	0	71	166
z034	0	0	6	0	0	0	0	0	0	0	0	377	383
z035	0	0	0	0	0	0	0	0	0	0	0	82	82
z036	0	802	176	51	0	0	0	0	0	0	25	733	1787
z038	345	562	426	34	138	50	0	28	0	0	0	2915	4498
z040	0	193	34	0	0	6	0	55	0	0	0	436	724
z041	59	48	75	0	16	32	132	0	0	0	39	1871	2272
z042	22	129	148	14	0	0	0	448	0	0	0	522	1283
z043	225	491	61	8	0	0	0	124	0	0	78	446	1433
z045	33	0	24	286	0	82	0	23	0	0	0	329	777
z046	0	0	0	0	0	0	0	0	0	0	0	1327	1327
z047	176	297	551	0	71	0	0	98	7	0	0	356	1556
z049	137	134	599	13	216	151	0	0	0	0	290	563	2103
z050	472	285	638	42	97	0	0	54	0	0	0	1551	3139
TOTAL	4057	6077	9654	2022	1246	1453	1089	2715	485	299	1674	49288	80059

Table A4.2 (continued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	0	0	0	0	83	0	0	0	0	77	0	6857	7017
z002	0	0	0	0	0	0	0	0	0	0	0	758	758
z003	737	0	411	0	0	0	0	0	40	0	0	3044	4232
z004	0	0	0	0	183	0	0	6	0	0	69	1754	2012
z005	0	0	100	0	18	0	0	0	0	0	0	3262	3380
z006	0	0	0	0	0	0	0	0	0	0	0	506	506
z007	0	49	152	0	17	0	0	51	77	102	0	4675	5123
z008	0	0	0	0	33	0	0	0	5	0	0	3087	3125
z009	0	0	277	0	0	0	0	0	0	0	0	708	985
z010	0	0	0	0	0	0	0	24	71	9	25	456	585
z011	0	0	0	345	0	0	0	0	0	0	0	399	744
z012	338	0	18	0	32	0	0	0	103	55	58	3256	3860
z013	0	0	0	39	116	21	93	55	229	24	648	3730	4955
z014	0	279	36	272	255	11	0	63	93	83	71	4538	5701
z015	0	0	0	0	25	0	0	22	28	0	0	1063	1138
z016	0	0	0	0	27	0	0	0	313	0	0	958	1298
z017	0	0	0	0	74	0	0	0	40	81	66	1754	2015
z018	12	0	0	0	0	0	0	0	0	0	0	571	583
z019	0	0	47	0	18	0	0	0	45	47	0	1827	1984
z020	0	0	164	0	0	0	0	0	0	0	0	69	233
z021	0	0	0	0	0	0	0	0	4	0	0	25	29
z022	0	0	54	0	29	0	0	0	0	0	0	902	985
z023	3	0	11	0	0	0	0	0	0	0	0	2099	2113
z024	0	0	104	13	68	4	0	0	0	0	0	945	1134
z025	0	13	26	0	77	0	0	0	0	0	0	327	443
z026	0	1	0	367	32	0	8	0	0	0	0	1518	1926
z027	34	24	18	0	0	0	0	0	0	0	0	589	665
z028	0	0	0	0	0	0	0	0	0	0	0	22	22
z030	0	0	0	0	0	0	0	11	1	0	84	59	155
z031	0	0	0	0	0	0	0	70	86	0	348	209	713
z032	0	0	0	0	0	0	0	9	0	32	25	44	110
z033	0	0	0	0	0	0	0	0	21	19	31	95	166
z034	0	0	0	0	0	0	0	0	0	0	3	380	383
z035	0	0	0	0	0	0	0	0	0	0	0	82	82
z036	80	0	0	0	45	0	0	0	0	0	0	1662	1787
z038	139	358	500	0	395	0	0	0	67	13	19	3007	4498
z040	0	0	0	0	56	0	0	0	0	0	0	668	724
z041	0	0	28	0	66	0	0	0	0	20	0	2158	2272
z042	0	0	0	0	77	0	0	0	0	0	0	1206	1283
z043	0	0	0	0	19	0	0	0	0	0	0	1414	1433
z045	0	0	0	0	43	0	0	0	0	0	0	734	777
z046	0	0	0	0	0	0	0	0	0	0	0	1327	1327
z047	51	0	0	0	0	0	0	0	0	0	0	1505	1556
z049	0	0	0	0	79	0	0	0	0	0	0	2024	2103
z050	122	0	0	0	361	0	0	0	0	0	0	2656	3139
TOTAL	1516	724	1946	1036	2228	36	101	311	1223	562	1447	68929	80059

Table A4.2 (continued)

O\D	z034	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	71	0	0	373	591	33	770	0	0	0	0	5179	7017
z002	0	0	0	267	0	0	0	0	0	0	0	491	758
z003	0	0	110	46	412	0	0	95	150	0	0	3419	4232
z004	43	0	0	281	0	246	0	0	0	0	0	1442	2012
z005	0	0	0	207	160	122	0	0	0	0	0	2891	3380
z006	0	0	0	0	0	0	0	0	0	0	0	506	506
z007	19	0	47	199	0	45	131	119	0	0	0	4563	5123
z008	0	0	488	420	103	149	100	0	0	0	0	1865	3125
z009	0	0	0	130	0	0	42	0	84	0	0	729	985
z010	0	0	53	36	0	22	42	0	0	0	0	432	585
z011	38	0	0	28	0	35	14	0	0	0	0	629	744
z012	14	0	0	183	41	16	243	104	34	0	0	3225	3860
z013	27	0	0	176	85	60	36	0	72	44	34	4421	4955
z014	7	0	75	748	407	69	125	81	114	0	0	4075	5701
z015	0	0	0	99	0	39	20	0	0	0	0	980	1138
z016	0	0	335	165	0	0	0	0	0	0	0	798	1298
z017	0	0	48	161	0	34	20	0	0	0	170	1582	2015
z018	0	21	0	0	182	24	0	29	0	0	0	327	583
z019	37	0	0	173	0	0	0	115	169	0	102	1388	1984
z020	0	0	0	0	0	0	0	0	0	0	0	233	233
z021	0	0	0	0	0	0	0	0	0	0	0	29	29
z022	4	0	0	87	0	0	65	0	0	0	0	829	985
z023	0	0	363	171	81	59	173	0	0	0	0	1266	2113
z024	20	2	134	256	0	0	0	0	0	0	0	722	1134
z025	0	0	0	82	0	0	0	0	0	0	0	361	443
z026	0	0	0	514	183	0	0	0	0	0	0	1229	1926
z027	0	0	0	5	0	18	141	0	0	0	0	501	665
z028	0	0	0	0	0	0	0	0	0	0	0	22	22
z030	0	0	0	0	0	0	0	0	0	0	0	155	155
z031	62	0	0	0	0	0	0	0	0	0	0	651	713
z032	0	0	0	0	0	0	0	0	0	0	0	110	110
z033	0	0	0	0	0	0	0	0	0	0	0	166	166
z034	60	212	0	0	0	102	0	0	0	0	0	9	383
z035	79	3	0	0	0	0	0	0	0	0	0	0	82
z036	0	0	0	151	0	62	0	0	0	0	0	1574	1787
z038	0	0	0	29	0	28	66	0	0	0	235	4140	4498
z040	0	0	0	0	0	17	191	0	0	0	0	516	724
z041	50	114	24	106	1079	0	0	0	0	0	0	899	2272
z042	0	0	227	183	35	0	0	0	0	0	0	838	1283
z043	0	0	0	103	0	0	0	0	0	75	0	1255	1433
z045	0	0	0	0	0	0	0	0	0	46	25	706	777
z046	0	0	0	178	0	0	0	462	372	0	0	315	1327
z047	7	0	0	92	0	0	0	62	144	0	0	1251	1556
z049	0	0	0	13	0	0	0	0	0	0	0	2090	2103
z050	0	0	71	738	0	0	0	0	0	0	0	2330	3139
TOTAL	538	352	1975	6400	3359	1180	2179	1067	1139	165	566	61139	80059

Table A4.2 (continued)

O\D	z049	z050	others	TOTAL
z001	0	0	7017	7017
z002	0	125	633	758
z003	0	0	4232	4232
z004	0	0	2012	2012
z005	0	0	3380	3380
z006	0	0	506	506
z007	0	0	5123	5123
z008	0	0	3125	3125
z009	0	0	985	985
z010	0	0	585	585
z011	0	0	744	744
z012	0	35	3825	3860
z013	0	100	4855	4955
z014	46	48	5607	5701
z015	38	0	1100	1138
z016	0	75	1223	1298
z017	0	0	2015	2015
z018	0	0	583	583
z019	0	0	1984	1984
z020	0	0	233	233
z021	0	0	29	29
z022	0	0	985	985
z023	0	0	2113	2113
z024	0	0	1134	1134
z025	0	0	443	443
z026	0	0	1926	1926
z027	0	0	665	665
z028	0	0	22	22
z030	0	0	155	155
z031	0	0	713	713
z032	0	0	110	110
z033	0	0	166	166
z034	0	0	383	383
z035	0	0	82	82
z036	0	0	1787	1787
z038	0	0	4498	4498
z040	0	6	718	724
z041	0	0	2272	2272
z042	0	0	1283	1283
z043	0	0	1433	1433
z045	0	0	777	777
z046	0	0	1327	1327
z047	0	0	1556	1556
z049	0	0	2103	2103
z050	0	0	3139	3139
TOTAL	84	389	79586	80059

Table A4.3 Origin - Destination Commodity Flow table for group # 3 (Foodstuffs, Non-Perishables)

O\D	z001	z002	z003	z004	z005	z007	z008	z009	z010	z011	z012	others	TOTAL
z001	0	0	0	0	113	1386	0	0	0	0	0	758	2257
z002	0	0	0	0	0	0	111	0	0	0	0	2972	3083
z003	33	0	0	0	0	0	0	0	0	0	19	277	329
z004	0	0	0	3	0	0	0	0	0	0	501	481	985
z005	372	0	74	221	0	0	0	399	0	0	226	3796	5088
z006	0	0	0	0	0	81	0	58	0	0	0	1163	1302
z007	0	209	0	42	388	0	114	0	0	0	0	1745	2498
z008	0	0	0	0	77	0	13	220	0	0	127	2915	3352
z009	0	0	0	0	393	0	307	10	0	0	0	310	1020
z010	0	0	0	0	0	0	0	0	312	0	0	396	708
z012	585	0	116	633	0	254	17	212	0	0	0	757	2574
z013	530	0	140	30	14	114	500	0	0	0	0	1836	3164
z014	0	0	12	0	787	973	408	533	0	0	0	3846	6559
z015	0	0	0	0	124	124	72	0	0	0	0	163	483
z016	22	0	89	0	337	0	0	0	368	0	0	959	1775
z017	0	0	11	0	200	37	0	0	0	0	0	429	677
z018	226	0	0	0	0	99	106	0	0	0	74	441	946
z019	236	0	168	0	1023	440	243	0	353	0	0	458	2921
z020	0	0	0	0	0	157	0	0	0	0	0	112	269
z021	0	0	0	0	0	38	119	0	0	0	227	996	1380
z022	0	0	58	0	0	0	0	0	0	639	19	374	1090
z023	0	0	0	0	102	179	0	0	0	0	0	403	684
z024	0	0	0	0	0	0	0	0	0	0	0	1377	1377
z025	0	0	0	0	0	34	0	0	0	0	0	967	1001
z026	0	0	0	0	0	0	0	0	0	0	0	10	10
z027	0	0	0	0	44	20	0	378	0	0	0	114	556
z029	0	0	0	0	0	0	0	0	0	0	0	118	118
z030	0	0	32	0	0	0	0	0	0	0	0	58	90
z031	0	0	0	0	0	0	0	0	0	0	121	369	490
z032	0	0	0	0	0	0	0	0	0	0	0	15	15
z033	0	0	0	0	147	0	0	0	0	0	0	220	367
z034	0	0	0	0	38	0	0	0	0	0	0	338	376
z035	0	0	0	3	14	0	0	0	0	0	0	76	93
z036	174	0	0	0	0	0	0	0	0	0	0	658	832
z038	49	0	265	222	33	39	0	41	11	0	172	2386	3218
z040	0	0	0	0	0	0	0	0	0	0	0	150	150
z041	0	86	0	0	0	0	0	0	0	0	28	483	597
z042	0	0	0	0	0	0	0	0	0	0	0	49	49
z043	0	0	0	92	0	0	0	0	0	0	19	417	528
z045	0	0	0	0	109	0	0	0	0	0	186	776	1071
z046	0	0	0	0	0	36	8	0	0	0	0	810	854
z047	0	0	0	0	79	0	0	0	0	0	31	841	951
z049	0	0	0	0	0	0	0	0	0	0	17	0	17
z050	0	0	0	0	0	0	0	0	0	0	0	71	71
TOTAL	2227	295	965	1246	4022	4011	2018	1851	1044	639	1767	35890	55975

Table A3 (Continued)

O\D	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	z023	others	TOTAL
z001	102	0	0	0	0	0	231	0	145	0	0	1779	2257
z002	105	185	133	0	0	21	0	0	0	1752	0	787	3083
z003	0	277	0	0	0	0	0	0	0	0	0	52	329
z004	0	0	0	0	0	39	64	0	0	0	0	882	985
z005	488	657	298	215	236	4	150	0	0	0	58	2982	5088
z006	0	787	0	0	0	0	0	0	0	89	0	426	1302
z007	0	412	0	0	0	115	44	0	0	0	0	1927	2498
z008	270	692	0	29	74	54	262	0	0	0	0	1971	3352
z009	0	0	0	0	0	0	26	0	0	0	0	994	1020
z010	321	75	0	0	0	0	0	0	0	0	0	312	708
z012	0	0	0	0	0	0	0	0	0	0	0	2574	2574
z013	0	0	0	0	160	0	3	0	115	0	0	2886	3164
z014	0	0	0	0	159	128	112	0	25	391	0	5744	6559
z015	0	0	0	0	0	0	75	0	0	0	0	408	483
z016	0	0	0	0	0	0	0	0	34	0	0	1741	1775
z017	0	0	0	35	0	0	0	0	0	0	0	642	677
z018	133	7	0	0	0	0	0	0	0	0	0	806	946
z019	0	166	3	0	0	0	0	0	0	0	0	2752	2921
z020	0	0	0	0	0	0	0	0	39	0	0	230	269
z021	76	557	70	0	101	0	21	0	0	0	0	555	1380
z022	0	0	0	0	0	0	0	0	0	0	0	1090	1090
z023	0	0	0	0	0	0	6	0	0	0	0	678	684
z024	588	399	40	0	0	0	0	0	0	0	0	350	1377
z025	0	58	99	0	0	0	0	0	0	0	0	844	1001
z026	0	0	0	0	0	0	0	0	0	0	0	10	10
z027	18	65	0	0	0	0	0	0	0	0	0	473	556
z029	118	0	0	0	0	0	0	0	0	0	0	0	118
z030	0	3	0	0	0	0	0	0	5	0	0	82	90
z031	46	91	0	135	0	0	0	46	0	0	0	172	490
z032	0	12	0	0	0	0	0	0	0	0	0	3	15
z033	0	88	0	0	0	0	0	0	0	0	0	279	367
z034	0	0	0	0	0	0	0	0	0	0	0	376	376
z035	0	0	0	0	0	0	0	0	0	0	0	93	93
z036	58	0	0	232	0	182	0	0	0	0	0	360	832
z038	0	34	741	19	194	0	0	0	0	0	146	2084	3218
z040	0	150	0	0	0	0	0	0	0	0	0	0	150
z041	0	91	0	0	28	0	0	0	0	0	0	478	597
z042	0	23	0	0	0	0	0	0	0	0	0	26	49
z043	0	43	0	0	0	0	0	25	0	0	0	460	528
z045	86	84	44	0	0	0	35	0	0	161	0	661	1071
z046	0	225	0	0	0	0	0	0	0	0	0	629	854
z047	104	0	0	0	0	206	65	89	0	0	0	487	951
z049	0	0	0	0	0	0	0	0	0	0	0	17	17
z050	0	0	0	0	0	0	71	0	0	0	0	0	71
TOTAL	2513	5181	1428	665	952	749	1165	160	363	2493	204	40102	55975

Table A4.3 (continued)

O\D	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	z034	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	43	2214	2257
z002	0	0	0	0	0	0	0	0	0	0	0	3083	3083
z003	0	0	0	0	0	0	0	0	0	0	0	329	329
z004	89	0	0	0	0	0	0	0	0	0	0	896	985
z005	0	189	0	0	0	0	0	0	281	118	70	4430	5088
z006	0	0	0	0	0	0	0	0	0	0	0	1302	1302
z007	55	0	8	163	0	0	0	0	0	175	0	2097	2498
z008	190	0	0	577	215	0	6	0	0	0	0	2364	3352
z009	0	0	0	0	0	0	0	0	0	0	0	1020	1020
z010	0	0	0	0	0	0	0	0	0	0	0	708	708
z012	0	0	0	0	58	0	0	47	141	47	0	2281	2574
z013	0	0	0	674	0	0	6	32	0	126	0	2326	3164
z014	0	50	76	579	232	0	154	2	0	43	150	5273	6559
z015	0	0	0	19	0	0	0	24	0	0	45	395	483
z016	0	0	0	0	0	0	0	0	0	0	420	1355	1775
z017	0	0	0	0	0	0	0	0	95	89	0	493	677
z018	0	0	0	0	0	0	0	47	0	0	0	899	946
z019	0	0	0	0	0	0	29	39	42	0	0	2811	2921
z020	0	0	0	0	0	0	0	0	0	0	73	196	269
z021	0	0	0	0	0	0	0	28	10	83	0	1259	1380
z022	0	156	0	0	0	0	0	0	0	0	0	934	1090
z023	0	70	0	0	0	0	0	0	0	0	0	614	684
z024	0	58	0	172	0	0	0	0	0	0	0	1147	1377
z025	27	0	0	0	0	0	0	0	0	0	0	974	1001
z026	0	0	10	0	0	0	0	0	0	0	0	0	10
z027	30	1	0	0	0	0	0	0	0	0	0	525	556
z029	0	0	0	0	0	0	0	0	0	0	0	118	118
z030	0	0	0	0	0	0	15	0	0	0	0	75	90
z031	0	0	0	0	0	0	0	12	28	11	0	439	490
z032	0	0	0	0	0	0	0	0	0	3	0	12	15
z033	0	0	0	0	0	0	0	0	0	106	26	235	367
z034	0	0	0	0	0	0	0	0	0	15	18	343	376
z035	0	0	0	0	0	0	0	0	0	0	0	93	93
z036	0	0	0	0	0	0	0	0	0	0	0	832	832
z038	156	49	219	243	0	67	0	0	24	0	14	2446	3218
z040	0	0	0	0	0	0	0	0	0	0	0	150	150
z041	0	0	0	0	0	0	0	0	0	0	119	478	597
z042	0	0	0	0	0	0	0	0	0	0	0	49	49
z043	0	10	0	0	0	0	0	0	0	0	0	518	528
z045	0	0	0	0	0	0	0	0	0	0	0	1071	1071
z046	0	0	0	195	0	0	0	0	0	0	0	659	854
z047	0	0	0	0	0	0	0	0	0	0	0	951	951
z049	0	0	0	0	0	0	0	0	0	0	0	17	17
z050	0	0	0	0	0	0	0	0	0	0	0	71	71
TOTAL	547	583	313	2622	505	67	210	231	621	816	978	48482	55975

Table A4.3 (continued)

O\D	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	z049	others	TOTAL
z001	0	0	237	0	0	0	0	0	0	0	0	2020	2257
z002	0	0	676	0	0	0	0	0	0	0	0	2407	3083
z003	0	0	0	0	0	0	0	0	0	0	0	329	329
z004	0	0	254	0	35	0	0	0	0	0	0	696	985
z005	50	93	217	77	31	204	0	240	120	0	0	4056	5088
z006	0	0	0	0	0	0	188	99	0	0	0	1015	1302
z007	0	0	291	71	180	0	0	231	0	0	0	1725	2498
z008	0	0	104	46	56	93	0	0	247	0	0	2806	3352
z009	0	0	96	0	0	0	0	188	0	0	0	736	1020
z010	0	0	0	0	0	0	0	0	0	0	0	708	708
z012	0	0	105	0	0	0	156	101	0	102	0	2110	2574
z013	74	0	77	0	41	0	69	402	57	0	0	2444	3164
z014	0	0	546	0	57	0	0	467	0	604	71	4814	6559
z015	0	0	0	0	0	0	0	0	0	0	0	483	483
z016	0	0	0	0	0	0	0	0	0	312	193	1270	1775
z017	0	0	0	0	123	46	0	0	0	41	0	467	677
z018	0	0	0	0	0	0	243	11	0	0	0	692	946
z019	0	0	13	0	0	0	0	0	126	0	40	2742	2921
z020	0	0	0	0	0	0	0	0	0	0	0	269	269
z021	0	0	50	0	0	0	0	0	0	0	0	1330	1380
z022	0	0	159	0	40	19	0	0	0	0	0	872	1090
z023	0	101	226	0	0	0	0	0	0	0	0	357	684
z024	0	0	120	0	0	0	0	0	0	0	0	1257	1377
z025	0	0	0	0	608	20	0	0	0	18	99	256	1001
z026	0	0	0	0	0	0	0	0	0	0	0	10	10
z027	0	0	0	0	0	0	0	0	0	0	0	556	556
z029	0	0	0	0	0	0	0	0	0	0	0	118	118
z030	35	0	0	0	0	0	0	0	0	0	0	55	90
z031	0	0	0	0	0	0	0	0	0	0	0	490	490
z032	0	0	0	0	0	0	0	0	0	0	0	15	15
z033	0	0	0	0	0	0	0	0	0	0	0	367	367
z034	305	0	0	0	0	0	0	0	0	0	0	71	376
z035	76	0	0	0	0	0	0	0	0	0	0	17	93
z036	0	0	0	0	0	0	0	70	0	0	0	762	832
z038	0	0	87	0	38	0	0	0	355	0	0	2738	3218
z040	0	0	0	0	0	0	0	0	0	0	0	150	150
z041	245	0	0	0	0	0	0	0	0	0	0	352	597
z042	0	0	26	0	0	0	0	0	0	0	0	23	49
z043	0	0	206	0	133	0	0	0	0	0	0	189	528
z045	0	52	0	0	0	0	0	0	223	91	0	705	1071
z046	0	0	0	0	0	0	64	326	0	0	0	464	854
z047	0	0	153	0	0	0	63	161	0	0	0	574	951
z049	0	0	0	0	0	0	0	0	0	0	0	17	17
z050	0	0	0	0	0	0	0	0	0	0	0	71	71
TOTAL	785	246	3643	194	1342	382	783	2296	1128	1168	403	43605	55975

Table A4.3 (continued)

O\D	z050	others	TOTAL
z001	0	2257	2257
z002	0	3083	3083
z003	0	329	329
z004	0	985	985
z005	0	5088	5088
z006	0	1302	1302
z007	0	2498	2498
z008	0	3352	3352
z009	0	1020	1020
z010	0	708	708
z012	0	2574	2574
z013	0	3164	3164
z014	0	6559	6559
z015	0	483	483
z016	0	1775	1775
z017	0	677	677
z018	0	946	946
z019	0	2921	2921
z020	0	269	269
z021	0	1380	1380
z022	0	1090	1090
z023	0	684	684
z024	0	1377	1377
z025	38	963	1001
z026	0	10	10
z027	0	556	556
z029	0	118	118
z030	0	90	90
z031	0	490	490
z032	0	15	15
z033	0	367	367
z034	0	376	376
z035	0	93	93
z036	116	716	832
z038	0	3218	3218
z040	0	150	150
z041	0	597	597
z042	0	49	49
z043	0	528	528
z045	0	1071	1071
z046	0	854	854
z047	0	951	951
z049	0	17	17
z050	0	71	71
TOTAL	154	55821	55975

Table A4.4 Origin - Destination Commodity Flow table for group # 4 (General Freight)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	8	339	37	0	162	0	376	78	62	0	243	1950	3255
z002	0	0	0	0	0	0	0	0	0	0	48	605	653
z003	0	139	0	0	30	0	137	63	0	0	0	2517	2886
z004	82	0	0	32	123	0	6	25	0	0	123	1444	1835
z005	371	0	101	46	0	0	87	213	0	86	516	2624	4044
z006	0	0	0	0	0	0	7	0	0	0	0	11	18
z007	102	0	328	2	348	0	179	180	0	0	0	6131	7270
z008	398	23	37	67	100	0	332	159	236	63	24	2810	4249
z009	36	0	0	0	397	0	31	331	21	17	100	2501	3434
z010	0	0	0	0	0	0	0	49	0	0	11	669	729
z011	0	0	83	0	18	0	0	86	0	173	0	1028	1388
z012	562	59	77	51	594	0	723	131	157	35	30	3392	5811
z013	225	33	98	0	201	0	381	194	19	0	0	2726	3877
z014	404	0	176	59	399	39	604	550	0	0	3	5030	7264
z015	0	77	6	0	109	0	194	21	0	0	0	1636	2043
z016	123	0	40	0	138	0	251	16	0	0	0	1150	1718
z017	90	0	0	20	291	0	138	268	101	0	0	4102	5010
z018	0	0	4	0	0	0	49	23	0	0	0	403	479
z019	188	297	248	177	167	0	399	636	29	18	40	3568	5767
z020	741	11	117	0	115	0	553	268	0	0	0	1571	3376
z021	0	0	0	0	2	0	0	55	0	0	0	332	389
z022	24	0	0	0	128	0	151	0	0	0	0	554	857
z023	0	0	0	0	157	0	0	0	271	21	0	532	981
z024	36	0	0	0	0	0	157	0	105	0	0	2035	2333
z025	1	0	0	0	9	0	0	0	0	0	0	1387	1397
z026	135	0	0	0	0	0	49	6	260	0	0	1415	1865
z027	0	0	0	0	16	22	41	0	22	0	0	456	557
z028	0	0	0	0	0	0	0	0	0	0	0	467	467
z029	0	0	0	0	0	0	0	0	142	0	0	166	308
z030	0	0	0	0	46	0	5	185	5	0	1	291	533
z031	0	0	0	0	102	0	0	65	303	0	0	1468	1938
z032	0	0	0	0	15	0	0	0	0	0	0	438	453
z033	0	0	0	0	0	0	0	0	0	0	0	965	965
z034	0	0	0	0	19	0	0	0	0	0	0	664	683
z035	0	0	0	0	9	0	0	0	0	0	0	377	386
z036	28	0	25	0	38	0	130	0	0	0	0	966	1187
z038	320	89	87	25	99	0	206	174	164	17	0	5522	6703
z040	0	0	1	0	0	0	33	0	0	0	0	767	801
z041	28	0	0	0	21	0	105	82	84	0	0	1595	1915
z042	0	0	0	17	58	0	65	21	224	0	0	1250	1635
z043	0	0	0	63	22	0	96	0	0	0	221	1804	2206
z045	17	0	0	49	102	0	51	255	0	4	0	2343	2821
z046	87	313	65	39	82	0	280	119	45	0	324	2533	3887
z047	0	128	88	42	71	0	779	83	141	0	863	4335	6530
z049	0	156	18	70	6	0	0	41	0	0	280	809	1380
z050	0	0	1	0	0	0	0	0	0	0	27	737	765
TOTAL	4006	1664	1637	759	4194	61	6595	4377	2391	434	2854	80076	109048

Table A4.4 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	247	62	278	126	27	16	6	109	404	0	0	1980	3255
z002	19	0	0	22	0	0	0	0	0	0	0	612	653
z003	250	54	173	76	515	36	0	123	96	0	0	1563	2886
z004	55	22	31	0	0	0	0	0	14	0	0	1713	1835
z005	304	294	317	19	76	34	24	68	224	80	0	2604	4044
z006	0	0	0	0	0	0	0	0	0	0	0	18	18
z007	536	453	372	124	346	165	201	133	327	55	463	4095	7270
z008	349	295	328	43	285	80	0	96	346	0	0	2427	4249
z009	25	8	0	14	0	177	10	143	239	0	752	2066	3434
z010	28	0	22	0	17	0	0	0	141	0	0	521	729
z011	0	0	0	0	0	0	0	0	0	0	162	1226	1388
z012	0	0	0	0	3	0	79	99	131	45	132	5322	5811
z013	0	0	0	0	0	39	23	78	0	0	0	3737	3877
z014	0	0	0	0	0	6	4	282	97	28	51	6796	7264
z015	0	0	0	0	0	90	14	13	0	25	0	1901	2043
z016	0	0	0	0	0	0	0	169	0	18	0	1531	1718
z017	310	28	32	6	0	253	121	92	149	0	314	3705	5010
z018	22	0	2	1	0	0	0	0	0	0	0	454	479
z019	102	40	253	65	2	134	0	27	1	52	0	5091	5767
z020	0	0	0	0	0	0	12	0	61	0	0	3303	3376
z021	37	5	40	2	56	0	0	0	0	13	0	236	389
z022	0	0	347	0	39	0	35	0	5	0	0	431	857
z023	0	0	39	0	3	0	0	0	20	0	0	919	981
z024	124	0	68	0	54	178	0	0	9	0	0	1900	2333
z025	185	65	141	17	31	168	0	0	56	0	0	734	1397
z026	1	22	50	0	22	9	0	256	0	0	0	1505	1865
z027	11	0	76	0	0	0	0	52	24	0	0	394	557
z028	13	0	0	0	0	0	0	0	2	0	0	452	467
z029	87	0	0	0	0	0	0	0	0	0	0	221	308
z030	0	14	15	0	2	0	0	42	0	3	0	457	533
z031	74	23	127	293	4	0	0	343	0	0	0	1074	1938
z032	80	19	87	0	29	0	0	0	0	19	0	219	453
z033	0	164	112	13	0	0	0	37	0	0	0	639	965
z034	23	8	17	0	0	0	0	0	0	0	0	635	683
z035	54	0	57	0	0	0	0	0	0	0	0	275	386
z036	342	21	13	58	16	0	0	23	34	0	0	680	1187
z038	462	305	582	176	105	163	41	264	179	17	23	4386	6703
z040	350	0	67	0	0	0	0	47	0	0	0	337	801
z041	71	41	94	25	23	138	10	14	0	8	0	1491	1915
z042	74	166	112	0	4	216	75	11	0	0	0	977	1635
z043	242	81	196	477	173	271	0	52	79	0	0	635	2206
z045	385	411	143	96	120	19	0	139	52	0	0	1456	2821
z046	72	12	45	0	70	80	22	101	539	0	0	2946	3887
z047	482	157	120	79	436	279	230	83	443	79	63	4079	6530
z049	38	160	8	34	0	180	55	20	53	69	34	729	1380
z050	21	2	401	0	0	48	0	47	0	0	0	246	765
TOTAL	5475	2932	4765	1766	2458	2779	962	2963	3725	511	1994	78718	109048

Table A4.4 (continued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	0	94	0	0	0	0	0	0	0	0	0	3161	3255
z002	0	0	0	0	0	0	0	0	0	0	0	653	653
z003	174	0	0	0	0	0	0	0	0	0	0	2712	2886
z004	0	145	179	0	21	0	0	0	32	0	0	1458	1835
z005	69	0	21	0	0	12	0	0	31	72	37	3802	4044
z006	0	0	0	0	0	0	0	0	0	0	0	18	18
z007	120	73	34	2	70	10	30	21	0	13	48	6849	7270
z008	0	0	0	0	0	0	0	0	0	0	0	4249	4249
z009	105	0	162	90	32	0	0	0	34	0	20	2991	3434
z010	0	38	5	0	16	0	0	0	23	0	0	647	729
z011	0	0	0	0	0	0	0	0	9	0	0	1379	1388
z012	166	52	16	88	38	0	0	30	180	47	117	5077	5811
z013	0	508	35	0	35	0	0	35	169	163	67	2865	3877
z014	83	143	56	254	451	14	0	23	494	34	157	5555	7264
z015	197	606	13	0	48	0	0	4	47	0	66	1062	2043
z016	0	20	60	0	42	0	0	2	65	4	0	1525	1718
z017	51	30	26	73	43	0	58	28	121	16	275	4289	5010
z018	0	0	0	0	3	0	13	12	68	0	0	383	479
z019	0	206	0	175	116	23	27	0	187	28	76	4929	5767
z020	0	0	9	0	22	0	0	0	0	0	0	3345	3376
z021	0	0	0	0	0	0	0	0	0	0	0	389	389
z022	0	10	0	0	0	0	0	0	0	0	0	847	857
z023	0	0	0	0	10	0	0	0	0	0	0	971	981
z024	0	0	38	1	55	4	0	0	0	0	0	2235	2333
z025	82	83	0	1	73	0	0	0	0	0	0	1158	1397
z026	46	5	0	0	139	0	7	0	0	97	0	1571	1865
z027	14	23	102	0	0	0	35	0	0	0	0	383	557
z028	0	0	0	0	0	0	86	0	0	0	0	381	467
z029	0	0	0	0	0	0	58	0	0	0	0	250	308
z030	0	0	0	0	0	0	0	12	9	19	68	425	533
z031	0	0	0	0	0	0	0	6	59	32	189	1652	1938
z032	0	0	0	0	0	0	0	0	15	27	5	406	453
z033	0	0	0	0	0	0	0	13	81	16	151	704	965
z034	0	0	0	0	0	0	0	0	0	0	174	509	683
z035	0	0	0	0	0	0	0	0	0	0	0	386	386
z036	29	3	0	0	2	0	38	0	0	28	142	945	1187
z038	111	728	3	8	502	7	38	0	41	132	46	5087	6703
z040	33	1	0	0	8	0	87	0	0	0	0	672	801
z041	0	0	0	0	48	106	0	0	80	8	0	1673	1915
z042	4	23	0	101	62	0	132	0	0	8	8	1297	1635
z043	16	7	13	0	0	0	0	0	2	0	0	2168	2206
z045	0	0	0	0	2	0	0	0	0	0	0	2819	2821
z046	0	0	0	0	83	0	0	0	0	0	0	3804	3887
z047	0	0	832	11	11	17	0	0	0	50	0	5609	6530
z049	27	0	0	0	0	0	0	0	0	0	0	1353	1380
z050	0	0	0	0	0	0	0	0	0	0	0	765	765
TOTAL	1327	2798	1604	804	1932	193	609	186	1747	794	1646	95408	109048

Table A4.4 (continued)

O\D	z034	z035	z036	z038	z039	z040	z041	z042	z043	z045	z046	others	TOTAL
z001	0	0	0	182	0	0	0	0	0	335	0	2738	3255
z002	0	0	0	104	0	0	0	0	0	0	143	406	653
z003	0	0	53	545	0	0	0	0	24	0	352	1912	2886
z004	0	0	17	150	0	0	63	0	76	398	134	997	1835
z005	0	0	18	190	0	78	0	0	120	76	233	3329	4044
z006	0	0	0	0	0	0	0	11	0	0	0	7	18
z007	7	7	213	285	0	101	25	237	257	200	605	5333	7270
z008	0	0	0	178	0	2	0	0	0	0	267	3802	4249
z009	7	0	0	194	0	37	40	50	19	147	116	2824	3434
z010	0	0	209	53	0	0	0	75	0	4	0	388	729
z011	0	0	0	0	0	0	48	57	25	54	468	736	1388
z012	14	291	104	400	0	189	101	146	205	148	134	4079	5811
z013	17	0	68	211	0	342	41	116	183	74	62	2763	3877
z014	76	18	238	838	44	627	100	285	133	59	15	4831	7264
z015	0	0	0	93	0	0	44	34	85	64	132	1591	2043
z016	0	0	39	58	0	139	4	80	0	39	178	1181	1718
z017	0	61	108	188	0	121	37	141	320	113	595	3326	5010
z018	0	0	0	9	0	0	22	72	0	21	0	355	479
z019	31	0	0	228	0	0	73	115	341	49	349	4581	5767
z020	0	0	13	379	0	0	0	80	85	285	261	2273	3376
z021	0	0	0	61	0	0	0	49	17	26	0	236	389
z022	0	0	0	35	0	0	0	0	0	0	48	774	857
z023	0	0	51	272	0	0	12	123	0	2	0	521	981
z024	0	0	6	1069	0	0	0	11	2	113	303	829	2333
z025	12	0	0	329	0	0	32	48	0	64	0	912	1397
z026	0	0	153	484	0	0	57	0	0	0	0	1171	1865
z027	0	1	0	0	0	0	7	94	6	0	0	449	557
z028	0	0	0	0	0	0	0	0	0	361	0	106	467
z029	0	0	0	0	0	0	10	11	0	0	0	287	308
z030	0	79	0	0	0	0	0	0	0	1	0	453	533
z031	8	0	0	184	0	0	60	22	29	2	0	1633	1938
z032	97	0	0	0	0	0	0	60	0	0	0	296	453
z033	347	0	0	0	0	0	31	0	0	0	0	587	965
z034	107	223	0	9	0	7	84	12	0	0	0	241	683
z035	0	32	0	0	0	0	234	0	0	0	0	120	386
z036	4	0	0	19	0	0	0	72	0	0	0	1092	1187
z038	24	0	0	50	0	119	92	179	23	264	258	5694	6703
z040	0	0	0	0	0	0	36	138	0	0	0	627	801
z041	138	362	0	106	0	53	0	0	0	248	0	1008	1915
z042	29	0	48	86	0	91	0	0	0	0	0	1381	1635
z043	0	0	16	55	0	0	0	42	0	0	52	2041	2206
z045	0	0	0	15	0	0	0	0	0	0	709	2097	2821
z046	0	0	112	254	0	0	62	0	270	811	0	2378	3887
z047	0	0	51	494	0	8	0	0	19	391	0	5567	6530
z049	0	0	0	131	0	0	0	0	0	0	0	1249	1380
z050	0	0	0	218	0	0	0	0	0	0	0	547	765
TOTAL	918	1074	1517	8156	44	1914	1315	2360	2239	4349	5414	79748	109048

Table A4.4 (continued)

O\D	z047	z049	z050	others	TOTAL
z001	0	0	0	3255	3255
z002	289	28	0	336	653
z003	46	0	0	2840	2886
z004	107	0	0	1728	1835
z005	219	0	8	3817	4044
z006	0	0	0	18	18
z007	354	147	97	6672	7270
z008	541	0	0	3708	4249
z009	53	0	27	3354	3434
z010	38	0	0	691	729
z011	156	49	0	1183	1388
z012	194	117	126	5374	5811
z013	258	190	12	3417	3877
z014	91	152	177	6844	7264
z015	40	0	21	1982	2043
z016	193	0	40	1485	1718
z017	372	20	0	4618	5010
z018	158	0	0	321	479
z019	692	64	112	4899	5767
z020	327	37	0	3012	3376
z021	26	0	0	363	389
z022	0	35	0	822	857
z023	0	0	0	981	981
z024	0	0	0	2333	2333
z025	0	0	0	1397	1397
z026	67	0	0	1798	1865
z027	0	11	0	546	557
z028	5	0	0	462	467
z029	0	0	0	308	308
z030	27	0	0	506	533
z031	0	13	0	1925	1938
z032	0	0	0	453	453
z033	0	0	0	965	965
z034	0	0	0	683	683
z035	0	0	0	386	386
z036	66	0	56	1065	1187
z038	409	9	162	6123	6703
z040	0	0	0	801	801
z041	0	22	0	1893	1915
z042	0	0	0	1635	1635
z043	30	0	0	2176	2206
z045	252	0	0	2569	2821
z046	0	0	0	3887	3887
z047	0	0	0	6530	6530
z049	0	0	0	1380	1380
z050	0	0	0	765	765
TOTAL	5074	894	838	102242	109048

Table A4.5 Origin - Destination Commodity Flow table for group # 5 (Metal Products).

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	0	0	0	0	0	0	0	237	1005	687	0	2617	4546
z002	0	0	0	0	0	0	0	0	0	0	0	421	421
z003	46	0	0	337	0	0	0	0	628	0	0	661	1672
z004	866	0	129	44	78	0	0	0	0	0	0	2022	3139
z005	67	0	59	0	0	0	29	0	0	0	0	1286	1441
z007	0	9	521	0	336	0	25	313	0	0	32	5752	6988
z008	147	0	181	197	0	0	154	0	538	45	0	2043	3305
z009	1586	3647	86	0	2241	0	11	1832	175	0	673	12037	22288
z010	74	136	0	0	0	0	37	171	0	0	0	2043	2461
z011	0	0	0	0	0	0	0	105	141	11	0	449	706
z012	382	0	192	843	720	0	1268	278	1391	0	0	2506	7580
z013	120	0	174	0	163	55	197	290	11	432	4	1668	3114
z014	342	0	0	14	0	52	162	240	0	196	0	2797	3803
z015	4	0	0	50	32	0	342	44	0	0	0	1741	2213
z016	23	0	0	0	0	0	314	0	0	0	0	1676	2013
z017	41	0	0	86	0	0	226	408	0	27	0	3203	3991
z018	617	0	0	0	0	0	13	148	0	0	0	97	875
z019	56	76	355	109	99	0	648	172	66	0	12	2660	4253
z020	242	0	569	0	0	0	252	322	33	0	0	1586	3004
z021	0	0	0	0	1	0	4	7	0	0	0	289	301
z022	0	0	0	0	0	0	0	0	0	124	0	434	558
z023	0	0	17	0	65	29	0	0	0	0	0	141	252
z024	0	0	0	0	166	0	0	0	50	0	0	1175	1391
z025	0	0	0	0	0	0	321	9	41	167	0	444	982
z026	0	0	0	0	354	0	189	376	0	0	0	2388	3307
z027	0	0	0	0	0	0	154	0	0	0	0	159	313
z028	0	0	0	647	0	0	0	0	0	0	0	812	1459
z029	0	0	0	0	0	0	0	0	0	0	0	34	34
z030	0	2	0	0	0	0	30	7	0	0	0	461	500
z031	0	0	0	0	0	0	247	424	0	375	27	1180	2253
z032	0	0	0	0	0	0	346	0	0	0	0	191	537
z033	0	367	0	0	0	0	211	397	623	214	0	597	2409
z034	0	0	0	0	0	0	0	0	0	0	0	157	157
z035	0	0	0	0	0	0	0	0	0	0	0	35	35
z036	0	0	0	434	0	0	179	230	0	0	0	2328	3171
z038	1169	937	199	42	66	174	915	1320	739	327	0	5939	11827
z040	0	0	0	0	0	0	0	0	0	25	0	178	203
z041	0	6	0	55	137	0	0	0	45	0	0	493	736
z042	0	0	86	12	72	0	0	0	81	246	0	1086	1583
z043	0	0	0	0	159	0	84	0	638	43	0	1574	2498
z045	46	0	179	50	169	0	111	469	246	0	0	2408	3678
z046	0	311	0	0	0	0	249	154	315	0	0	4152	5181
z047	0	34	164	0	119	0	287	451	201	414	27	3040	4737
z049	0	0	0	127	0	0	85	0	0	50	0	171	433
z050	0	0	0	0	0	0	0	21	0	0	0	134	155
TOTAL	5828	5525	2911	3047	4977	310	7090	8425	6967	3383	775	77265	126503

Table A4.5 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	898	19	166	0	0	628	0	158	347	0	0	2330	4546
z002	0	0	0	0	0	241	0	0	0	0	0	180	421
z003	0	0	287	0	0	0	0	58	0	0	0	1327	1672
z004	1058	0	0	384	8	0	0	0	0	0	0	1689	3139
z005	398	0	79	0	0	0	0	364	96	0	0	504	1441
z007	160	4	191	0	933	278	176	169	633	0	405	4039	6988
z008	198	0	181	103	0	127	76	148	0	80	0	2392	3305
z009	1334	692	114	0	328	653	44	1665	859	123	0	16476	22288
z010	65	0	90	0	0	226	0	0	0	0	0	2080	2461
z011	0	0	0	0	0	0	0	6	0	0	0	700	706
z012	0	0	0	0	0	66	0	123	0	214	0	7177	7580
z013	0	0	0	0	0	0	0	96	0	138	181	2699	3114
z014	0	0	5	0	0	227	0	51	0	0	0	3520	3803
z015	0	0	0	0	0	0	0	56	1346	0	0	811	2213
z016	0	0	0	0	0	0	0	17	220	0	0	1776	2013
z017	793	0	17	77	0	169	0	87	96	0	0	2752	3991
z018	0	0	0	0	0	0	0	0	0	0	0	875	875
z019	182	218	88	0	0	90	0	22	0	22	0	3631	4253
z020	0	0	0	0	0	0	0	46	0	0	0	2958	3004
z021	0	12	0	0	0	0	0	1	0	15	0	273	301
z022	0	0	0	0	0	0	0	0	0	0	0	558	558
z023	0	0	0	0	0	0	0	0	0	0	0	252	252
z024	0	0	449	0	0	0	0	0	0	0	0	942	1391
z025	0	0	9	0	0	0	0	0	112	0	0	861	982
z026	59	0	51	0	0	363	0	0	0	0	0	2834	3307
z027	0	0	0	0	0	0	0	9	0	0	0	304	313
z028	0	0	0	0	0	0	0	0	0	0	0	1459	1459
z029	0	0	0	0	0	0	0	0	0	0	0	34	34
z030	0	289	1	0	0	0	0	16	0	0	0	194	500
z031	0	213	252	0	17	240	0	0	0	0	0	1531	2253
z032	123	18	50	0	0	0	0	0	0	0	0	346	537
z033	58	0	123	0	154	84	0	14	0	0	0	1976	2409
z034	0	0	46	0	0	0	0	0	0	0	0	111	157
z035	5	0	0	0	0	0	0	0	0	0	0	30	35
z036	260	0	61	286	0	15	0	120	10	0	0	2419	3171
z038	387	156	487	256	237	660	103	205	332	63	54	8887	11827
z040	0	0	68	0	0	0	0	0	0	0	0	135	203
z041	0	50	82	0	0	0	0	0	85	0	0	519	736
z042	160	70	184	0	0	0	0	25	0	0	245	899	1583
z043	180	132	52	0	40	101	28	247	117	0	0	1601	2498
z045	120	111	0	0	14	172	0	33	40	0	0	3188	3678
z046	432	79	261	0	0	7	0	223	323	0	114	3742	5181
z047	128	238	199	6	52	92	0	1381	26	0	27	2588	4737
z049	151	0	0	0	0	0	0	0	0	0	0	282	433
z050	0	0	0	0	0	0	0	0	0	0	0	155	155
TOTAL	7149	2301	3593	1112	1783	4439	427	5340	4642	655	1026	94036	126503

Table A4.5 (continued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	0	0	0	9	0	0	0	0	0	0	0	4537	4546
z002	0	0	0	0	0	0	0	0	0	0	0	421	421
z003	0	0	0	0	0	0	0	0	0	0	0	1672	1672
z004	0	0	0	0	0	0	0	0	0	3	0	3136	3139
z005	0	0	0	38	0	0	0	0	0	0	0	.403	1441
z007	0	0	12	0	0	0	0	26	0	85	0	6865	6988
z008	0	0	0	0	100	0	0	0	119	18	164	2904	3305
z009	1645	0	43	33	360	0	0	0	56	169	356	19626	22288
z010	0	384	0	0	0	0	0	0	0	0	159	1918	2461
z011	0	0	0	0	0	0	0	0	0	0	0	706	706
z012	0	0	49	0	0	0	0	44	9	20	144	7314	7580
z013	0	0	48	0	0	0	0	17	43	77	52	2877	3114
z014	0	0	0	176	71	0	6	0	71	0	70	3409	3803
z015	0	0	0	0	0	0	0	0	45	0	0	2168	2213
z016	0	0	774	56	0	0	0	0	0	0	0	1183	2013
z017	291	0	0	0	0	0	0	0	0	0	7	3693	3991
z018	0	0	0	0	0	0	0	0	0	0	0	875	875
z019	0	0	0	0	0	0	0	1	54	124	12	4062	4253
z020	0	0	0	0	54	0	0	0	0	0	0	2950	3004
z021	0	0	0	0	0	0	0	77	0	0	0	224	301
z022	0	0	0	0	0	0	0	0	0	0	0	558	558
z023	0	0	0	0	0	0	0	0	0	0	0	252	252
z024	0	0	19	40	0	31	0	0	0	0	0	1301	1391
z025	10	176	0	0	0	0	0	0	30	0	0	766	982
z026	0	0	0	0	19	0	0	0	0	0	0	3288	3307
z027	3	0	0	0	0	0	1	0	0	0	12	297	313
z028	0	0	236	0	0	0	0	0	0	0	0	1223	1459
z029	0	0	0	0	0	0	26	0	8	0	0	0	34
z030	0	0	0	0	0	0	0	0	63	0	1	436	500
z031	0	18	0	0	0	0	0	0	23	0	0	2207	2253
z032	0	0	0	0	0	0	0	0	0	0	0	537	537
z033	0	0	0	0	0	0	0	0	0	0	10	2399	2409
z034	0	0	0	0	0	0	0	0	0	0	31	126	157
z035	0	0	0	0	0	16	0	0	0	0	0	19	35
z036	0	41	0	0	4	0	0	0	0	0	25	3101	3171
z038	0	209	0	0	159	12	187	158	17	38	85	10962	11827
z040	0	0	0	0	0	0	0	38	0	0	37	128	203
z041	0	0	0	0	0	0	0	0	0	0	0	736	736
z042	0	0	0	0	0	0	0	0	0	0	0	1583	1583
z043	25	17	39	0	0	0	0	0	0	74	0	2343	2498
z045	0	0	36	0	0	0	0	0	0	0	68	3574	3678
z046	0	0	0	0	0	0	0	0	0	0	0	5181	5181
z047	0	0	0	0	76	0	0	0	7	0	168	4486	4737
z049	0	17	0	0	0	0	0	0	0	0	0	416	433
z050	0	0	0	0	0	0	0	0	0	0	0	155	155
TOTAL	1974	862	1256	352	843	59	220	361	550	608	1401	118017	126503

Table A4.5 (continued)

O\D	z034	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	0	0	392	0	0	0	0	0	0	0	0	4154	4546
z002	0	0	0	0	0	0	0	0	0	35	145	241	421
z003	0	0	0	0	0	0	0	0	0	0	316	1356	1672
z004	0	0	0	249	0	0	0	0	0	114	163	2613	3139
z005	0	0	0	0	0	0	65	0	138	0	108	1130	1441
z007	0	0	113	250	859	195	291	405	173	54	274	4374	6988
z008	0	0	0	298	25	49	100	0	0	118	139	2576	3305
z009	31	0	333	1107	147	127	136	84	368	139	1091	18725	22288
z010	0	0	38	120	82	41	123	24	614	0	77	1342	2461
z011	0	0	49	0	258	36	30	0	0	0	70	263	706
z012	47	0	181	124	208	31	132	251	46	103	567	5890	7580
z013	0	0	0	472	0	21	69	0	0	244	210	2098	3114
z014	79	145	18	583	0	18	268	235	176	20	478	1783	3803
z015	0	0	0	52	82	0	10	0	0	29	121	1919	2213
z016	0	0	0	43	0	112	0	108	292	0	54	1404	2013
z017	51	0	114	0	16	59	87	185	301	298	355	2525	3991
z018	8	0	0	89	0	0	0	0	0	0	0	778	875
z019	35	0	0	0	184	0	52	0	100	261	1119	2502	4253
z020	3	0	0	438	0	0	117	134	147	171	476	1518	3004
z021	0	0	0	0	0	0	0	8	17	84	71	121	301
z022	0	0	0	80	0	0	0	0	0	0	201	277	558
z023	0	0	0	0	0	0	103	0	0	38	0	111	252
z024	0	0	73	436	0	0	0	24	28	0	25	805	1391
z025	0	0	0	107	0	0	0	0	0	0	0	875	982
z026	0	0	0	313	0	0	0	0	613	186	784	1411	3307
z027	0	0	0	66	0	0	0	0	0	68	0	179	313
z028	0	0	0	0	0	0	0	0	0	0	576	883	1459
z029	0	0	0	0	0	0	0	0	0	0	0	34	34
z030	0	0	0	0	0	0	0	0	91	0	0	409	500
z031	0	14	0	0	0	0	0	0	138	260	0	1841	2253
z032	0	0	0	0	0	0	0	0	0	0	0	537	537
z033	51	0	0	75	0	23	5	0	0	0	0	2255	2409
z034	35	43	0	0	0	2	0	0	0	0	0	77	157
z035	0	14	0	0	0	0	0	0	0	0	0	21	35
z036	0	0	0	2	0	0	13	197	715	0	505	1739	3171
z038	0	0	0	0	0	0	99	0	816	252	694	9966	11827
z040	0	0	0	0	0	16	0	0	0	0	19	168	203
z041	73	171	0	32	0	0	0	0	0	0	0	460	736
z042	0	0	118	268	16	0	0	0	0	0	0	1181	1583
z043	0	0	0	171	0	69	78	0	0	1	203	1976	2498
z045	0	0	196	108	0	0	0	0	0	810	700	1864	3678
z046	0	0	45	846	0	0	0	720	1102	0	0	2468	5181
z047	0	0	227	271	21	0	0	0	121	0	0	4097	4737
z049	0	0	3	0	0	0	0	0	0	0	0	430	433
z050	0	0	12	122	0	0	0	0	0	0	0	21	155
TOTAL	413	387	1912	6722	1898	799	1778	2375	5996	3285	9541	91397	126503

Table A4.5 (continued)

O\D	z049	z050	others	TOTAL
z001	0	0	4546	4546
z002	0	0	421	421
z003	0	0	1672	1672
z004	0	43	3096	3139
z005	0	0	1441	1441
z007	66	0	6922	6988
z008	0	0	3305	3305
z009	0	0	22288	22288
z010	0	0	2461	2461
z011	0	0	706	706
z012	147	0	7433	7580
z013	0	0	3114	3114
z014	100	0	3703	3803
z015	0	0	2213	2213
z016	0	0	2013	2013
z017	200	0	3791	3991
z018	0	0	875	875
z019	0	96	4157	4253
z020	0	0	3004	3004
z021	4	0	297	301
z022	153	0	405	558
z023	0	0	252	252
z024	50	0	1341	1391
z025	0	0	982	982
z026	0	0	3307	3307
z027	0	0	313	313
z028	0	0	1459	1459
z029	0	0	34	34
z030	0	0	500	500
z031	0	0	2253	2253
z032	0	0	537	537
z033	0	0	2409	2409
z034	0	0	157	157
z035	0	0	35	35
z036	14	60	3097	3171
z038	259	14	11554	11827
z040	0	0	203	203
z041	0	0	736	736
z042	0	0	1583	1583
z043	0	0	2498	2498
z045	0	0	3678	3678
z046	0	0	5181	5181
z047	0	0	4737	4737
z049	0	0	433	433
z050	0	0	155	155
TOTAL	993	213	125297	126503

Table A4.6 Origin - Destination Commodity Flow table for group # 6 (Non-Metal Products)

O\D	z001	z003	z004	z005	z007	z008	z009	z010	z011	z012	z013	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	0	1005	1005
z002	0	0	0	0	0	0	0	0	0	70	0	0	70
z003	0	0	0	0	54	0	0	0	0	0	0	766	820
z004	0	0	0	24	0	0	0	0	308	2	0	2779	3113
z005	0	0	0	0	0	159	0	0	0	0	175	1580	1914
z006	0	79	0	0	0	0	0	0	92	0	146	347	664
z007	129	645	0	0	0	106	0	0	0	551	0	5403	6834
z008	0	0	0	0	0	0	258	0	2	70	0	1178	1508
z009	165	0	107	0	48	369	0	0	0	61	0	1497	2247
z010	0	0	0	0	0	132	0	0	0	26	0	207	365
z011	0	0	0	466	0	30	0	0	0	0	0	118	614
z012	322	0	292	214	1510	604	0	332	0	0	0	2980	6254
z013	0	140	0	0	0	45	0	0	0	0	0	1102	1287
z014	1141	0	0	440	619	47	0	0	0	0	0	1460	3707
z015	0	0	0	0	155	0	0	0	0	0	0	828	983
z016	0	0	0	0	0	3	0	21	0	0	0	1616	1640
z017	21	38	0	1048	780	0	48	95	0	2158	0	2784	6972
z018	0	0	0	0	128	0	0	0	0	0	0	464	592
z019	0	0	6	181	148	30	0	0	0	1	0	809	1175
z020	0	0	0	212	225	171	399	0	0	0	0	928	1935
z021	0	63	0	0	0	0	0	0	0	0	0	220	283
z022	0	0	0	0	147	0	0	0	0	0	0	217	364
z023	0	0	0	0	0	0	299	0	0	0	0	2676	2975
z024	0	0	0	0	0	0	0	0	0	0	0	466	466
z025	0	0	0	0	0	0	0	0	0	0	0	482	482
z026	0	0	0	0	0	0	0	0	0	0	0	678	678
z027	0	0	0	0	0	0	0	0	0	0	0	1581	1581
z028	0	0	0	0	0	0	0	0	0	4	0	0	4
z029	0	0	0	0	0	0	0	0	0	0	0	32	32
z030	0	0	0	0	0	0	0	0	0	0	0	64	64
z031	0	0	0	0	53	39	0	0	0	0	0	711	803
z032	0	0	0	0	0	0	0	0	0	0	0	28	28
z033	0	0	0	0	0	0	0	0	0	0	0	53	53
z034	0	0	0	0	0	0	0	0	0	0	0	337	337
z035	0	0	0	0	0	0	0	0	0	0	0	117	117
z036	0	0	0	0	308	0	0	0	0	0	0	2215	2523
z038	0	0	0	0	112	5	164	0	0	105	63	1388	1837
z041	0	0	0	0	0	0	0	0	0	0	0	881	881
z042	0	0	0	0	0	0	0	0	0	0	0	235	235
z043	0	0	57	0	195	0	113	0	0	21	246	584	1216
z045	0	0	0	0	7	93	237	0	0	164	41	477	1019
z046	0	0	0	0	0	0	0	0	0	0	0	598	598
z047	0	0	398	0	0	424	284	0	0	186	212	1594	3098
z049	0	0	0	0	0	0	0	376	0	0	0	0	376
TOTAL	1778	965	860	2585	4489	2257	1802	824	402	3419	883	43485	63749

Table A4.6 (Continued)

O\D	z014	z015	z016	z017	z018	z019	z020	z021	z022	z023	z024	others	TOTAL
z001	240	0	0	225	0	0	41	0	0	0	0	499	1005
z002	0	0	0	0	0	0	0	0	0	0	0	70	70
z003	165	0	0	55	0	409	0	0	0	0	0	191	820
z004	0	615	0	0	0	0	0	0	0	981	516	1001	3113
z005	783	117	0	0	0	213	0	0	0	0	0	801	1914
z006	177	0	0	0	0	0	79	0	0	0	0	408	664
z007	565	374	245	240	0	665	0	1	314	0	99	4331	6834
z008	163	0	0	87	0	635	0	0	0	0	0	623	1508
z009	0	0	0	284	0	0	0	0	0	0	0	1963	2247
z010	0	0	115	0	0	0	0	0	0	0	0	250	365
z011	0	0	0	118	0	0	0	0	0	0	0	496	614
z012	0	0	0	464	66	2	0	350	0	0	0	5372	6254
z013	0	0	0	102	0	0	0	0	0	0	0	1185	1287
z014	0	0	0	460	23	176	0	0	67	0	0	2981	3707
z015	0	0	0	161	11	0	0	0	227	0	40	544	983
z016	0	0	0	0	0	0	205	0	0	230	100	1105	1640
z017	616	382	0	340	33	475	0	0	0	0	0	5126	6972
z018	0	0	0	0	0	0	0	0	0	0	0	592	592
z019	0	0	88	165	0	38	0	0	0	0	0	884	1175
z020	0	0	0	0	215	0	307	15	0	0	0	1398	1935
z021	0	0	203	0	0	0	0	17	0	0	0	63	283
z022	0	0	0	17	0	0	0	0	0	0	0	347	364
z023	0	0	0	0	0	2028	0	0	0	0	0	947	2975
z024	0	0	0	0	0	0	0	0	0	0	0	466	466
z025	0	0	0	0	0	0	0	0	0	0	220	262	482
z026	0	0	0	0	0	0	0	0	0	0	1	677	678
z027	0	17	0	0	134	0	0	0	0	337	0	1093	1581
z028	0	0	0	0	0	0	0	0	0	0	0	4	4
z029	0	0	0	0	0	0	0	0	0	0	0	32	32
z030	0	0	0	0	0	0	0	0	0	0	0	64	64
z031	0	0	0	0	0	34	0	0	0	0	0	769	803
z032	0	0	0	0	0	0	0	0	0	0	0	28	28
z033	0	0	0	0	0	0	0	0	0	0	0	53	53
z034	27	0	0	0	0	0	0	0	0	0	0	310	337
z035	49	0	0	0	0	0	0	0	0	0	0	68	117
z036	306	0	0	0	0	68	0	0	0	0	0	2149	2523
z038	55	0	0	24	0	0	270	0	0	0	41	1447	1837
z041	0	0	0	0	0	0	0	0	0	99	0	782	881
z042	107	0	5	0	32	17	0	0	0	0	0	74	235
z043	24	0	0	0	0	153	249	0	0	0	0	790	1216
z045	69	0	0	117	0	113	0	0	0	178	0	542	1019
z046	0	0	0	0	462	0	0	0	0	0	0	136	598
z047	187	0	0	197	307	88	41	0	0	0	0	2278	3098
z049	0	0	0	0	0	0	0	0	0	0	0	376	376
TOTAL	3533	1505	656	3056	1283	5114	1192	383	608	1825	1017	43577	63749

Table A4.6 (continued)

O\D	z025	z026	z027	z028	z029	z030	z031	z032	z033	z034	z035	others	TOTAL
z001	44	0	0	0	0	80	0	0	0	0	0	881	1005
z002	0	0	0	0	0	0	0	0	0	0	0	70	70
z003	120	0	0	0	0	0	0	0	0	0	0	700	820
z004	31	0	0	0	0	0	0	0	92	0	0	2990	3113
z005	0	0	0	0	0	0	7	74	0	0	0	1833	1914
z006	0	0	91	0	0	0	0	0	0	0	0	573	664
z007	0	125	74	0	0	49	0	0	623	0	0	5963	6834
z008	0	0	0	0	0	0	257	0	0	0	0	1251	1508
z009	0	0	0	62	0	0	182	206	18	0	0	1779	2247
z010	0	0	0	0	0	0	92	0	0	0	0	273	365
z011	0	0	0	0	0	0	0	0	0	0	0	614	614
z012	0	64	0	0	0	0	136	207	95	564	0	5188	6254
z013	0	0	0	0	0	0	3	0	28	0	0	1256	1287
z014	0	0	57	0	0	0	90	258	0	8	0	3294	3707
z015	0	0	0	0	0	0	0	0	0	0	0	983	983
z016	0	0	0	0	0	0	0	0	0	0	0	1640	1640
z017	31	0	0	0	0	0	6	0	279	0	0	6656	6972
z018	0	0	0	0	0	0	0	0	0	0	0	592	592
z019	0	0	0	0	0	0	0	0	0	0	0	1175	1175
z020	0	0	77	0	0	0	0	151	0	0	0	1707	1935
z021	0	0	0	0	0	0	0	0	0	0	0	283	283
z022	0	0	0	0	0	0	0	0	0	0	0	364	364
z023	0	0	0	198	0	0	0	0	0	0	0	2777	2975
z024	150	24	75	0	0	0	0	0	0	0	0	217	466
z025	0	0	0	262	0	0	0	0	0	0	0	220	482
z026	353	282	0	0	0	0	0	0	0	0	42	1	678
z027	174	784	0	0	0	0	0	135	0	0	0	488	1581
z028	0	0	0	0	0	0	0	0	0	0	0	4	4
z029	0	0	32	0	0	0	0	0	0	0	0	0	32
z030	0	0	0	0	0	64	0	0	0	0	0	0	64
z031	0	0	0	0	0	0	9	0	596	72	0	126	803
z032	0	0	0	0	0	0	0	28	0	0	0	0	28
z033	0	0	0	0	0	0	1	0	52	0	0	0	53
z034	0	0	0	0	0	0	0	0	0	310	0	27	337
z035	0	0	0	0	0	0	0	0	0	0	68	49	117
z036	1276	20	18	0	254	0	0	0	0	0	0	955	2523
z038	0	69	322	14	0	0	87	0	0	0	0	1345	1837
z041	0	0	0	0	0	0	0	0	0	166	616	99	881
z042	0	0	0	0	0	0	0	0	0	0	0	235	235
z043	0	67	0	0	0	0	0	0	0	0	0	1149	1216
z045	0	0	0	0	0	0	0	0	0	0	0	1019	1019
z046	0	0	0	0	0	0	0	0	0	0	0	598	598
z047	0	0	0	0	0	0	457	0	47	149	0	2445	3098
z049	0	0	0	0	0	0	0	0	0	0	0	376	376
TOTAL	2179	1435	746	536	254	193	1327	1059	1830	1269	726	52195	63749

Table A4.6 (continued)

O\D	z036	z038	z040	z041	z042	z043	z045	z046	z047	z049	z050	others	TOTAL
z001	142	0	233	0	0	0	0	0	0	0	0	630	1005
z002	0	0	0	0	0	0	0	0	0	0	0	70	70
z003	0	17	0	0	0	0	0	0	0	0	0	803	820
z004	41	503	0	0	0	0	0	0	0	0	0	2569	3113
z005	0	0	0	0	0	0	0	386	0	0	0	1528	1914
z006	0	0	0	0	0	0	0	0	0	0	0	664	664
z007	0	139	106	0	0	0	1278	241	128	137	0	4805	6834
z008	0	0	0	0	36	0	0	0	0	0	0	1472	1508
z009	0	294	373	0	0	53	25	0	0	0	0	1502	2247
z010	0	0	0	0	0	0	0	0	0	0	0	365	365
z011	0	0	0	0	0	0	0	0	0	0	0	614	614
z012	0	95	0	11	0	0	926	0	0	0	0	5222	6254
z013	0	49	0	896	0	24	0	0	0	0	0	318	1287
z014	0	157	0	67	40	0	57	0	0	0	0	3386	3707
z015	0	0	63	0	0	122	204	0	0	0	0	594	983
z016	0	109	0	85	0	887	0	0	0	0	0	559	1640
z017	0	410	0	0	0	0	212	0	0	0	0	6350	6972
z018	71	182	0	92	0	0	0	0	119	0	0	128	592
z019	0	518	0	0	0	0	0	0	0	0	0	657	1175
z020	0	54	0	0	0	0	0	109	0	0	0	1772	1935
z021	0	0	0	0	0	0	0	0	0	0	0	283	283
z022	0	0	0	0	0	0	0	0	200	0	0	164	364
z023	0	216	0	0	0	0	158	76	0	0	0	2525	2975
z024	0	217	0	0	0	0	0	0	0	0	0	249	466
z025	0	0	0	0	0	0	0	0	0	0	0	482	482
z026	0	0	0	0	0	0	0	0	0	0	0	678	678
z027	0	0	0	0	0	0	0	0	0	0	0	1581	1581
z028	0	0	0	0	0	0	0	0	0	0	0	4	4
z029	0	0	0	0	0	0	0	0	0	0	0	32	32
z030	0	0	0	0	0	0	0	0	0	0	0	64	64
z031	0	0	0	0	0	0	0	0	0	0	0	803	803
z032	0	0	0	0	0	0	0	0	0	0	0	28	28
z033	0	0	0	0	0	0	0	0	0	0	0	53	53
z034	0	0	0	0	0	0	0	0	0	0	0	337	337
z035	0	0	0	0	0	0	0	0	0	0	0	117	117
z036	0	0	0	0	0	0	56	0	217	0	0	2250	2523
z038	0	43	0	0	0	0	0	0	354	0	109	1331	1837
z041	0	0	0	0	0	0	0	0	0	0	0	881	881
z042	0	74	0	0	0	0	0	0	0	0	0	161	235
z043	0	38	0	0	26	0	0	0	27	0	0	1125	1216
z045	0	0	0	0	0	0	0	0	0	0	0	1019	1019
z046	0	0	0	0	0	85	0	0	0	0	51	462	598
z047	43	78	0	0	0	0	0	0	0	0	0	2977	3098
z049	0	0	0	0	0	0	0	0	0	0	0	376	376
TOTAL	297	3193	775	1151	102	1171	2916	812	1045	137	160	51990	63749

Table A4.7 Origin - Destination Commodity Flow table for group # 7 (Fabricated Products)

O\D	z001	z003	z004	z005	z007	z008	z009	z012	z013	z014	z015	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	98	47	145
z002	0	0	0	0	0	0	0	0	0	0	137	0	137
z003	0	0	0	0	111	0	0	372	0	159	0	563	1205
z004	0	0	79	0	0	0	0	88	0	0	0	0	167
z005	0	0	0	0	72	0	0	0	0	0	0	175	247
z006	0	0	0	0	0	0	53	0	0	0	0	0	53
z007	0	0	0	0	0	0	0	36	0	0	0	502	538
z008	0	0	0	0	0	0	111	7	114	0	0	100	332
z009	0	0	0	0	0	0	0	0	0	101	0	0	101
z010	0	0	0	0	0	0	0	0	0	0	0	81	81
z012	0	0	686	0	0	15	0	0	0	0	0	319	1020
z013	0	0	0	19	0	8	0	0	0	0	0	17	44
z014	0	0	0	0	151	8	0	0	0	0	0	628	787
z015	0	0	0	0	33	0	0	0	0	0	0	16	49
z016	0	0	0	26	0	0	0	0	0	0	0	326	352
z017	71	0	0	0	4	45	0	0	0	0	0	375	495
z018	0	0	0	0	0	0	0	0	7	0	0	56	63
z019	0	0	0	0	544	0	0	0	5	0	0	269	818
z020	0	0	0	0	128	0	0	0	0	144	0	0	272
z021	0	0	0	0	0	0	0	0	0	0	0	7	7
z023	0	0	0	0	67	0	0	0	0	0	0	1	68
z024	53	0	0	0	0	0	0	0	0	0	0	478	531
z026	0	0	0	0	0	0	0	0	0	0	0	88	88
z027	0	0	0	0	0	0	0	0	0	0	0	31	31
z030	0	0	0	0	0	0	0	0	0	0	0	30	30
z031	0	0	0	0	0	0	0	0	0	0	0	124	124
z033	0	0	0	0	0	0	0	0	0	0	0	8	8
z034	0	0	0	0	0	0	0	0	0	0	0	2	2
z036	0	0	0	0	106	0	0	139	0	0	148	8	401
z038	0	0	0	607	171	37	432	50	0	0	50	243	1590
z041	0	0	0	0	0	0	0	0	0	0	0	107	107
z042	0	0	0	0	0	0	0	0	0	0	0	34	34
z043	0	21	0	0	0	0	0	0	102	6	0	221	350
z045	0	0	0	0	0	0	0	22	0	0	0	32	54
z046	0	0	0	0	0	0	0	47	0	0	0	0	47
z047	0	0	0	0	0	0	0	0	0	270	0	716	986
z049	0	0	0	0	0	0	0	0	0	0	0	153	153
z050	0	0	0	0	0	0	0	0	0	55	0	0	55
TOTAL	124	21	765	652	1387	113	596	761	228	735	433	5757	11572

Table A4.7 (Continued)

O\D	z016	z017	z018	z019	z020	z021	z022	z023	z024	z025	z026	others	TOTAL
z001	47	0	0	0	0	0	0	0	0	0	0	98	145
z002	0	0	0	0	0	0	0	0	0	0	0	137	137
z003	0	0	60	0	318	0	0	0	0	0	0	827	1205
z004	0	0	0	0	0	0	0	0	0	0	0	167	167
z005	0	175	0	0	0	0	0	0	0	0	0	72	247
z006	0	0	0	0	0	0	0	0	0	0	0	53	53
z007	0	0	0	0	0	0	24	0	0	0	0	514	538
z008	0	0	0	0	0	0	0	68	0	0	0	264	332
z009	0	0	0	0	0	0	0	0	0	0	0	101	101
z010	31	0	0	0	0	0	0	0	0	0	0	50	81
z012	0	0	0	0	0	0	0	0	0	0	0	1020	1020
z013	0	0	0	11	0	0	0	0	0	6	0	27	44
z014	0	0	7	0	0	0	0	0	0	0	0	780	787
z015	0	0	0	0	0	0	0	0	0	0	0	49	49
z016	0	0	55	0	0	0	0	0	0	0	0	297	352
z017	0	0	0	0	0	0	0	0	0	0	0	495	495
z018	0	0	0	0	0	0	0	0	0	0	0	63	63
z019	0	0	0	0	0	26	0	0	0	0	0	792	818
z020	0	0	0	0	0	0	0	0	0	0	0	272	272
z021	0	0	0	0	0	0	0	0	0	0	0	7	7
z023	0	0	0	0	0	0	0	0	0	1	0	67	68
z024	0	27	0	0	0	0	0	0	0	0	0	504	531
z026	0	0	0	0	0	0	0	0	0	0	0	88	88
z027	11	7	0	0	0	0	0	0	13	0	0	0	31
z030	0	0	0	0	0	0	0	0	0	0	0	30	30
z031	0	0	0	0	0	0	0	0	0	0	0	124	124
z033	0	0	0	0	0	0	0	0	0	0	0	8	8
z034	0	0	0	0	0	0	0	0	0	0	0	2	2
z036	0	0	0	0	0	0	0	0	0	0	0	401	401
z038	0	0	1	0	0	0	0	0	17	0	0	1572	1590
z041	0	0	0	0	0	0	0	0	0	0	0	107	107
z042	4	0	0	0	0	0	0	0	0	0	0	30	34
z043	0	161	0	37	0	0	0	0	0	0	0	152	350
z045	0	0	0	0	0	0	0	0	0	0	29	25	54
z046	0	0	0	0	0	0	0	0	0	0	0	47	47
z047	218	110	22	32	0	0	0	306	0	0	0	298	986
z049	0	0	0	0	66	0	0	0	20	0	26	41	153
z050	0	0	0	0	0	0	0	0	0	0	0	55	55
TOTAL	311	480	145	80	384	26	24	374	50	7	55	9636	11572

Table A4.7 (continued)

O\D	z027	z029	z030	z031	z034	z035	z036	z038	z040	z041	z042	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	0	145	145
z002	0	0	0	0	0	0	0	0	0	0	0	137	137
z003	0	0	0	0	0	0	0	0	0	0	0	1205	1205
z004	0	0	0	0	0	0	0	0	0	0	0	167	167
z005	0	0	0	0	0	0	0	0	0	0	0	247	247
z006	0	0	0	0	0	0	0	0	0	0	0	53	53
z007	40	0	0	0	0	0	70	217	0	37	0	174	538
z008	0	0	0	0	0	0	0	32	0	0	0	300	332
z009	0	0	0	0	0	0	0	0	0	0	0	101	101
z010	0	0	0	0	0	0	0	50	0	0	0	31	81
z012	0	0	15	82	0	0	0	201	0	21	0	701	1020
z013	0	0	0	0	0	0	0	0	0	0	0	44	44
z014	0	0	0	33	0	0	0	197	0	0	0	557	787
z015	0	0	0	0	0	0	0	0	0	0	0	49	49
z016	0	0	0	0	0	0	0	0	230	0	41	81	352
z017	0	0	0	18	18	0	0	281	0	0	0	178	495
z018	0	0	0	0	0	0	0	56	0	0	0	7	63
z019	0	0	0	0	0	0	0	150	0	0	0	668	818
z020	0	0	0	0	0	0	0	0	0	0	0	272	272
z021	0	0	0	7	0	0	0	0	0	0	0	0	7
z023	0	0	0	0	0	0	0	0	0	0	0	68	68
z024	0	0	0	0	0	0	68	383	0	0	0	80	531
z026	0	0	88	0	0	0	0	0	0	0	0	0	88
z027	0	0	0	0	0	0	0	0	0	0	0	31	31
z030	0	5	0	2	0	0	0	23	0	0	0	0	30
z031	0	0	0	0	124	0	0	0	0	0	0	0	124
z033	0	0	0	0	8	0	0	0	0	0	0	0	8
z034	0	0	0	0	0	2	0	0	0	0	0	0	2
z036	8	0	0	0	0	0	0	0	0	0	0	393	401
z038	100	0	0	0	31	0	0	0	0	0	0	1459	1590
z041	0	0	0	0	34	73	0	0	0	0	0	0	107
z042	0	0	0	0	0	30	0	0	0	0	0	4	34
z043	0	0	0	0	0	0	0	0	0	0	0	350	350
z045	0	0	0	0	0	0	0	3	0	0	0	51	54
z046	0	0	0	0	0	0	0	0	0	0	0	47	47
z047	0	0	0	0	0	0	0	28	0	0	0	958	986
z049	0	0	0	0	0	17	0	24	0	0	0	112	153
z050	0	0	0	0	0	0	0	0	0	0	0	55	55
TOTAL	148	5	103	142	215	122	138	1645	230	58	41	8725	11572

Table A4.7 (continued)

O\D	z043	z045	z046	z047	z049	z050	others	TOTAL
z001	0	0	0	0	0	0	145	145
z002	0	0	0	0	0	0	137	137
z003	185	0	0	0	0	0	1020	1205
z004	0	0	0	0	0	0	167	167
z005	0	0	0	0	0	0	247	247
z006	0	0	0	0	0	0	53	53
z007	49	0	0	0	65	0	424	538
z008	0	0	0	0	0	0	332	332
z009	0	0	0	0	0	0	101	101
z010	0	0	0	0	0	0	81	81
z012	0	0	0	0	0	0	1020	1020
z013	0	0	0	0	0	0	44	44
z014	0	0	391	0	0	0	396	787
z015	0	0	16	0	0	0	33	49
z016	0	0	0	0	0	0	352	352
z017	0	58	0	0	0	0	437	495
z018	0	0	0	0	0	0	63	63
z019	86	0	7	0	0	0	725	818
z020	0	0	0	0	0	0	272	272
z021	0	0	0	0	0	0	7	7
z023	0	0	0	0	0	0	68	68
z024	0	0	0	0	0	0	531	531
z026	0	0	0	0	0	0	88	88
z027	0	0	0	0	0	0	31	31
z030	0	0	0	0	0	0	30	30
z031	0	0	0	0	0	0	124	124
z033	0	0	0	0	0	0	8	8
z034	0	0	0	0	0	0	2	2
z036	0	0	0	0	0	0	401	401
z038	0	0	0	64	0	30	1496	1590
z041	0	0	0	0	0	0	107	107
z042	0	0	0	0	0	0	34	34
z043	0	0	0	23	0	0	327	350
z045	0	0	0	0	0	0	54	54
z046	0	0	0	0	0	0	47	47
z047	0	0	0	0	0	0	986	986
z049	0	0	0	0	0	0	153	153
z050	0	0	0	0	0	0	55	55
TOTAL	320	58	414	87	65	30	10598	11572

Table A4.8 Origin - Destination Commodity Flow table for group # 8 (Crude Materials, except petroleum)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	0	0	0	0	0	0	0	0	264	0	0	145	409
z002	0	0	0	0	0	0	0	0	0	0	0	110	110
z003	0	0	70	0	0	0	0	0	0	0	0	936	1006
z004	0	0	0	11	5	0	0	0	0	0	0	363	379
z005	0	0	0	144	0	0	0	0	46	0	0	694	884
z006	0	0	0	0	0	0	0	0	0	0	0	34	34
z007	0	0	0	609	0	0	0	71	0	0	0	3679	4359
z008	0	0	0	24	0	0	0	0	73	0	0	518	615
z009	0	0	0	0	0	0	0	597	0	0	0	683	1280
z010	0	0	0	0	0	0	0	38	0	17	64	226	345
z011	0	0	0	0	0	0	0	0	0	0	0	54	54
z012	0	0	0	0	0	0	384	1	507	0	690	7998	9580
z013	0	0	0	0	0	0	0	7	7	0	0	440	454
z014	0	0	0	90	0	0	172	25	0	0	0	1503	1790
z015	0	0	0	0	0	0	0	0	0	289	0	150	439
z016	0	0	1271	0	0	0	0	0	0	0	0	272	1543
z017	0	0	0	0	0	0	15	0	0	0	386	32571	32972
z018	0	0	0	0	0	0	0	0	0	0	0	1279	1279
z019	166	0	0	16	95	0	0	21	70	0	0	3267	3635
z020	0	0	0	0	0	0	0	129	0	0	0	114	243
z021	0	0	0	0	0	0	115	0	0	0	0	281	396
z022	0	0	177	0	0	0	0	562	0	0	0	94	833
z023	0	0	0	0	0	0	0	0	0	0	0	170	170
z024	0	0	0	0	0	89	321	0	0	0	0	192	602
z025	0	0	0	0	0	0	0	0	28	0	0	79	107
z026	0	0	0	0	0	0	0	0	0	0	0	696	696
z027	0	0	0	0	0	0	112	0	0	0	0	288	400
z028	0	0	0	0	0	0	0	0	0	0	0	69	69
z029	0	594	0	0	0	0	0	0	0	0	0	110	704
z030	0	0	0	0	0	0	0	0	80	0	0	404	484
z031	0	0	0	0	0	0	0	106	39	0	0	616	761
z032	0	0	0	0	0	0	0	0	0	0	0	560	560
z033	0	0	0	0	0	0	0	0	0	0	0	68	68
z034	0	0	0	0	0	0	0	0	0	0	0	804	804
z035	0	0	0	0	0	0	0	0	0	0	0	983	983
z036	0	0	136	48	0	0	0	0	50	0	0	959	1193
z038	0	0	0	69	0	0	0	34	0	0	0	805	908
z040	946	0	0	0	0	0	0	774	0	0	0	1178	2898
z041	0	0	0	0	0	0	0	0	24	0	0	321	345
z042	0	0	0	0	0	0	0	0	0	0	0	669	669
z043	0	0	0	0	0	0	142	117	139	0	0	1465	1863
z045	0	0	0	0	0	0	0	0	286	0	0	345	631
z046	0	108	0	0	0	0	168	349	322	0	0	133	1080
z047	0	0	0	0	0	0	242	0	196	0	0	609	1047
z049	0	0	0	181	0	0	0	0	17	0	0	0	198
z050	0	0	0	0	0	0	0	0	0	43	0	27	70
TOTAL	1112	702	1654	1192	100	89	1671	2831	2148	349	1140	66961	79949

Table A4.8 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	0	409	409
z002	0	0	0	0	0	0	0	0	0	0	0	110	110
z003	171	0	329	0	0	0	0	0	0	0	0	506	1006
z004	225	0	116	0	0	0	0	16	0	0	0	22	379
z005	0	0	0	0	0	299	0	0	55	0	0	530	884
z006	0	0	0	0	0	0	0	0	0	0	0	34	34
z007	2114	231	183	0	190	0	101	69	276	0	0	1195	4359
z008	43	76	126	2	31	0	0	0	0	0	0	337	615
z009	186	0	0	0	0	0	5	0	0	0	0	1089	1280
z010	0	0	0	0	0	68	0	4	120	34	0	119	345
z011	0	0	0	0	0	0	0	0	0	0	0	54	54
z012	0	0	0	0	0	6412	1354	25	0	0	0	1789	9580
z013	0	0	0	0	0	251	0	0	0	0	0	203	454
z014	0	0	0	0	0	515	319	136	0	0	0	820	1790
z015	0	0	0	0	0	0	0	47	0	0	0	392	439
z016	0	0	0	0	0	167	0	0	0	0	0	1376	1543
z017	5032	1445	3049	2860	1854	11559	1439	4486	847	0	0	401	32972
z018	222	0	0	356	0	0	0	701	0	0	0	0	1279
z019	263	56	60	0	15	2220	0	158	0	0	0	863	3635
z020	0	0	0	0	0	114	0	0	0	0	0	129	243
z021	176	18	79	0	0	0	0	0	0	0	8	115	396
z022	0	0	0	0	0	0	0	0	0	0	0	833	833
z023	0	0	0	170	0	0	0	0	0	0	0	0	170
z024	0	0	0	0	0	0	0	0	0	0	110	492	602
z025	0	0	0	0	0	0	0	0	0	0	0	107	107
z026	0	0	0	59	0	0	0	0	0	0	0	637	696
z027	0	0	0	0	0	285	0	0	0	0	0	115	400
z028	0	0	0	0	0	0	0	0	0	0	0	69	69
z029	0	0	0	0	0	0	0	0	0	0	0	704	704
z030	8	0	0	0	0	0	0	0	0	0	0	476	484
z031	0	78	138	0	0	0	0	205	0	0	0	340	761
z032	112	0	0	0	0	0	0	0	25	0	0	423	560
z033	0	0	0	0	0	0	0	0	0	0	0	68	68
z034	0	0	0	0	0	0	0	0	0	0	0	804	804
z035	0	0	50	0	0	0	0	24	0	0	0	909	983
z036	0	0	78	0	0	0	0	0	0	0	0	1115	1193
z038	0	0	20	0	0	53	0	0	405	0	0	430	908
z040	337	0	223	0	0	0	0	464	0	0	0	1874	2898
z041	29	0	31	0	0	0	0	0	0	0	0	285	345
z042	149	0	0	163	0	0	0	0	0	0	0	357	669
z043	51	0	44	0	497	0	153	0	130	0	0	988	1863
z045	0	0	0	0	0	0	0	0	32	0	0	599	631
z046	0	0	0	0	0	0	0	0	0	0	0	1080	1080
z047	0	0	462	0	0	3	0	0	0	0	0	582	1047
z049	0	0	0	0	0	0	0	0	0	0	0	198	198
z050	0	0	27	0	0	0	0	0	0	0	0	43	70
TOTAL	9118	1904	5015	3610	2587	21946	3371	6335	1890	34	118	24021	79949

Table A4.8 (conitnued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	25	0	384	409
z002	0	0	0	0	0	0	0	0	0	0	0	110	110
z003	21	0	0	242	0	0	0	0	0	0	0	743	1006
z004	0	0	0	0	0	0	0	0	6	0	0	373	379
z005	116	0	0	0	0	0	0	0	0	0	0	768	884
z006	0	0	0	0	0	0	0	0	0	0	0	34	34
z007	0	0	0	0	0	0	0	103	0	0	0	4256	4359
z008	0	28	0	108	5	0	0	0	0	0	0	474	615
z009	0	0	0	0	0	0	0	0	0	97	0	1183	1280
z010	0	0	0	0	0	0	0	0	0	0	0	345	345
z011	0	0	0	0	0	0	0	0	0	0	0	54	54
z012	0	0	0	0	0	0	0	0	8	0	98	9474	9580
z013	0	0	0	0	0	0	0	0	189	0	0	265	454
z014	0	0	0	0	0	0	0	0	0	5	0	1785	1790
z015	0	0	0	0	0	0	0	0	0	0	0	439	439
z016	0	0	0	0	0	0	0	0	0	0	0	1543	1543
z017	0	0	0	0	0	0	0	0	0	0	0	32972	32972
z018	0	0	0	0	0	0	0	0	0	0	0	1279	1279
z019	0	0	0	0	0	0	0	0	0	0	0	3635	3635
z020	0	0	0	0	0	0	0	0	0	0	0	243	243
z021	0	0	0	0	0	0	0	0	0	0	0	396	396
z022	0	0	0	0	0	9	0	0	0	0	0	824	833
z023	0	0	0	0	0	0	0	0	0	0	0	170	170
z024	0	0	82	0	0	0	0	0	0	0	0	520	602
z025	51	28	0	0	0	0	0	0	0	0	0	28	107
z026	0	0	0	546	54	0	0	0	0	0	0	96	696
z027	0	0	3	0	0	0	0	0	0	0	0	397	400
z028	0	0	0	0	0	15	54	0	0	0	0	0	69
z029	0	0	0	0	0	17	0	0	18	0	0	669	704
z030	0	0	0	0	18	0	0	318	0	60	0	88	484
z031	0	0	0	0	0	0	0	0	165	30	0	566	761
z032	0	0	0	0	0	0	0	0	0	423	0	137	560
z033	0	0	0	0	0	0	47	0	0	0	0	21	68
z034	0	0	0	0	0	0	0	0	0	0	5	799	804
z035	0	0	0	0	0	0	0	0	0	0	0	983	983
z036	0	0	0	248	0	0	0	0	0	0	0	945	1193
z038	0	0	1	36	0	21	124	0	0	0	0	726	908
z040	0	0	0	0	0	0	0	0	0	0	0	2898	2898
z041	0	0	0	0	0	0	0	0	0	0	0	345	345
z042	0	0	0	0	0	0	0	0	0	0	0	669	669
z043	0	0	0	0	257	0	0	0	333	0	0	1273	1863
z045	44	0	0	0	11	0	0	0	0	0	25	551	631
z046	0	0	0	0	0	0	0	0	0	0	0	1080	1080
z047	0	0	0	0	0	0	0	0	0	0	34	1013	1047
z049	0	0	0	0	0	0	0	0	0	0	0	198	198
z050	0	0	0	0	0	0	0	0	0	0	0	70	70
TOTAL	232	56	86	1180	345	62	225	421	719	640	162	75821	79949

Table A4.8 (continued)

O\D	z034	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	0	0	0	120	0	0	0	0	0	0	0	289	409
z002	0	0	0	0	0	0	0	0	0	0	110	0	110
z003	0	0	173	0	0	0	0	0	0	0	0	833	1006
z004	0	0	0	0	0	0	0	0	0	0	0	379	379
z005	0	0	0	0	0	0	0	0	0	0	224	660	884
z006	0	0	0	34	0	0	0	0	0	0	0	0	34
z007	0	0	412	0	0	0	0	0	0	0	0	3947	4359
z008	0	0	0	0	0	22	38	0	0	0	39	516	615
z009	0	0	0	102	0	0	0	80	147	0	66	885	1280
z010	0	0	0	0	0	0	0	0	0	0	0	345	345
z011	0	0	0	0	0	0	0	54	0	0	0	0	54
z012	0	0	0	57	0	0	0	28	0	0	16	9479	9580
z013	0	0	0	0	0	0	0	0	0	0	0	454	454
z014	0	0	0	384	0	64	0	0	45	0	0	1297	1790
z015	0	0	0	30	0	0	0	0	23	0	50	336	439
z016	0	0	0	0	0	0	0	51	54	0	0	1438	1543
z017	0	0	0	0	0	0	0	0	0	0	0	32972	32972
z018	0	0	0	0	0	0	0	0	0	0	0	1279	1279
z019	0	160	0	0	0	0	0	29	0	0	306	3140	3635
z020	0	0	0	0	0	0	0	0	0	0	0	243	243
z021	0	0	0	0	0	0	0	0	0	0	0	396	396
z022	0	0	0	50	0	0	0	0	0	0	35	748	833
z023	0	0	0	0	0	0	0	0	0	0	0	170	170
z024	0	0	0	0	0	0	0	0	0	0	0	602	602
z025	0	0	0	0	0	0	0	0	0	0	0	107	107
z026	0	0	0	0	0	0	0	0	0	0	37	659	696
z027	0	0	0	0	0	0	0	0	0	0	0	400	400
z028	0	0	0	0	0	0	0	0	0	0	0	69	69
z029	0	0	0	75	0	0	0	0	0	0	0	629	704
z030	0	0	0	0	0	0	0	0	0	0	0	484	484
z031	0	0	0	0	0	0	0	0	0	0	0	761	761
z032	0	0	0	0	0	0	0	0	0	0	0	560	560
z033	1	0	0	0	0	20	0	0	0	0	0	47	68
z034	387	188	0	0	11	69	124	0	20	0	0	5	804
z035	77	317	0	0	0	0	0	515	0	0	0	74	983
z036	0	39	0	0	0	0	168	0	0	74	352	560	1193
z038	0	0	0	0	0	13	0	36	0	0	82	777	908
z040	0	0	0	0	64	0	0	0	0	0	90	2744	2898
z041	99	0	0	162	0	0	0	0	0	0	0	84	345
z042	0	0	0	357	0	0	0	0	0	0	0	312	669
z043	0	0	0	0	0	0	0	0	0	0	0	1863	1863
z045	0	0	0	43	0	0	0	0	0	127	63	398	631
z046	0	0	0	65	0	0	0	0	68	0	0	947	1080
z047	15	0	0	27	0	0	0	0	68	0	0	937	1047
z049	0	0	0	0	0	0	0	0	0	0	0	198	198
z050	0	0	0	0	0	0	0	0	0	0	0	70	70
TOTAL	579	704	585	1506	75	188	330	793	425	201	1470	73093	79949

Table A4.8 (continued)

O\D	z049	z050	others	TOTAL
z001	0	0	409	409
z002	0	0	110	110
z003	0	0	1006	1006
z004	0	0	379	379
z005	0	0	884	884
z006	0	0	34	34
z007	0	0	4359	4359
z008	0	0	615	615
z009	0	0	1280	1280
z010	0	0	345	345
z011	0	0	54	54
z012	0	0	9580	9580
z013	0	0	454	454
z014	0	35	1755	1790
z015	0	0	439	439
z016	0	0	1543	1543
z017	0	0	32972	32972
z018	0	0	1279	1279
z019	0	0	3635	3635
z020	0	0	243	243
z021	0	0	396	396
z022	0	0	833	833
z023	0	0	170	170
z024	0	0	602	602
z025	0	0	107	107
z026	0	0	696	696
z027	0	0	400	400
z028	0	0	69	69
z029	0	0	704	704
z030	0	0	484	484
z031	0	0	761	761
z032	0	0	560	560
z033	0	0	68	68
z034	0	0	804	804
z035	0	0	983	983
z036	0	0	1193	1193
z038	14	0	894	908
z040	0	0	2898	2898
z041	0	0	345	345
z042	0	0	669	669
z043	0	0	1863	1863
z045	0	0	631	631
z046	0	0	1080	1080
z047	0	0	1047	1047
z049	0	0	198	198
z050	0	0	70	70
TOTAL	14	35	79900	79949

Table A4.9 Origin - Destination Commodity Flow table for group # 9 (Forest Products)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	0	0	10	767	93	0	0	52	0	0	0	149	1071
z002	0	0	0	0	0	0	0	0	0	0	0	147	147
z003	0	0	0	0	0	0	0	0	0	0	0	60	60
z004	0	0	0	235	0	0	0	2	0	57	0	2910	3204
z005	143	0	13	87	93	0	0	35	0	160	0	784	1315
z006	0	0	0	0	0	0	0	0	0	0	0	110	110
z007	0	0	0	0	0	0	66	50	0	0	0	2515	2631
z008	61	55	0	0	0	0	3	41	75	0	0	2230	2465
z009	0	0	0	0	0	0	13	54	2	0	0	646	715
z010	0	0	0	0	0	0	0	24	0	0	81	401	506
z011	0	20	0	0	0	0	0	0	2	213	0	865	1100
z012	151	0	64	353	97	0	665	421	659	0	0	3509	5919
z013	22	0	0	47	108	0	222	208	123	0	0	725	1455
z014	26	0	0	59	164	125	204	575	0	0	0	3840	4993
z015	0	74	0	0	0	0	16	22	0	0	0	517	629
z016	0	0	0	0	0	0	100	0	11	0	0	1903	2014
z017	315	0	462	0	0	0	593	327	0	0	0	2182	3879
z018	0	0	0	0	0	0	200	118	0	0	0	607	925
z019	0	157	12	93	3	0	34	160	2	42	10	3248	3761
z020	0	0	0	0	86	0	0	47	0	456	0	298	887
z021	0	0	1007	0	0	0	67	0	58	0	0	360	1492
z022	0	0	0	337	49	0	160	257	0	0	0	970	1773
z023	0	0	0	0	396	0	286	0	546	0	0	3705	4933
z024	0	0	0	171	0	0	123	0	0	35	0	1421	1750
z025	0	0	0	0	0	0	10	0	0	0	0	510	520
z026	0	0	0	21	70	0	0	0	153	147	0	1717	2108
z027	0	0	0	0	50	0	19	53	312	0	0	873	1307
z028	0	0	0	0	0	0	0	0	101	0	0	284	385
z029	52	984	1003	0	101	42	0	96	235	0	0	2800	5313
z030	72	0	0	0	118	0	0	26	80	0	26	1961	2283
z031	0	0	204	0	0	0	201	218	61	0	0	2151	2835
z032	0	0	0	192	47	0	124	35	901	0	27	2339	3665
z033	0	0	0	120	0	0	109	0	76	0	0	7956	8261
z034	48	0	15	0	166	0	0	139	0	0	0	13158	13526
z035	0	0	153	42	0	0	0	29	0	0	0	5727	5951
z036	0	178	0	122	300	0	876	666	65	66	0	6381	8654
z038	91	0	45	159	99	0	159	294	120	89	0	7272	8328
z040	0	0	0	0	7	0	0	0	0	0	0	2628	2635
z041	0	0	0	0	0	0	8	0	0	0	0	1300	1308
z042	50	0	0	0	0	0	81	196	54	0	147	5760	6288
z043	0	83	0	74	33	0	0	404	57	0	0	2681	3332
z045	0	0	0	70	97	0	81	0	140	0	0	851	1239
z046	0	0	0	0	0	0	0	145	0	0	0	1095	1240
z047	0	63	0	105	0	0	0	160	0	0	0	3414	3742
z049	0	0	0	0	0	0	0	0	490	0	27	1304	1821
z050	0	0	0	0	0	0	78	0	0	0	0	426	504
TOTAL	1031	1614	2988	3054	2177	167	4498	4854	4323	1265	318	106690	132979

Table A4.9 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	56	0	60	0	0	0	0	0	0	0	0	955	1071
z002	0	0	0	0	0	0	0	0	0	0	0	147	147
z003	0	1	5	0	0	0	0	0	0	0	0	54	60
z004	0	0	0	0	0	253	22	91	188	53	0	2597	3204
z005	12	42	62	0	261	0	0	0	0	0	0	938	1315
z006	0	0	0	0	110	0	0	0	0	0	0	0	110
z007	192	0	137	0	210	26	36	540	0	0	25	1465	2631
z008	18	97	200	0	98	102	285	24	43	0	0	1598	2465
z009	0	0	64	3	0	0	0	0	0	0	0	648	715
z010	7	0	41	0	46	17	0	3	0	0	0	392	506
z011	0	0	0	0	0	0	0	0	0	0	0	1100	1100
z012	70	0	0	0	0	0	6	121	38	16	195	5473	5919
z013	0	0	0	0	0	40	0	16	0	0	0	1399	1455
z014	0	0	0	0	0	17	0	72	0	99	523	4282	4993
z015	0	0	0	0	0	0	0	0	0	0	0	629	629
z016	0	0	0	0	0	40	0	8	0	0	0	1966	2014
z017	0	0	0	17	124	0	0	0	358	0	0	3380	3879
z018	17	67	30	0	0	0	0	0	0	0	0	811	925
z019	329	24	142	36	0	172	0	91	429	0	0	2538	3761
z020	0	0	30	0	0	9	0	41	0	0	0	807	887
z021	0	0	106	0	0	0	0	0	0	0	0	1386	1492
z022	0	0	289	0	0	162	0	0	0	0	0	1322	1773
z023	0	1530	201	605	0	0	0	0	100	0	0	2497	4933
z024	0	0	43	0	0	0	0	0	0	0	0	1707	1750
z025	0	43	11	0	0	0	0	0	0	0	0	466	520
z026	345	0	69	0	18	0	167	629	25	0	0	855	2108
z027	23	0	186	0	0	0	0	17	0	0	12	1069	1307
z028	0	0	0	0	0	0	0	0	43	0	0	342	385
z029	0	0	78	0	0	0	46	120	0	0	0	5069	5313
z030	96	54	201	99	0	93	6	188	0	35	0	1511	2283
z031	273	79	239	15	0	200	24	2	0	0	0	2003	2835
z032	114	61	92	24	55	19	38	240	47	99	24	2852	3665
z033	88	89	160	176	35	482	0	11	241	73	0	6906	8261
z034	119	98	210	287	154	0	0	225	73	0	0	12360	13526
z035	32	32	0	24	29	4	0	45	0	0	0	5746	5951
z036	35	143	494	860	72	253	387	199	89	57	0	6065	8654
z038	182	93	311	133	125	209	113	1608	327	72	940	4215	8328
z040	125	125	127	0	276	437	0	32	0	0	0	1513	2635
z041	53	88	39	0	0	21	212	0	0	0	0	895	1308
z042	103	0	136	123	209	120	102	108	37	0	468	4882	6288
z043	73	174	44	186	0	105	33	200	117	0	0	2400	3332
z045	148	45	0	99	124	0	0	30	0	0	0	793	1239
z046	132	51	313	0	376	0	0	0	0	0	0	368	1240
z047	360	197	254	0	596	0	160	390	0	0	355	1430	3742
z049	184	0	191	101	86	54	0	0	0	0	148	1057	1821
z050	0	0	0	0	21	0	0	338	30	0	0	115	504
TOTAL	3186	3133	4565	2788	3025	2874	1637	5389	2185	504	2690	101003	132979

Table A4.9 (continued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	0	0	0	0	33	0	0	0	0	0	0	1038	1071
z002	0	0	0	0	0	0	0	0	0	0	0	147	147
z003	0	0	0	0	0	0	0	0	0	0	0	60	60
z004	0	0	0	0	0	0	33	0	46	0	106	3019	3204
z005	0	0	0	0	0	0	0	0	0	0	0	1315	1315
z006	0	0	0	0	0	0	0	0	0	0	0	110	110
z007	567	0	0	51	0	0	0	106	72	0	0	1835	2631
z008	0	38	17	24	0	0	62	0	289	28	32	1975	2465
z009	0	0	0	0	0	0	65	0	15	0	0	635	715
z010	0	48	0	60	0	0	0	0	0	0	0	398	506
z011	0	0	0	0	459	0	0	0	132	0	0	509	1100
z012	270	1042	15	0	57	0	59	0	223	0	25	4228	5919
z013	417	0	0	0	1	0	0	32	0	24	17	964	1455
z014	0	499	21	62	22	0	0	9	53	18	50	4259	4993
z015	0	0	0	0	0	0	0	0	210	0	0	419	629
z016	0	0	0	0	13	0	0	0	36	0	17	1948	2014
z017	0	0	0	68	0	0	80	0	0	153	48	3530	3879
z018	0	0	0	0	0	0	0	0	188	0	86	651	925
z019	0	570	0	100	0	0	28	62	45	0	58	2898	3761
z020	0	0	0	0	50	0	0	0	57	0	0	780	887
z021	0	0	0	0	0	0	0	0	0	62	0	1430	1492
z022	0	0	0	0	0	0	0	0	0	0	0	1773	1773
z023	0	0	74	0	20	0	0	0	0	0	0	4839	4933
z024	0	0	0	119	0	0	0	0	0	0	0	1631	1750
z025	0	34	0	0	81	274	0	0	0	0	0	131	520
z026	0	1	0	0	16	0	0	0	0	0	0	2091	2108
z027	36	8	0	0	0	0	23	0	0	0	0	1240	1307
z028	0	0	0	0	0	0	0	0	123	0	0	262	385
z029	0	0	0	0	0	490	842	146	314	0	140	3381	5313
z030	0	0	0	0	0	0	376	0	62	0	275	1570	2283
z031	472	47	82	78	0	0	6	169	115	75	42	1749	2835
z032	0	0	0	0	0	0	0	0	215	373	136	2941	3665
z033	0	0	0	0	0	0	0	149	0	120	3883	4109	8261
z034	29	0	0	0	0	0	0	92	0	604	345	12456	13526
z035	0	0	185	0	56	0	0	0	0	0	0	5710	5951
z036	117	312	401	0	239	0	0	0	0	0	0	7585	8654
z038	32	160	0	139	157	6	250	168	250	39	44	7083	8328
z040	1325	79	0	0	0	0	22	0	0	0	0	1209	2635
z041	63	0	0	0	0	0	326	8	230	0	0	681	1308
z042	0	124	0	29	0	0	0	121	0	96	0	5918	6288
z043	351	419	36	9	668	0	0	0	0	0	0	1849	3332
z045	303	0	0	0	0	0	0	0	0	0	0	936	1239
z046	0	0	0	0	0	0	0	0	63	0	0	1177	1240
z047	0	0	2	0	0	0	0	0	0	21	139	3580	3742
z049	0	0	0	0	0	0	0	0	0	0	0	1821	1821
z050	0	0	0	0	0	0	0	0	0	0	0	504	504
TOTAL	3982	3381	833	739	1872	770	2172	1062	2738	1613	5443	108374	132979

Table A4.9 (continued)

O\D	z034	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	0	1071	1071
z002	0	0	0	0	0	0	0	88	0	0	59	0	147
z003	0	0	0	54	0	0	0	0	0	0	0	6	60
z004	0	0	0	496	0	0	3	1477	51	0	91	1086	3204
z005	0	0	270	0	0	0	0	0	137	0	0	908	1315
z006	0	0	0	0	0	0	0	0	0	0	0	110	110
z007	0	0	329	104	80	0	30	0	10	0	0	2078	2631
z008	36	0	281	174	0	13	0	0	0	79	290	1592	2465
z009	0	0	0	0	0	372	0	56	26	0	45	216	715
z010	0	0	0	55	0	0	61	63	0	0	0	327	506
z011	0	0	0	274	0	0	0	0	0	0	0	826	1100
z012	87	18	0	254	0	48	54	216	266	0	429	4547	5919
z013	0	0	0	69	35	12	36	0	0	0	26	1277	1455
z014	97	0	81	389	151	23	202	349	168	47	44	3442	4993
z015	0	0	0	132	0	0	0	1	41	0	0	455	629
z016	59	0	0	38	0	33	17	259	73	0	0	1535	2014
z017	0	0	0	172	0	0	16	158	565	195	213	2560	3879
z018	0	0	114	0	0	29	0	0	0	0	76	706	925
z019	74	280	0	8	0	9	57	131	0	391	145	2666	3761
z020	0	0	0	111	0	0	0	0	0	0	0	776	887
z021	0	0	91	0	30	0	0	0	0	0	0	1371	1492
z022	0	0	0	154	0	0	0	0	0	0	365	1254	1773
z023	0	0	572	280	194	52	0	29	48	0	0	3758	4933
z024	0	0	24	1065	58	0	0	90	22	0	0	491	1750
z025	30	0	0	0	0	0	0	0	0	0	37	453	520
z026	0	0	63	270	0	0	0	0	114	0	0	1661	2108
z027	0	0	0	0	0	0	0	0	232	19	317	739	1307
z028	0	0	0	118	0	0	0	0	0	0	0	267	385
z029	0	0	0	478	0	0	0	0	0	0	146	4689	5313
z030	47	0	56	76	0	30	34	154	79	0	0	1807	2283
z031	0	0	0	0	16	28	0	0	0	37	69	2625	2835
z032	41	182	0	327	0	0	0	0	101	87	64	2863	3665
z033	1660	0	0	108	125	0	0	445	0	0	111	5812	8261
z034	9358	9	0	223	208	114	0	0	0	603	407	2604	13526
z035	947	3537	38	52	139	168	0	0	0	0	400	670	5951
z036	0	0	7	26	0	65	0	219	715	188	990	6444	8654
z038	22	0	0	211	0	33	104	103	583	351	420	6501	8328
z040	0	0	0	0	0	0	0	0	0	0	80	2555	2635
z041	101	131	0	28	0	0	0	0	0	0	0	1048	1308
z042	86	0	3865	33	0	0	0	0	0	0	0	2304	6288
z043	0	0	39	184	0	0	0	0	0	43	0	3066	3332
z045	0	0	0	84	0	0	0	0	0	14	4	1137	1239
z046	0	0	3	76	0	0	0	26	55	0	0	1080	1240
z047	277	24	0	480	0	0	0	0	159	0	0	2802	3742
z049	0	0	443	97	0	0	0	0	0	0	0	1281	1821
z050	0	0	0	37	0	0	0	0	0	0	0	467	504
TOTAL	12922	4181	6276	6737	1036	1029	614	3864	3445	2114	4828	85933	132979

Table A4.9 (continued)

O\D	z049	z050	others	TOTAL
z001	0	0	1071	1071
z002	0	0	147	147
z003	0	0	60	60
z004	0	0	3204	3204
z005	0	0	1315	1315
z006	0	0	110	110
z007	0	0	2631	2631
z008	0	0	2465	2465
z009	0	0	715	715
z010	0	0	506	506
z011	0	0	1100	1100
z012	0	0	5919	5919
z013	0	0	1455	1455
z014	844	0	4149	4993
z015	133	0	496	629
z016	1310	0	704	2014
z017	15	0	3864	3879
z018	0	0	925	925
z019	0	67	3694	3761
z020	0	0	887	887
z021	71	0	1421	1492
z022	0	0	1773	1773
z023	0	0	4933	4933
z024	0	0	1750	1750
z025	0	0	520	520
z026	0	0	2108	2108
z027	0	0	1307	1307
z028	0	0	385	385
z029	0	0	5313	5313
z030	0	0	2283	2283
z031	0	23	2812	2835
z032	0	0	3665	3665
z033	0	0	8261	8261
z034	0	0	13526	13526
z035	0	0	5951	5951
z036	0	513	8141	8654
z038	87	0	8241	8328
z040	0	0	2635	2635
z041	0	0	1308	1308
z042	0	0	6288	6288
z043	0	0	3332	3332
z045	0	0	1239	1239
z046	0	0	1240	1240
z047	0	0	3742	3742
z049	0	0	1821	1821
z050	0	0	504	504
TOTAL	2460	603	129916	132979

Table A4.10 Origin - Destination Commodity Flow table for group # 10 (Heavy Machinery)

O\D	z001	z002	z003	z004	z005	z007	z008	z009	z010	z011	z012	others	TOTAL
z001	0	0	109	506	204	122	105	60	0	78	0	946	2130
z002	62	0	0	0	0	119	0	0	0	0	0	772	953
z003	218	0	0	0	0	0	0	0	0	0	209	1168	1595
z004	0	0	0	1	0	0	0	0	0	0	0	353	354
z005	11	0	0	0	0	0	3	76	13	0	0	1086	1189
z006	0	0	0	0	0	0	0	0	0	0	0	160	160
z007	168	0	0	0	80	105	5	0	0	182	26	3620	4186
z008	347	0	7	0	0	45	104	21	11	144	0	2505	3184
z009	224	0	0	0	0	0	174	0	0	0	0	762	1160
z010	0	0	30	0	0	0	0	0	0	0	0	292	322
z011	0	0	0	1	0	0	35	0	79	0	0	534	649
z012	24	247	68	0	0	123	0	0	0	0	0	897	1359
z013	210	70	66	0	0	0	0	0	0	0	0	44	390
z014	24	0	0	0	116	411	0	0	0	0	0	661	1212
z015	0	0	0	0	0	25	50	0	0	0	0	365	440
z016	0	0	0	0	0	0	78	0	0	0	0	36	114
z017	386	94	631	0	29	105	0	0	0	0	0	749	1994
z018	0	0	0	0	0	0	0	0	0	0	0	7	7
z019	118	0	0	211	0	473	38	237	15	0	49	641	1782
z020	134	0	185	0	724	344	0	0	0	0	0	1531	2918
z021	0	0	0	0	0	0	4	0	0	0	0	911	915
z022	0	0	0	0	0	0	0	0	0	0	0	231	231
z023	0	0	0	0	0	0	0	0	0	0	0	204	204
z024	0	0	0	0	0	0	0	0	0	0	0	176	176
z025	0	0	0	0	0	0	0	0	0	0	0	116	116
z026	0	0	0	0	0	0	0	0	0	0	0	122	122
z027	0	0	0	0	0	0	0	0	0	0	0	281	281
z028	0	0	0	0	0	0	0	0	0	0	0	0	0
z030	0	0	0	0	0	0	0	0	0	0	5	280	285
z031	0	0	35	0	0	0	0	0	0	0	0	871	906
z032	0	0	0	0	0	6	10	0	0	0	0	86	102
z033	0	0	0	57	0	0	0	33	0	0	0	215	305
z034	0	0	0	0	0	0	0	0	0	0	0	776	776
z035	0	0	0	14	0	0	0	0	0	0	0	621	635
z036	0	0	0	0	0	0	0	0	0	0	0	293	293
z038	62	0	0	0	0	105	0	47	90	0	46	920	1270
z040	0	0	0	0	0	0	0	0	0	0	0	235	235
z041	0	0	0	0	0	0	0	15	0	0	6	559	580
z042	0	0	0	0	0	0	229	0	0	0	0	503	732
z043	0	13	0	16	108	658	0	0	0	0	0	259	1054
z045	0	0	0	0	54	0	0	0	0	20	0	1331	1405
z046	0	0	0	0	0	0	0	0	0	100	53	1254	1407
z047	0	0	0	0	43	0	226	0	0	852	296	1715	3132
z049	0	0	0	0	0	0	0	0	0	9	587	18	614
z050	0	0	0	0	0	0	0	0	0	69	81	393	543
TOTAL	1988	424	1131	806	1358	2641	1061	489	208	1454	1358	29499	42417

Table A4.10 (Continued)

O\D	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	z023	others	TOTAL
z001	0	54	0	0	23	0	97	470	0	0	0	1486	2130
z002	0	0	0	0	166	0	99	25	231	0	0	432	953
z003	0	0	0	0	0	0	636	128	0	0	0	831	1595
z004	0	0	0	0	0	0	0	13	0	0	0	341	354
z005	0	0	106	0	301	0	50	198	0	0	0	534	1189
z006	0	0	0	0	0	0	0	0	0	0	0	160	160
z007	0	570	0	0	291	29	347	317	1	0	0	2631	4186
z008	0	47	35	67	50	0	65	112	0	0	0	2808	3184
z009	0	65	0	0	163	0	14	0	0	0	0	918	1160
z010	0	0	0	0	0	0	0	145	0	0	0	177	322
z011	0	0	0	0	0	0	19	0	0	0	0	630	649
z012	0	0	0	0	0	0	128	0	0	150	0	1081	1359
z013	0	0	0	0	0	0	0	0	0	0	0	390	390
z014	0	0	0	0	0	0	0	0	0	0	0	1212	1212
z015	0	0	0	0	22	0	0	0	0	0	0	418	440
z016	0	0	0	0	0	0	0	0	0	0	0	114	114
z017	0	0	85	0	0	28	0	0	0	0	0	1881	1994
z018	0	7	0	0	0	0	0	0	0	0	0	0	7
z019	0	0	8	0	0	0	292	9	0	0	0	1473	1782
z020	0	0	0	0	130	0	75	0	0	0	0	2713	2918
z021	0	0	0	29	0	0	27	0	36	0	0	823	915
z022	0	0	0	0	0	0	0	0	0	0	0	231	231
z023	0	0	0	0	0	0	0	196	0	0	0	8	204
z024	0	0	0	0	0	0	0	0	0	4	0	172	176
z025	0	0	0	0	0	0	0	0	0	0	0	116	116
z026	0	0	0	0	0	0	28	0	17	0	0	77	122
z027	0	0	0	0	0	0	0	4	0	0	0	277	281
z028	0	0	0	0	0	0	0	0	0	0	0	0	0
z030	0	0	0	3	50	0	0	0	83	0	0	149	285
z031	0	12	30	0	0	0	38	5	39	0	0	782	906
z032	0	0	0	0	0	0	16	0	0	0	0	86	102
z033	0	0	0	0	0	0	0	0	0	0	0	305	305
z034	0	1	0	0	65	0	0	0	0	0	0	710	776
z035	0	0	0	0	0	0	0	0	0	0	0	635	635
z036	0	0	0	0	0	0	0	0	0	0	0	293	293
z038	28	46	0	0	75	16	17	19	0	0	0	1069	1270
z040	0	0	0	0	0	0	0	0	0	0	0	235	235
z041	0	218	0	0	0	0	0	0	0	35	0	327	580
z042	0	108	0	0	168	0	94	0	0	0	0	362	732
z043	46	42	0	0	43	0	28	0	0	3	0	892	1054
z045	45	0	0	0	0	0	26	298	0	0	3	1033	1405
z046	0	133	0	65	0	0	267	68	0	0	0	874	1407
z047	0	72	0	0	85	0	310	0	13	33	132	2487	3132
z049	18	0	0	0	0	0	0	0	0	0	0	596	614
z050	0	133	0	0	0	0	49	108	0	0	0	253	543
TOTAL	137	1508	264	164	1632	73	2722	2115	420	225	135	33022	42417

Table A4.10 (continued)

O\D	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	z034	others	TOTAL
z001	0	0	36	0	0	0	0	29	0	0	0	2065	2130
z002	0	0	88	14	0	0	0	0	0	0	0	851	953
z003	0	0	0	0	0	0	0	0	0	0	0	1595	1595
z004	0	0	0	0	0	0	0	0	0	0	0	354	354
z005	0	0	0	0	0	0	0	190	0	0	0	999	1189
z006	0	0	0	0	0	0	0	0	0	0	0	160	160
z007	0	0	0	145	5	0	0	27	0	0	0	4009	4186
z008	0	65	184	0	0	0	32	69	0	0	714	2120	3184
z009	0	0	0	0	0	0	0	0	0	0	0	1160	1160
z010	0	0	0	0	0	0	0	0	0	0	0	322	322
z011	0	0	0	0	0	0	0	68	0	15	0	566	649
z012	0	0	0	0	0	0	0	94	0	0	0	1265	1359
z013	0	0	0	0	0	0	0	0	0	0	0	390	390
z014	0	60	0	0	0	0	0	36	0	99	18	999	1212
z015	0	0	0	265	0	0	0	0	0	0	0	175	440
z016	0	0	0	0	0	0	0	0	0	0	0	114	114
z017	0	0	0	0	0	0	0	0	0	0	32	1962	1994
z018	0	0	0	0	0	0	0	0	0	0	0	7	7
z019	0	0	0	0	0	0	0	0	40	0	0	1742	1782
z020	0	0	0	0	0	0	0	111	125	66	0	2616	2918
z021	0	0	0	0	0	0	0	0	0	0	0	915	915
z022	0	0	0	0	0	0	174	0	0	0	0	57	231
z023	0	0	0	0	0	0	0	0	8	0	0	196	204
z024	46	0	0	15	0	0	0	0	0	0	0	115	176
z025	0	116	0	0	0	0	0	0	0	0	0	0	116
z026	1	0	0	0	0	0	0	0	0	0	0	121	122
z027	241	0	0	36	0	0	0	0	0	0	0	4	281
z028	0	0	0	0	0	0	0	0	0	0	0	0	0
z030	0	0	0	0	0	0	109	23	0	0	0	153	285
z031	0	0	0	0	0	0	268	39	0	69	0	530	906
z032	0	0	0	0	0	0	0	0	0	0	0	102	102
z033	0	0	0	0	0	0	0	49	0	56	0	200	305
z034	0	0	0	0	0	0	0	60	14	122	514	66	776
z035	35	0	0	0	0	0	0	152	15	40	85	308	635
z036	17	0	0	0	0	20	0	0	188	20	0	48	293
z038	224	0	100	63	0	0	0	28	45	9	21	780	1270
z040	0	0	0	0	0	0	0	217	0	18	0	0	235
z041	0	0	0	0	0	0	0	0	0	0	25	555	580
z042	0	0	0	0	0	0	0	0	0	0	0	732	732
z043	0	0	0	0	0	0	0	0	0	0	0	1054	1054
z045	0	0	0	34	0	0	0	0	0	0	0	1371	1405
z046	0	0	0	0	0	0	0	0	0	0	0	1407	1407
z047	0	0	0	0	0	0	0	0	0	0	37	3095	3132
z049	0	0	0	0	0	0	0	0	0	0	0	614	614
z050	0	0	0	0	0	0	0	0	5	0	5	533	543
TOTAL	564	241	408	572	5	20	583	1192	440	514	1451	36427	42417

Table A4.10 (continued)

O\D	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	z049	others	TOTAL
z001	0	107	68	62	0	0	0	0	0	0	0	1893	2130
z002	0	0	0	0	0	0	0	51	98	0	0	804	953
z003	0	404	0	0	0	0	0	0	0	0	0	1191	1595
z004	0	39	20	0	0	0	122	159	0	0	0	14	354
z005	0	0	11	0	0	0	0	0	230	0	0	948	1189
z006	0	0	0	0	0	27	0	0	0	133	0	0	160
z007	0	0	0	106	0	8	0	0	0	1774	0	2298	4186
z008	0	0	29	0	27	9	0	465	0	509	0	2145	3184
z009	0	0	40	0	42	6	0	156	0	0	276	640	1160
z010	0	0	114	0	31	2	0	0	0	0	0	175	322
z011	0	0	0	0	97	0	0	32	136	98	0	286	649
z012	0	0	41	203	15	266	0	0	0	0	0	834	1359
z013	0	0	13	0	31	0	0	0	0	0	0	346	390
z014	0	18	46	65	37	33	0	0	249	0	0	764	1212
z015	0	0	0	0	0	5	0	0	0	73	0	362	440
z016	0	23	0	0	13	0	0	0	0	0	0	78	114
z017	0	0	0	0	0	0	0	40	29	474	0	1451	1994
z018	0	0	0	0	0	0	0	0	0	0	0	7	7
z019	49	0	60	0	0	0	49	0	0	0	13	1611	1782
z020	0	24	52	0	0	0	0	165	348	435	0	1894	2918
z021	0	0	0	0	0	0	0	0	0	819	0	96	915
z022	0	0	0	0	0	0	0	0	0	0	57	174	231
z023	0	0	0	0	0	0	0	0	0	0	0	204	204
z024	0	0	111	0	0	0	0	0	0	0	0	65	176
z025	0	0	0	0	0	0	0	0	0	0	0	116	116
z026	0	0	76	0	0	0	0	0	0	0	0	46	122
z027	0	0	0	0	0	0	0	0	0	0	0	281	281
z028	0	0	0	0	0	0	0	0	0	0	0	0	0
z030	0	0	0	0	0	12	0	0	0	0	0	273	285
z031	0	0	0	71	0	17	0	0	0	0	283	535	906
z032	0	0	0	0	0	0	0	0	0	0	0	102	102
z033	0	0	0	0	110	0	0	0	0	0	0	195	305
z034	0	0	0	0	0	0	0	0	0	0	0	776	776
z035	190	0	0	0	104	0	0	0	0	0	0	341	635
z036	0	0	0	0	0	34	0	0	0	14	0	245	293
z038	0	0	0	0	0	27	33	0	64	105	0	1041	1270
z040	0	0	0	0	0	0	0	0	0	0	0	235	235
z041	236	0	45	0	0	0	0	0	0	0	0	299	580
z042	0	22	0	111	0	0	0	0	0	0	0	599	732
z043	0	0	0	0	0	0	0	0	97	0	0	957	1054
z045	0	0	0	0	0	0	0	0	925	0	0	480	1405
z046	0	1	263	0	0	0	376	81	0	0	0	686	1407
z047	0	0	570	195	0	0	114	154	0	0	0	2099	3132
z049	0	0	0	0	0	0	0	0	0	0	0	614	614
z050	0	61	32	0	0	0	0	0	0	0	0	450	543
TOTAL	475	699	1591	813	507	446	694	1303	2176	4434	629	28650	42417

Table A4.10 (continued)

O\D	z050	others	TOTAL
z001	0	2130	2130
z002	0	953	953
z003	0	1595	1595
z004	0	354	354
z005	0	1189	1189
z006	0	160	160
z007	0	4186	4186
z008	26	3158	3184
z009	0	1160	1160
z010	0	322	322
z011	69	580	649
z012	0	1359	1359
z013	0	390	390
z014	0	1212	1212
z015	0	440	440
z016	0	114	114
z017	61	1933	1994
z018	0	7	7
z019	121	1661	1782
z020	0	2918	2918
z021	0	915	915
z022	0	231	231
z023	0	204	204
z024	0	176	176
z025	0	116	116
z026	0	122	122
z027	0	281	281
z028	0	0	0
z030	0	285	285
z031	0	906	906
z032	70	32	102
z033	0	305	305
z034	0	776	776
z035	0	635	635
z036	0	293	293
z038	0	1270	1270
z040	0	235	235
z041	0	580	580
z042	0	732	732
z043	0	1054	1054
z045	0	1405	1405
z046	0	1407	1407
z047	0	3132	3132
z049	0	614	614
z050	0	543	543
TOTAL	347	42070	42417

Table A4.11 Origin - Destination Commodity Flow table for group # 11 (Crude Coal and petroleum)

O\D	z003	z004	z005	z007	z008	z009	z010	z012	z013	z014	z015	others	TOTAL
z003	0	0	0	0	0	0	0	0	0	376	0	219	595
z004	0	0	0	0	0	0	0	0	0	0	0	83	83
z005	0	0	0	29	0	0	0	0	0	0	0	0	29
z007	0	0	0	0	89	0	0	0	0	0	0	348	437
z008	99	0	0	0	0	15	0	0	0	0	0	84	198
z009	98	0	0	0	139	0	0	0	0	465	0	955	1657
z010	0	0	0	99	0	0	0	0	0	0	0	456	555
z011	0	0	0	0	46	0	0	0	0	0	0	444	490
z012	0	0	0	0	0	0	0	0	0	0	0	396	396
z013	0	22	0	0	0	0	0	0	0	0	0	0	22
z014	0	0	0	29	0	0	0	0	0	0	0	145	174
z015	0	0	0	0	0	0	0	0	0	0	0	171	171
z017	0	0	0	0	0	0	0	0	0	0	0	353	353
z019	0	0	67	0	15	0	0	12	55	0	42	0	191
z024	0	0	0	0	0	0	0	0	0	0	0	98	98
z026	0	0	0	0	0	0	0	0	0	0	0	313	313
z027	0	0	0	0	0	0	0	0	0	0	0	24	24
z030	0	0	0	0	0	0	0	0	0	0	0	48	48
z032	0	0	0	0	0	0	112	0	0	0	0	0	112
z033	0	0	0	0	0	0	0	0	0	0	0	40	40
z035	0	0	0	0	0	0	0	0	0	0	0	45	45
z038	0	0	0	0	0	0	0	0	0	0	0	862	862
z040	0	0	0	0	0	0	0	0	0	0	0	67	67
z041	0	0	0	0	0	0	0	16	0	0	0	10	123
z042	0	0	0	0	0	0	0	0	0	0	0	11	11
z043	0	0	0	0	0	0	0	58	0	229	0	0	287
z045	0	0	3	0	0	168	0	0	0	0	0	0	171
z047	0	0	0	0	0	0	0	0	0	0	0	89	89
z049	0	0	0	0	0	0	0	0	0	0	0	123	123
z050	0	0	0	0	0	0	0	0	0	0	0	61	61
TOTAL	197	22	70	157	289	183	112	86	55	1070	42	5542	7825

Table A4.11 (Continued)

O\D	z017	z018	z019	z021	z022	z023	z024	z026	z027	z030	z031	others	TOTAL
z003	0	0	0	0	0	0	0	0	0	0	0	595	595
z004	0	0	0	0	0	0	0	0	0	0	40	43	83
z005	0	0	0	0	0	0	0	0	0	0	0	29	29
z007	0	0	0	0	0	327	0	0	0	0	0	110	437
z008	0	0	0	0	0	0	0	0	0	0	0	198	198
z009	0	0	169	599	0	0	0	0	0	0	0	889	1657
z010	242	0	0	0	0	0	0	0	0	0	158	155	555
z011	0	0	0	0	444	0	0	0	0	0	0	46	490
z012	113	0	55	0	0	0	0	0	0	0	0	228	396
z013	0	0	0	0	0	0	0	0	0	0	0	22	22
z014	145	0	0	0	0	0	0	0	0	0	0	29	174
z015	0	0	0	0	0	0	0	0	0	95	76	0	171
z017	0	0	0	0	0	0	253	0	0	0	0	100	353
z019	0	0	0	0	0	0	0	0	0	0	0	191	191
z024	0	0	0	0	0	0	0	23	75	0	0	0	98
z026	0	0	0	0	0	0	0	0	8	0	0	305	313
z027	0	0	0	0	0	0	0	24	0	0	0	0	24
z030	0	0	0	3	0	0	0	0	0	0	0	45	48
z032	0	0	0	0	0	0	0	0	0	0	0	112	112
z033	0	0	0	0	0	0	0	0	0	0	0	40	40
z035	0	0	0	0	0	0	0	0	0	0	0	45	45
z038	0	0	0	0	0	0	0	0	22	0	76	764	862
z040	0	0	0	0	0	0	0	0	0	0	0	67	67
z041	0	0	0	0	0	0	0	0	0	0	0	123	123
z042	0	0	0	0	0	0	0	0	0	0	0	11	11
z043	0	0	0	0	0	0	0	0	0	0	0	287	287
z045	0	0	0	0	0	0	0	0	0	0	0	171	171
z047	10	0	0	0	0	0	0	0	0	0	0	79	89
z049	0	123	0	0	0	0	0	0	0	0	0	0	123
z050	0	0	0	0	0	0	0	0	0	0	0	61	61
TOTAL	510	123	224	602	444	327	253	47	105	95	350	4745	7825

Table A4.11 (continued)

O\D	z033	z034	z038	z041	z042	z043	z045	z046	others	TOTAL
z003	0	0	0	0	0	0	219	0	376	595
z004	0	43	0	0	0	0	0	0	40	83
z005	0	0	0	0	0	0	0	0	29	29
z007	0	0	0	0	0	0	21	0	416	437
z008	0	0	0	84	0	0	0	0	114	198
z009	0	0	164	0	0	23	0	0	1470	1657
z010	0	0	56	0	0	0	0	0	499	555
z011	0	0	0	0	0	0	0	0	490	490
z012	0	0	54	0	18	156	0	0	168	396
z013	0	0	0	0	0	0	0	0	22	22
z014	0	0	0	0	0	0	0	0	174	174
z015	0	0	0	0	0	0	0	0	171	171
z017	0	0	100	0	0	0	0	0	253	353
z019	0	0	0	0	0	0	0	0	191	191
z024	0	0	0	0	0	0	0	0	98	98
z026	0	0	305	0	0	0	0	0	8	313
z027	0	0	0	0	0	0	0	0	24	24
z030	0	0	45	0	0	0	0	0	3	48
z032	0	0	0	0	0	0	0	0	112	112
z033	40	0	0	0	0	0	0	0	0	40
z035	0	0	0	45	0	0	0	0	0	45
z038	0	0	0	0	0	0	513	251	98	862
z040	0	0	0	0	0	0	67	0	0	67
z041	0	107	0	0	0	0	0	0	16	123
z042	0	0	11	0	0	0	0	0	0	11
z043	0	0	0	0	0	0	0	0	287	287
z045	0	0	0	0	0	0	0	0	171	171
z047	0	0	79	0	0	0	0	0	10	89
z049	0	0	0	0	0	0	0	0	123	123
z050	0	0	61	0	0	0	0	0	0	61
TOTAL	40	150	875	129	18	179	820	251	5363	7825

Table A4.12 Origin - Destination Commodity Flow table for group # 12 (Petroleum and coal products)

O\D	z001	z002	z003	z004	z005	z007	z008	z009	z010	z011	z012	others	TOTAL
z001	0	0	63	0	0	0	34	0	0	0	0	185	282
z002	0	0	9	0	0	0	0	0	0	0	0	0	9
z003	429	128	44	0	97	542	0	92	528	0	156	4761	6777
z004	0	0	0	17	214	0	0	0	0	0	0	489	720
z005	0	0	40	57	0	283	0	0	0	0	0	212	592
z007	0	0	0	0	0	0	0	0	0	0	0	917	917
z008	0	0	304	16	0	0	3	217	40	0	1	228	809
z009	0	0	25	0	0	0	984	0	0	0	98	1185	2292
z010	0	0	0	0	0	198	0	0	0	3	271	190	662
z011	0	0	0	0	0	0	153	0	0	0	0	746	899
z012	0	0	123	0	342	27	140	0	771	0	0	625	2028
z013	0	353	0	0	0	0	0	0	0	0	0	162	515
z014	296	0	223	840	143	724	47	0	0	0	0	4977	7250
z015	174	0	17	0	60	0	0	0	0	0	0	3330	3581
z016	0	0	69	0	0	64	0	0	0	0	0	201	334
z017	0	0	0	0	0	0	2	0	0	0	19	29	50
z018	0	0	0	0	0	11	0	0	0	0	0	0	11
z019	0	0	595	0	94	0	0	0	0	2	0	292	983
z020	0	0	0	0	0	0	0	0	0	0	0	140	140
z021	0	0	0	0	0	0	0	0	0	49	0	24	73
z023	0	0	0	0	0	8	0	0	0	0	0	0	8
z024	0	0	0	0	0	117	0	0	0	0	0	674	791
z025	0	0	19	0	0	0	0	0	0	0	0	103	122
z026	0	0	0	0	0	0	0	0	0	0	0	232	232
z027	0	0	0	0	0	0	0	0	0	0	0	2286	2286
z030	0	0	0	0	0	0	11	0	0	0	0	1412	1423
z031	0	0	0	0	0	0	0	0	0	0	7	24	31
z032	0	0	0	0	0	0	0	0	0	0	0	31	31
z033	0	0	22	0	0	0	0	0	18	0	0	401	441
z034	0	0	0	0	0	0	0	0	0	0	0	417	417
z035	0	0	0	0	0	0	0	0	0	0	0	217	217
z036	0	0	13	0	0	0	0	0	0	0	0	49	62
z038	0	0	0	0	102	173	0	60	0	0	63	1538	1936
z041	0	0	0	0	0	0	0	0	0	0	0	1285	1285
z042	0	0	0	0	0	0	0	0	0	0	0	115	115
z043	0	0	0	0	30	62	88	0	71	0	0	197	448
z045	0	0	0	23	0	0	258	47	0	0	321	840	1489
z046	0	0	0	0	0	0	0	0	0	0	0	155	155
z047	0	0	0	0	0	110	0	0	0	0	0	566	676
z050	0	0	0	0	0	0	0	0	0	0	322	0	322
TOTAL	899	481	1566	953	1082	2319	1720	416	1428	54	1258	29235	41411

Table A4.12 (Continued)

O\D	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	z023	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	0	282	282
z002	0	0	0	0	0	0	0	0	0	0	0	9	9
z003	461	976	0	47	119	0	757	0	104	0	0	4313	6777
z004	0	0	0	0	0	0	0	0	0	115	0	605	720
z005	0	0	0	0	94	0	0	0	0	0	0	498	592
z007	0	0	0	0	0	0	0	0	0	0	0	917	917
z008	62	25	0	0	0	0	0	0	0	0	0	722	809
z009	0	0	0	0	0	0	0	915	0	0	0	1377	2292
z010	0	0	0	0	0	0	0	0	0	0	0	662	662
z011	0	0	0	0	0	63	0	0	0	0	0	836	899
z012	0	0	0	0	0	0	4	0	0	0	538	1486	2028
z013	0	0	0	0	0	0	0	0	0	0	0	515	515
z014	0	0	0	0	0	64	355	633	33	664	0	5501	7250
z015	0	0	0	0	0	246	319	0	300	711	0	2005	3581
z016	0	0	0	0	54	0	0	0	114	0	0	166	334
z017	0	0	0	0	0	0	0	0	0	0	0	50	50
z018	0	0	0	0	0	0	0	0	0	0	0	11	11
z019	0	1	0	0	0	0	135	0	0	0	0	847	983
z020	0	0	0	0	0	0	0	0	0	0	0	140	140
z021	8	0	15	0	0	0	0	0	1	0	0	49	73
z023	0	0	0	0	0	0	0	0	0	0	0	8	8
z024	0	0	0	0	0	0	121	0	0	0	0	670	791
z025	0	0	0	0	0	0	0	0	0	0	0	122	122
z026	0	0	0	0	0	0	0	0	0	0	0	232	232
z027	0	0	0	0	0	0	0	0	0	0	0	2286	2286
z030	0	100	0	0	24	0	10	54	4	0	0	1231	1423
z031	0	0	0	0	0	0	0	0	0	0	0	31	31
z032	0	0	0	0	0	0	0	0	0	0	0	31	31
z033	0	0	0	0	0	0	0	0	0	0	0	441	441
z034	0	15	0	0	0	0	0	0	0	0	0	402	417
z035	0	0	0	0	0	0	0	0	0	0	0	217	217
z036	0	0	6	0	0	0	43	0	0	0	0	13	62
z038	0	1011	274	0	0	0	76	0	0	0	0	575	1936
z041	0	0	0	0	0	0	0	0	0	0	0	1285	1285
z042	0	71	0	0	44	0	0	0	0	0	0	0	115
z043	0	80	0	32	85	0	0	0	0	0	0	251	448
z045	173	615	0	0	0	0	0	0	0	0	0	701	1489
z046	0	0	0	0	0	0	0	0	0	0	155	0	155
z047	0	258	0	0	167	0	0	0	0	0	0	251	676
z050	0	0	0	0	0	0	0	0	0	0	0	322	322
TOTAL	704	3152	295	79	587	373	1820	1602	556	1490	693	30060	41411

Table A4.12 (continued)

O\D	z024	z025	z026	z027	z029	z030	z031	z032	z033	z034	z035	others	TOTAL
z001	0	0	0	0	0	0	0	0	0	0	0	282	282
z002	0	0	0	0	0	0	0	0	0	0	0	9	9
z003	0	0	106	456	0	0	323	0	0	0	0	5892	6777
z004	0	0	0	0	0	0	181	0	0	0	0	539	720
z005	0	0	88	0	0	0	0	0	0	0	0	504	592
z007	0	0	0	0	0	0	0	0	0	0	0	917	917
z008	0	0	0	0	0	0	141	0	0	0	0	668	809
z009	0	0	0	0	0	0	241	0	0	0	0	2051	2292
z010	0	0	61	0	0	33	0	0	0	0	0	568	662
z011	0	0	0	0	0	0	0	0	2	581	0	316	899
z012	0	0	0	0	0	40	0	0	0	0	0	1988	2028
z013	0	0	0	0	0	0	0	0	0	0	0	515	515
z014	1510	0	0	57	0	52	567	118	83	338	0	4525	7250
z015	0	0	0	0	0	338	982	89	265	0	0	1907	3581
z016	0	0	0	0	0	0	0	0	33	0	0	301	334
z017	0	0	0	0	0	0	0	0	0	29	0	21	50
z018	0	0	0	0	0	0	0	0	0	0	0	11	11
z019	0	0	0	0	0	0	156	0	0	0	0	827	983
z020	0	140	0	0	0	0	0	0	0	0	0	0	140
z021	0	0	0	0	0	0	0	0	0	0	0	73	73
z023	0	0	0	0	0	0	0	0	0	0	0	8	8
z024	1	0	0	13	0	0	0	0	0	0	0	777	791
z025	0	0	0	103	0	0	0	0	0	0	0	19	122
z026	0	0	0	5	0	0	0	0	0	0	0	227	232
z027	0	341	912	0	247	0	118	0	0	0	0	668	2286
z030	0	0	0	0	0	0	366	439	415	0	0	203	142
z031	0	0	0	0	0	0	24	0	0	0	0	7	.
z032	0	0	0	0	0	0	0	31	0	0	0	0	31
z033	0	0	0	0	0	0	0	107	294	0	0	40	441
z034	0	0	0	0	0	0	0	0	98	209	95	15	417
z035	0	0	0	0	0	0	0	0	0	0	217	0	217
z036	0	0	0	0	0	0	0	0	0	0	0	62	62
z038	0	0	0	84	0	0	93	0	0	0	0	1759	1936
z041	0	0	0	0	0	0	0	0	0	268	1017	0	1285
z042	0	0	0	0	0	0	0	0	0	0	0	115	115
z043	0	0	0	0	0	0	0	0	0	0	0	448	448
z045	0	0	52	0	0	0	0	0	0	0	0	1437	1489
z046	0	0	0	0	0	0	0	0	0	0	0	155	155
z047	0	0	0	0	0	0	0	0	0	30	0	646	676
z050	0	0	0	0	0	0	0	0	0	0	0	322	322
TOTAL	1511	481	1219	718	247	463	3192	784	1190	1455	1329	28822	41411

Table A4.12 (continued)

O\D	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	0	0	0	0	0	0	0	185	0	97	282
z002	0	0	0	0	0	0	0	0	0	9	9
z003	308	257	632	0	0	136	79	0	0	5365	6777
z004	0	0	0	0	0	0	193	0	0	527	720
z005	0	30	0	0	0	0	0	0	0	562	592
z007	0	595	0	0	0	77	53	0	192	0	917
z008	0	0	0	0	0	0	0	0	0	809	809
z009	0	0	0	0	0	0	0	0	29	2263	2292
z010	96	0	0	0	0	0	0	0	0	566	662
z011	0	0	0	0	0	0	100	0	0	799	899
z012	0	0	0	0	43	0	0	0	0	1985	2028
z013	0	93	0	0	0	0	69	0	0	353	515
z014	82	201	0	165	0	0	55	0	0	6747	7250
z015	0	59	0	0	21	0	0	0	0	3501	3581
z016	0	0	0	0	0	0	0	0	0	334	334
z017	0	0	0	0	0	0	0	0	0	50	50
z018	0	0	0	0	0	0	0	0	0	11	11
z019	0	0	0	0	0	0	0	0	0	983	983
z020	0	0	0	0	0	0	0	0	0	140	140
z021	0	0	0	0	0	0	0	0	0	73	73
z023	0	0	0	0	0	0	0	0	0	8	8
z024	0	539	0	0	0	0	0	0	0	252	791
z025	0	0	0	0	0	0	0	0	0	122	122
z026	0	227	0	0	0	0	0	0	0	5	232
z027	0	281	0	0	0	0	387	0	0	1618	2286
z030	0	0	0	0	0	0	0	0	0	1423	1423
z031	0	0	0	0	0	0	0	0	0	31	31
z032	0	0	0	0	0	0	0	0	0	31	31
z033	0	0	0	0	0	0	0	0	0	441	441
z034	0	0	0	0	0	0	0	0	0	417	417
z035	0	0	0	0	0	0	0	0	0	217	217
z036	0	0	0	0	0	0	0	0	0	62	62
z038	0	0	0	0	0	0	0	0	0	1936	1936
z041	0	0	0	0	0	0	0	0	0	1285	1285
z042	0	0	0	0	0	0	0	0	0	115	115
z043	0	0	0	0	0	0	0	0	0	448	448
z045	0	0	0	0	0	0	0	0	0	1489	1489
z046	0	0	0	0	0	0	0	0	0	155	155
z047	44	67	0	0	0	0	0	0	0	565	676
z050	0	0	0	0	0	0	0	0	0	322	322
TOTAL	530	2349	632	165	64	213	936	185	221	36116	41411

Table A4.13 Origin - Destination Commodity Flow table for group # 13 (Chemicals and materials products)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	232	0	85	175	0	0	331	260	0	0	149	2326	3558
z002	0	0	0	0	0	0	0	0	0	0	0	155	155
z003	0	0	0	162	163	0	117	179	186	628	0	7236	8671
z004	0	0	0	0	0	0	0	0	0	0	6	673	679
z005	0	0	3	0	0	0	0	333	0	0	0	1226	1562
z006	0	0	0	0	0	0	3	0	0	0	0	0	3
z007	0	0	974	0	0	0	0	16	0	0	0	2039	3029
z008	63	0	0	0	0	0	282	55	350	73	0	1559	2382
z009	0	196	0	0	0	0	0	88	0	0	0	1229	1513
z010	0	0	0	0	0	0	0	3	0	0	127	729	859
z011	0	0	0	4	0	7	0	140	0	28	0	492	671
z012	59	0	13	23	48	64	259	0	0	0	0	2004	2470
z013	350	0	145	143	0	0	63	128	0	0	0	1244	2073
z014	437	0	72	0	45	0	255	41	598	138	0	1098	2684
z015	0	0	87	0	0	0	199	89	10	0	0	36	421
z016	0	0	197	215	38	0	2	48	43	0	0	425	968
z017	162	0	76	0	107	0	269	76	0	0	0	921	1611
z018	0	0	0	1	0	0	0	0	0	0	0	276	277
z019	16	0	97	6	0	0	130	129	0	0	0	361	739
z020	27	0	0	3	0	0	29	92	0	407	0	263	821
z021	0	0	0	0	0	0	5	0	7	0	514	167	693
z022	0	0	0	0	0	0	0	0	0	0	0	263	263
z023	0	0	0	0	0	0	0	0	146	0	0	342	488
z024	38	41	0	0	0	0	0	0	0	0	0	548	627
z025	0	0	189	0	0	0	1008	0	0	0	0	1564	2761
z026	0	0	235	0	0	0	193	70	0	0	0	1277	1775
z028	0	0	0	0	0	0	0	0	0	0	0	46	46
z029	0	0	0	0	0	0	0	0	0	0	0	22	22
z030	0	0	0	0	0	0	0	0	0	0	0	296	296
z031	0	0	0	0	0	0	0	0	0	18	15	1981	2014
z032	0	0	0	0	1	0	0	14	0	0	0	221	236
z033	0	0	0	0	0	0	0	0	0	0	0	11	11
z034	0	0	0	0	0	0	0	0	0	0	0	611	611
z035	0	0	0	0	0	0	0	0	0	0	0	61	61
z036	0	0	17	0	38	0	62	0	0	0	0	598	715
z038	168	62	136	0	113	0	499	35	588	0	0	2789	4390
z040	31	0	0	0	0	0	0	0	0	0	0	23	54
z041	0	0	0	0	0	0	0	0	67	0	11	257	335
z042	0	0	0	0	0	0	0	0	43	0	0	171	214
z043	0	0	0	49	132	0	136	0	0	0	0	1575	1892
z045	0	0	147	6	0	0	0	0	0	0	0	590	743
z046	177	0	119	0	0	0	202	0	0	0	0	961	1459
z047	0	0	0	300	55	0	0	103	137	72	21	2121	2809
z049	0	0	0	520	0	0	0	0	0	0	0	708	1228
z050	0	0	0	112	0	0	0	0	0	0	0	242	354
TOTAL	1760	299	2592	1719	740	71	4044	1899	2175	1364	843	41737	59243

Table A4.13 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	109	443	130	202	138	0	0	0	0	0	0	2536	3558
z002	0	0	0	0	0	0	0	0	0	0	0	155	155
z003	1114	576	348	678	275	1217	0	1398	0	0	102	2963	8671
z004	209	0	0	0	0	0	0	0	0	0	0	470	679
z005	185	381	115	0	65	0	0	60	23	0	0	733	1562
z006	0	0	0	0	0	0	0	0	0	0	0	3	3
z007	104	235	0	3	0	209	0	26	0	1	0	2451	3029
z008	70	241	215	0	59	122	0	359	120	0	0	1196	2382
z009	0	0	173	0	0	0	62	462	0	12	0	804	1513
z010	0	36	273	0	0	6	0	0	0	0	0	544	859
z011	0	78	114	0	0	0	40	0	0	0	0	439	671
z012	0	0	0	0	0	0	299	253	0	0	0	1918	2470
z013	0	0	0	0	0	0	0	6	0	30	0	2037	2073
z014	0	0	0	0	0	0	0	0	0	0	0	2684	2684
z015	0	0	0	0	0	0	0	4	0	0	0	417	421
z016	0	0	0	0	0	0	0	0	0	0	0	968	968
z017	1	0	0	0	0	0	0	1	0	16	0	1593	1611
z018	0	0	234	0	0	0	0	0	0	0	0	43	277
z019	0	0	36	17	0	0	1	58	33	0	0	594	739
z020	0	0	0	0	0	0	9	0	26	5	0	781	821
z021	0	0	0	82	0	0	0	0	0	0	0	611	693
z022	0	0	0	0	0	0	0	32	0	0	0	231	263
z023	0	0	0	0	0	0	0	0	0	0	0	488	488
z024	0	0	0	0	0	37	0	0	0	0	0	590	627
z025	0	34	21	4	270	97	0	0	11	0	0	2324	2761
z026	45	1	43	63	0	504	0	0	0	0	0	1119	1775
z028	0	0	0	0	0	0	0	0	0	0	0	46	46
z029	0	0	0	0	0	0	0	0	0	0	0	22	22
z030	0	0	0	0	0	0	0	0	0	9	4	283	296
z031	0	0	53	24	84	210	0	0	0	9	0	1634	2014
z032	0	0	0	36	0	0	0	0	0	0	0	200	236
z033	0	0	0	0	0	0	0	0	0	0	0	11	11
z034	0	0	0	0	0	0	0	0	0	0	0	611	611
z035	0	0	0	0	0	0	0	0	0	0	0	61	61
z036	42	128	35	0	0	13	0	49	0	139	0	309	715
z038	93	122	130	26	0	246	122	349	0	0	57	3245	4390
z040	0	0	23	0	0	0	0	0	0	0	0	31	54
z041	0	82	38	0	0	0	0	0	0	0	0	215	335
z042	77	0	7	0	0	0	0	0	0	0	0	130	214
z043	96	227	156	0	133	83	0	344	45	0	0	808	1892
z045	12	105	35	0	0	0	150	0	187	0	0	254	743
z046	0	0	302	0	0	0	0	0	509	0	0	648	1459
z047	286	112	163	0	23	97	0	287	165	0	0	1676	2809
z049	0	0	0	0	36	0	0	4	0	61	0	1127	1228
z050	0	0	0	0	0	0	0	0	0	0	0	354	354
TOTAL	2443	2801	2644	1135	1083	2841	683	3692	1119	282	163	40357	59243

Table A4.13 (continued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	151	0	0	43	0	0	0	0	0	0	1076	2288	3558
z002	0	0	0	0	0	0	0	0	0	0	0	155	155
z003	0	0	142	133	18	0	0	0	0	0	77	8301	8671
z004	0	0	0	0	0	0	0	0	0	67	0	612	679
z005	0	0	0	0	0	19	0	0	116	0	0	1427	1562
z006	0	0	0	0	0	0	0	0	0	0	0	3	3
z007	201	177	97	0	104	0	0	0	0	0	0	2450	3029
z008	78	0	0	0	0	0	0	0	0	0	0	2304	2382
z009	0	0	0	0	0	39	0	0	0	0	0	1474	1513
z010	0	0	0	0	0	0	0	0	18	0	0	841	859
z011	0	0	0	0	0	0	0	0	0	0	0	671	671
z012	0	0	0	35	23	0	0	0	8	0	0	2404	2470
z013	0	373	21	0	0	0	0	0	168	0	48	1463	2073
z014	0	0	66	0	4	0	0	0	15	0	29	2570	2684
z015	0	0	0	0	0	0	0	0	0	0	0	421	421
z016	0	0	0	0	0	0	0	0	51	0	0	917	968
z017	0	0	73	49	0	0	0	0	0	0	10	1479	1611
z018	0	0	0	0	0	0	0	0	0	0	0	277	277
z019	0	0	0	0	0	0	0	0	0	19	0	720	739
z020	0	0	0	0	0	0	0	0	0	0	0	821	821
z021	16	0	0	0	0	0	0	0	0	0	0	677	693
z022	0	0	0	0	0	0	0	0	0	0	0	263	263
z023	0	0	0	0	0	0	0	0	0	0	0	488	488
z024	26	0	80	0	0	0	0	0	0	0	0	521	627
z025	0	0	0	0	0	0	0	0	0	0	0	2761	2761
z026	0	0	0	0	39	0	0	0	0	0	27	1709	1775
z028	0	0	0	0	0	0	0	0	0	0	0	46	46
z029	0	0	0	0	0	0	0	0	0	0	0	22	22
z030	0	0	0	0	0	0	0	0	6	0	0	290	296
z031	0	0	0	0	0	0	0	23	0	0	1192	799	2014
z032	0	0	0	0	0	0	0	0	0	0	152	84	236
z033	0	0	0	0	0	0	0	0	0	0	0	11	11
z034	59	0	0	50	0	0	0	0	0	11	23	468	611
z035	0	0	0	0	0	0	0	0	0	0	0	61	61
z036	0	13	0	0	13	0	0	56	0	0	0	633	715
z038	42	76	3	189	255	0	45	0	47	6	238	3489	4390
z040	0	0	0	0	0	0	0	0	0	0	0	54	54
z041	0	0	0	0	0	0	0	0	0	0	0	335	335
z042	0	0	0	59	0	0	0	0	14	0	0	141	214
z043	0	0	79	2	0	0	0	0	77	0	0	1734	1892
z045	0	0	0	0	0	0	0	0	0	0	0	743	743
z046	0	0	0	0	0	0	0	0	0	0	0	1459	1459
z047	0	0	201	0	0	0	0	0	23	0	0	2585	2809
z049	0	0	22	0	0	0	0	0	0	0	0	1206	1228
z050	0	0	0	0	0	0	0	0	82	0	0	272	354
TOTAL	573	639	784	560	456	58	45	79	625	103	2872	52449	59243

Table A4.13 (continued)

O\D	z034	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	0	0	0	11	0	0	0	23	0	0	0	3524	3558
z002	0	0	0	0	0	0	0	0	0	155	0	0	155
z003	0	0	389	349	0	0	145	53	52	126	44	7513	8671
z004	0	0	0	22	0	25	0	0	0	0	350	282	679
z005	0	0	0	0	0	0	0	0	114	148	0	1300	1562
z006	0	0	0	0	0	0	0	0	0	0	0	3	3
z007	0	0	0	561	0	0	0	321	0	0	0	2147	3029
z008	0	0	0	117	0	0	70	0	0	0	52	2143	2382
z009	0	0	0	0	0	0	0	76	63	0	211	1163	1513
z010	0	0	0	279	0	0	0	117	0	0	0	463	859
z011	0	0	140	53	0	36	0	0	24	7	0	411	671
z012	211	0	17	487	4	10	22	189	66	0	380	1084	2470
z013	0	0	0	381	0	16	0	0	11	0	190	1475	2073
z014	22	0	26	302	78	77	32	0	75	152	220	1700	2684
z015	0	0	0	0	0	0	0	32	0	0	0	389	421
z016	30	0	0	253	0	0	85	0	6	0	0	594	968
z017	0	0	0	36	7	14	0	225	105	167	180	877	1611
z018	0	0	0	0	0	42	0	0	0	0	0	235	277
z019	43	0	74	66	0	12	0	0	0	0	2	542	739
z020	0	0	87	136	0	0	0	0	0	0	0	598	821
z021	0	0	0	0	0	0	0	69	0	0	0	624	693
z022	0	0	0	0	0	0	0	0	0	43	188	32	263
z023	0	0	0	0	0	0	12	189	141	0	0	146	488
z024	0	0	128	277	0	0	0	0	0	0	0	222	627
z025	0	0	586	468	37	0	0	0	36	0	0	1634	2761
z026	0	0	361	194	0	0	0	0	0	0	0	1220	1775
z028	0	0	46	0	0	0	0	0	0	0	0	0	46
z029	0	0	0	22	0	0	0	0	0	0	0	0	22
z030	0	222	0	0	0	0	0	0	0	0	55	19	296
z031	0	0	0	0	263	0	20	0	52	0	0	1679	2014
z032	0	0	0	0	33	0	0	0	0	0	0	203	236
z033	11	0	0	0	0	0	0	0	0	0	0	0	11
z034	378	26	0	0	0	64	0	0	0	0	0	143	611
z035	2	23	0	0	0	36	0	0	0	0	0	0	61
z036	0	0	0	0	0	0	0	0	0	0	110	605	715
z038	92	8	0	98	0	33	50	0	59	69	204	3777	4390
z040	0	0	0	0	0	0	0	0	0	0	0	54	54
z041	0	126	0	11	0	0	0	0	0	0	0	198	335
z042	0	0	0	10	4	0	0	0	0	0	0	200	214
z043	0	0	0	295	0	0	38	0	0	0	0	1559	1892
z045	33	0	0	0	0	0	0	0	0	4	64	642	743
z046	0	0	85	65	0	0	0	0	0	0	0	1309	1459
z047	0	0	0	549	0	0	0	0	215	0	0	2045	2809
z049	0	0	0	434	0	0	0	151	0	0	0	643	1228
z050	0	0	0	160	0	0	0	0	0	0	0	194	354
TOTAL	822	405	1939	5636	426	365	474	1445	1019	871	2250	43591	59243

Table A4.13 (continued)

O\D	z049	z050	others	TOTAL
z001	0	0	3558	3558
z002	0	0	155	155
z003	0	0	8671	8671
z004	0	0	679	679
z005	0	0	1562	1562
z006	0	0	3	3
z007	0	0	3029	3029
z008	0	56	2326	2382
z009	131	0	1382	1513
z010	0	0	859	859
z011	0	0	671	671
z012	0	0	2470	2470
z013	0	0	2073	2073
z014	0	0	2684	2684
z015	0	0	421	421
z016	0	0	968	968
z017	0	37	1574	1611
z018	0	0	277	277
z019	0	0	739	739
z020	0	0	821	821
z021	0	0	693	693
z022	0	0	263	263
z023	0	0	488	488
z024	0	0	627	627
z025	0	0	2761	2761
z026	0	0	1775	1775
z028	0	0	46	46
z029	0	0	22	22
z030	0	0	296	296
z031	51	0	1963	2014
z032	0	0	236	236
z033	0	0	11	11
z034	0	0	611	611
z035	0	0	61	61
z036	0	0	715	715
z038	29	101	4260	4390
z040	0	0	54	54
z041	0	0	335	335
z042	0	0	214	214
z043	0	0	1892	1892
z045	0	0	743	743
z046	0	0	1459	1459
z047	0	0	2809	2809
z049	0	0	1228	1228
z050	0	0	354	354
TOTAL	211	194	58838	59243

Table A4.14 Origin - Destination Commodity Flow table for group # 14 (Arms and Explosives)

O\D	z007	z050	others	TOTAL
z030	0	33	0	33
z042	76	0	0	76
TOTAL	76	33	0	109

Table A4.15 Origin - Destination Commodity Flow table for group # 15 (Others)

O\D	z001	z002	z003	z004	z005	z006	z007	z008	z009	z010	z011	others	TOTAL
z001	0	0	178	0	240	0	58	0	0	0	0	496	972
z002	0	0	0	0	0	0	0	0	0	0	0	104	104
z003	0	0	0	0	0	0	0	0	14	0	0	848	862
z004	0	0	0	2	0	0	0	0	0	0	0	550	552
z005	145	0	50	241	0	0	199	0	182	0	0	361	1178
z007	394	0	0	0	0	0	1	0	0	0	0	1287	1682
z008	0	0	0	45	0	0	4	0	0	22	0	960	1031
z009	174	0	0	0	0	0	0	81	0	0	0	771	1026
z010	0	0	0	0	0	0	0	26	0	0	78	81	185
z011	363	0	0	0	0	0	0	0	0	0	0	357	720
z012	41	0	27	111	36	0	291	54	375	37	0	1733	2705
z013	69	0	0	293	85	0	75	16	0	0	0	479	1017
z014	102	0	40	75	72	23	366	123	0	22	0	976	1799
z015	0	0	0	0	0	0	77	16	325	0	0	51	469
z016	0	0	0	0	0	0	24	0	0	0	0	247	271
z017	137	0	563	0	26	0	2	0	0	0	0	2027	2755
z018	0	0	0	0	0	0	0	0	0	0	0	305	305
z019	0	2	23	0	0	0	441	0	70	0	106	576	1218
z020	59	0	34	0	0	0	0	215	0	0	0	118	426
z021	0	0	0	0	0	0	193	0	4	0	0	113	310
z022	0	0	0	0	0	0	118	0	0	0	0	344	462
z023	0	0	0	0	0	0	0	0	0	0	0	114	114
z024	0	0	0	0	0	0	21	0	0	0	0	371	392
z025	0	0	0	0	0	0	0	0	0	0	0	136	136
z026	0	258	0	118	0	0	0	0	0	0	0	797	1173
z027	0	0	0	0	0	0	0	0	0	0	0	761	761
z028	0	0	0	0	0	0	0	0	0	0	0	85	85
z029	0	0	0	0	0	0	0	0	0	0	0	82	82
z030	0	0	0	0	0	0	0	113	12	4	0	51	180
z031	0	0	0	0	0	0	0	0	0	21	0	346	367
z032	0	0	0	0	0	0	0	0	31	0	0	322	353
z033	0	0	0	0	0	0	0	0	0	0	0	365	365
z034	0	0	0	0	0	0	0	0	15	0	0	237	252
z035	0	0	0	16	0	0	0	0	0	0	0	182	198
z036	568	0	0	0	15	0	0	79	0	0	0	142	804
z038	0	0	152	0	23	0	31	0	6	0	0	2863	3075
z040	0	0	0	0	0	0	0	0	0	180	0	834	1014
z041	0	0	0	0	0	0	55	0	0	0	0	302	357
z042	0	0	0	0	0	0	22	0	0	0	0	422	444
z043	0	0	0	0	0	0	0	0	0	0	0	27	27
z045	0	0	0	0	6	0	0	14	0	0	0	1655	1675
z046	0	0	0	0	18	0	0	16	0	0	0	1915	1949
z047	0	64	51	0	0	0	81	50	397	0	0	920	1563
z049	0	0	0	327	0	0	0	0	0	0	0	341	668
z050	0	0	0	0	0	0	0	0	0	0	0	95	95
TOTAL	2052	324	1118	1228	521	23	2059	803	1431	286	184	26149	36178

Table A4.15 (Continued)

O\D	z012	z013	z014	z015	z016	z017	z018	z019	z020	z021	z022	others	TOTAL
z001	97	59	68	0	0	0	0	0	157	0	0	591	972
z002	0	0	104	0	0	0	0	0	0	0	0	0	104
z003	105	0	62	0	381	140	0	0	0	0	0	174	862
z004	130	0	0	0	58	0	0	0	14	0	0	350	552
z005	0	0	69	0	0	0	0	0	72	0	0	1037	1178
z007	13	152	173	441	0	110	114	106	48	0	0	525	1682
z008	58	96	128	0	0	0	0	52	24	0	0	673	1031
z009	203	0	0	0	0	0	0	0	0	0	0	823	1026
z010	0	0	38	0	43	0	0	0	0	0	0	104	185
z011	0	0	0	0	267	9	0	0	0	0	0	444	720
z012	0	0	0	0	0	391	71	106	0	0	0	2137	2705
z013	0	0	0	0	0	0	0	0	0	16	182	819	1017
z014	0	0	0	0	0	0	24	8	0	46	0	1721	1799
z015	0	0	0	0	0	0	0	0	0	0	0	469	469
z016	0	0	0	0	0	0	35	0	0	0	0	236	271
z017	0	146	0	0	0	0	0	176	0	0	907	1526	2755
z018	8	0	0	0	118	0	0	0	0	0	0	179	305
z019	76	90	122	18	0	2	0	83	0	0	0	827	1218
z020	0	0	0	0	0	0	0	0	0	0	0	426	426
z021	0	0	81	0	0	0	0	0	0	0	0	229	310
z022	0	0	0	0	0	0	0	31	0	0	0	431	462
z023	0	0	0	0	0	0	0	0	0	0	0	114	114
z024	0	0	104	0	0	0	0	0	0	0	0	288	392
z025	0	0	0	0	44	0	0	0	0	0	0	92	136
z026	74	0	14	0	0	0	0	0	0	0	0	1085	1173
z027	0	2	98	4	16	0	0	0	16	0	0	625	761
z028	0	0	15	0	0	0	0	0	70	0	0	0	85
z029	0	0	0	0	0	0	0	0	0	0	0	82	82
z030	0	0	28	0	0	0	0	0	0	0	0	152	180
z031	0	23	74	0	0	0	0	0	0	0	0	270	367
z032	3	0	0	0	0	4	0	0	0	0	0	346	353
z033	45	139	35	0	0	0	0	0	0	0	0	146	365
z034	0	0	57	0	0	0	0	0	0	0	0	195	252
z035	18	7	0	0	0	0	0	0	0	0	0	173	198
z036	0	0	0	22	0	4	0	0	0	0	0	778	804
z038	153	282	166	0	390	68	0	26	21	0	0	1969	3075
z040	0	0	0	0	0	0	0	806	0	0	0	208	1014
z041	26	0	31	0	0	176	0	0	0	0	0	124	357
z042	43	0	188	0	0	83	10	0	0	0	0	120	444
z043	3	0	0	0	0	24	0	0	0	0	0	0	27
z045	121	295	13	0	0	0	0	0	0	0	10	1236	1675
z046	0	106	89	0	86	1278	0	0	0	0	0	390	1949
z047	0	0	416	0	0	72	0	0	0	0	0	1075	1563
z049	166	0	15	88	0	0	0	72	0	0	0	327	668
z050	0	95	0	0	0	0	0	0	0	0	0	0	95
TOTAL	1342	1492	2188	573	1403	2361	254	1466	422	62	1099	23516	36178

Table A4.15 (continued)

O\D	z023	z024	z025	z026	z027	z028	z029	z030	z031	z032	z033	others	TOTAL
z001	0	0	0	0	99	0	0	0	0	0	0	873	972
z002	0	0	0	0	0	0	0	0	0	0	0	104	104
z003	0	0	0	0	0	0	0	0	129	0	0	733	862
z004	0	0	0	0	0	0	0	0	79	0	0	473	552
z005	130	0	0	0	0	11	0	0	0	45	0	992	1178
z007	2	30	0	0	5	0	0	0	0	0	3	1642	1682
z008	127	0	0	0	0	0	21	0	5	0	0	878	1031
z009	0	0	0	0	0	0	219	9	0	0	0	798	1026
z010	0	0	0	0	0	0	0	0	0	0	0	185	185
z011	0	0	0	0	0	0	0	0	27	0	0	693	720
z012	0	0	0	8	581	0	0	0	20	217	33	1846	2705
z013	0	0	35	0	11	0	0	0	93	0	0	878	1017
z014	0	0	8	52	142	0	0	0	0	26	71	1500	1799
z015	0	0	0	0	0	0	0	0	0	0	0	469	469
z016	0	0	0	0	56	0	0	0	0	0	0	215	271
z017	0	0	0	0	0	0	0	0	15	13	0	2727	2755
z018	0	0	0	0	0	0	0	0	0	0	0	305	305
z019	0	0	0	0	0	0	0	0	18	1	0	1199	1218
z020	0	0	12	0	18	0	0	0	12	0	0	384	426
z021	0	0	0	0	0	0	0	0	12	0	0	298	310
z022	0	0	119	0	0	0	0	0	0	0	128	215	462
z023	0	0	0	0	0	0	0	0	0	0	0	114	114
z024	0	3	15	25	3	0	0	0	0	0	0	346	392
z025	0	38	0	0	0	5	0	0	49	0	0	44	136
z026	0	0	0	6	42	2	0	0	0	0	0	1123	1173
z027	43	233	0	0	0	0	0	0	0	0	24	461	761
z028	0	0	0	0	0	0	0	0	0	0	0	85	85
z029	0	0	0	0	0	0	26	0	0	0	0	56	82
z030	0	0	0	0	0	0	0	11	0	0	0	169	180
z031	0	0	0	0	0	0	0	0	65	91	77	134	367
z032	0	0	0	0	0	0	0	0	4	31	5	313	353
z033	0	0	0	0	0	0	0	0	50	0	18	297	365
z034	0	0	0	0	0	0	19	0	0	0	95	138	252
z035	0	0	0	0	0	0	0	0	0	0	0	198	198
z036	0	11	0	2	73	0	11	0	0	0	0	707	804
z038	44	138	268	594	165	0	0	0	31	75	102	1658	3075
z040	0	0	0	0	8	0	0	0	0	0	0	1006	1014
z041	0	0	0	0	0	0	0	0	0	0	0	357	357
z042	0	0	0	0	48	0	0	0	0	0	0	396	444
z043	0	0	0	0	0	0	0	0	0	0	0	27	27
z045	0	13	0	0	0	0	0	0	0	0	0	1662	1675
z046	0	0	0	0	0	0	0	0	0	0	0	1949	1949
z047	0	356	0	0	0	0	0	0	0	57	0	1150	1563
z049	0	0	0	0	0	0	0	0	0	0	0	668	668
z050	0	0	0	0	0	0	0	0	0	0	0	95	95
TOTAL	346	822	457	687	1251	18	296	20	609	556	556	30560	36178

Table A4.15 (continued)

O\D	z034	z035	z036	z038	z040	z041	z042	z043	z045	z046	z047	others	TOTAL
z001	0	0	0	0	0	0	0	0	16	0	0	956	972
z002	0	0	0	0	0	0	0	0	0	0	0	104	104
z003	0	0	3	28	0	0	0	0	0	0	0	831	862
z004	0	0	82	62	0	0	0	0	0	0	37	371	552
z005	0	0	0	34	0	0	0	0	0	0	0	1144	1178
z007	0	0	33	57	0	0	0	0	0	0	0	1592	1682
z008	0	0	128	152	143	0	0	26	0	0	0	582	1031
z009	0	0	0	112	21	0	109	0	24	0	24	736	1026
z010	0	0	0	0	0	0	0	0	0	0	0	185	185
z011	0	0	0	0	0	54	0	0	0	0	0	666	720
z012	0	0	52	0	0	40	51	35	0	0	43	2484	2705
z013	0	0	0	28	20	0	38	0	0	56	0	875	1017
z014	41	0	0	138	0	23	21	0	188	178	10	1200	1799
z015	0	0	0	51	0	0	0	0	0	0	0	418	469
z016	0	0	0	0	0	0	0	0	0	0	156	115	271
z017	0	0	9	109	36	32	0	0	376	7	201	1985	2755
z018	0	0	0	42	0	32	0	105	0	0	0	126	305
z019	0	0	0	129	0	0	13	0	0	0	24	1052	1218
z020	0	0	0	0	0	0	19	0	57	0	0	350	426
z021	0	0	0	0	0	0	0	20	0	0	0	290	310
z022	0	0	0	66	0	0	0	0	0	0	0	396	462
z023	0	0	0	114	0	0	0	0	0	0	0	0	114
z024	0	0	29	190	0	0	0	2	0	0	0	171	392
z025	0	0	0	0	0	0	0	0	0	0	0	136	136
z026	0	0	0	590	0	0	0	69	0	0	0	514	1173
z027	0	0	8	0	0	0	129	0	0	0	0	624	761
z028	0	0	0	0	0	0	0	0	0	0	0	85	85
z029	0	0	0	56	0	0	0	0	0	0	0	26	82
z030	0	0	0	0	0	0	0	0	0	0	12	168	180
z031	0	0	0	16	0	0	0	0	0	0	0	351	367
z032	0	0	0	15	0	0	0	260	0	0	0	78	353
z033	67	0	0	0	0	0	11	0	0	0	0	287	365
z034	11	0	0	0	0	36	0	0	0	0	19	186	252
z035	29	94	0	0	0	34	0	0	0	0	0	41	198
z036	0	0	0	9	0	0	10	0	0	0	0	785	804
z038	226	0	0	0	0	17	38	0	0	0	23	2771	3075
z040	0	0	20	0	0	0	0	0	0	0	0	994	1014
z041	39	0	0	30	0	0	0	0	0	0	0	288	357
z042	0	0	0	50	0	0	0	0	0	0	0	394	444
z043	0	0	0	0	0	0	0	0	0	0	0	27	27
z045	0	0	0	0	0	0	0	0	0	275	928	472	1675
z046	23	0	13	0	0	0	0	147	173	0	0	1593	1949
z047	0	0	0	0	0	0	0	0	19	0	0	1544	1563
z049	0	0	0	0	0	0	0	0	0	0	0	668	668
z050	0	0	0	0	0	0	0	0	0	0	0	95	95
TOTAL	436	94	377	2078	220	268	439	664	853	516	1477	28756	36178

Table A4.15 (continued)

O\D	z049	z050	others	TOTAL
z001	0	0	972	972
z002	0	0	104	104
z003	0	0	862	862
z004	0	88	464	552
z005	0	0	1178	1178
z007	0	0	1682	1682
z008	0	0	1031	1031
z009	50	0	976	1026
z010	0	0	185	185
z011	0	0	720	720
z012	85	0	2620	2705
z013	0	0	1017	1017
z014	0	0	1799	1799
z015	0	0	469	469
z016	0	0	271	271
z017	0	0	2755	2755
z018	0	0	305	305
z019	0	0	1218	1218
z020	0	0	426	426
z021	0	0	310	310
z022	0	0	462	462
z023	0	0	114	114
z024	0	0	392	392
z025	0	0	136	136
z026	0	0	1173	1173
z027	0	188	573	761
z028	0	0	85	85
z029	0	0	82	82
z030	0	0	180	180
z031	0	0	367	367
z032	0	0	353	353
z033	0	0	365	365
z034	0	0	252	252
z035	0	0	198	198
z036	0	0	804	804
z038	0	36	3039	3075
z040	0	0	1014	1014
z041	0	0	357	357
z042	0	0	444	444
z043	0	0	27	27
z045	0	0	1675	1675
z046	0	0	1949	1949
z047	0	0	1563	1563
z049	0	0	668	668
z050	0	0	95	95
TOTAL	135	312	35731	36178

Table A.5 Census and projected population in Ontario.

COUNTY/DISTRICT/REGIONAL MUN.	(1989)	(1996)	G. FAC.
ALGOMA	133.6	133.5	0.995
BRANT	108.8	114.4	1.035
BRUCE	59.3	58.3	0.985
COCHRANE (TIMMINS, 12)	93.8	90.4	0.973
DUFFARIN	34.5	38.8	1.084
DURHAM (OSHAWA, 7)	374.9	464.8	1.145
ELGIN	71.7	74.8	1.033
ESSEX (WINDSOR, 1)	327.8	352.3	1.051
FRONTENAC (KINGSTON, 8)	120.8	129.4	1.046
GREY	76.0	80.0	1.039
HALDIMAND-NORFOLK	91.7	95.9	1.033
HALIBURTON	12.2	12.8	1.041
HALTON (METRO TORONTO,6)	287.7	324.9	1.092
HAMILTON-WENTWORTH (HAMILTON,5)	433.3	459.6	1.046
HASTINGS	114.0	121.9	1.044
HURON	56.4	57.8	1.018
KENORA	61.3	64.5	1.034
KENT	109.5	115.6	1.037
LAMBERTON	126.4	127.8	1.006
LANARK	52.5	58.7	1.081
LEEDS & GREENVILLE	88.5	97.2	1.067
LENNOX & ADDINGTON	36.5	41.3	1.090
MANITOULIN	10.3	10.6	1.029
METRO TORONTO (METRO TORONTO,6)	2274.0	2395.5	1.032
MIDDLESEX (LONDON,2)	349.2	379.6	1.058
MUSKOKA	42.9	49.3	1.103
NIAGRA (NIAGRA,4)	377.2	392.0	1.027
NIPISSING	79.4	79.6	1.000
NORTHHUMBERLAND	70.3	76.5	1.063
OTTAWA-CARLTON (OTTAWA, 9)	650.3	712.9	1.058
OXFORD	85.2	86.2	1.011
PARRY SOUND	34.8	37.5	1.053
PEEL	664.7	803.3	1.133
PERTH	67.2	68.8	1.018
PETERBOROUGH	107.5	113.9	1.043
PRESCOTT & RUSSELL	62.6	72.8	1.110
PRINCE EDWARD	22.6	23.2	1.022
RAINY RIVER	23.3	24.3	1.034
RENFREW	90.4	91.2	1.004
SIMCOA	251.0	277.3	1.071
STORMONT, DUNDAS & GLENGARY	105.3	109.7	1.028
SUDBURY (R.M.) (SUDBURY, 10)	151.1	148.9	0.991
SUDBURY (T.D.)	25.0	23.9	0.972
THUNDER BAY (THUNDER BAY, 11)	159.0	164.1	1.021
TIMISKAMING	39.9	39.4	0.992
VICTORIA	56.3	65.1	1.107
WATERLOO (KITCHENER,3)	351.0	398.8	1.094

Table A.5 CONTINUED.

COUNTY/DISTRICT/REGIONAL MUN.	(1989)	(1996)	G. FAC.
WELLINGTON	147.2	163.5	1.075
YORK	425.6	573.5	1.213

Source: Census of Canada and Demographics and Social Economics Branch. Office of Economic Policy, Ontario Ministry of Treasury and Economics, July 1989.

Table A.6 Growth factors of selected cities in Ontario.

Selected cities in Ontario	population 1989	population 1996	growth factors
1. Windsor	327.8	352.3	1.051
2. London	349.2	379.6	1.058
3. Kitchener	351.0	398.8	1.094
4. Niagra	377.2	392.0	1.027
5. Hamilton	433.3	459.6	1.046
6. Metro toronto	2561.7	2720.4	1.062
7. Oshawa	374.9	464.8	1.145
8. Kingston	120.8	129.4	1.046
9. Ottawa	650.3	712.9	1.058
10. Sudbury	151.1	148.9	0.991
11. Timmins	93.8	90.4	0.973
12. Thunder bay	159.0	164.1	1.021

Table A.7 Commodity flows for base year 1989. FOODSTUFFS, (PERSHABLES) GROUP # 2

	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.	TOTAL
WINDSOR	0	0	839	4	0	2678	225	0	83	0	77	71	373	4350
LONDON	0	0	0	0	710	1620	0	0	18	0	0	0	207	2555
KITCHENER	0	83	0	616	0	2631	77	49	17	77	102	19	199	3852
NIAGARA	29	4	0	0	40	1494	3	0	33	5	0	0	420	2028
HAMILTON	0	0	0	163	0	231	0	0	0	0	0	0	130	524
METRO TORONTO	436	1670	1890	899	362	0	0	279	455	837	162	86	1435	8511
OSHAWA	0	0	32	0	0	0	0	0	0	0	0	0	32	32
KINGSTON	0	104	0	0	0	429	0	0	68	0	0	20	256	877
OTTAWA	221	0	63	0	34	66	25	24	0	0	0	0	5	438
SUDBURY	0	0	50	0	0	58	5	0	0	0	0	62	0	175
TIMMINS	0	0	0	0	0	1	0	0	0	0	0	0	0	1
T. BAY	0	0	0	0	0	6	0	0	0	0	0	0	0	6
MONTREAL	449	137	206	85	0	1630	0	358	395	67	13	0	0	3340
TOTAL	1135	1998	3080	1767	1146	10826	335	710	1069	986	354	258	3025	26689

Table A.8 Commodity flows for forecast year 1996, FOODSTUFFS (PERISHABLES) GROUP # 2

	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.	TOTAL
WINDSOR	0	0	901	4	0	2796	254	0	86	0	76	69	385	4572
LONDON	0	0	0	0	742	1723	0	0	19	0	0	0	218	2702
KITCHENER	0	91	0	647	0	2887	92	53	19	78	107	20	218	4210
NIAGARA	30	4	0	0	40	1539	3	0	34	5	0	0	428	2083
HAMILTON	0	0	0	165	0	246	0	0	0	0	0	0	137	547
METRO TORONTO	464	1775	2092	919	383	0	0	295	488	822	166	86	1527	9016
OSHAWA	0	37	0	0	0	0	0	0	0	0	0	0	0	37
KINGSTON	0	108	0	0	0	451	0	0	71	0	0	20	266	917
OTTAWA	231	0	68	0	35	70	29	25	0	0	0	0	5	463
SUDBURY	0	0	51	0	0	58	5	0	0	0	0	57	0	172
TIMMINS	0	0	0	0	0	1	0	0	0	0	0	0	0	1
T. BAY	0	0	0	0	0	6	0	0	0	0	0	0	0	6
MONTREAL	469	143	224	85	0	1722	0	371	416	65	13	0	0	3508
TOTAL	1194	2121	3374	1820	1200	11498	383	744	1133	969	362	251	3185	28234

Table A.9 Commodity flows for base year 1989, FOODSTUFFS (NON-PERSHABLES) GROUP # 3

	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.	TOTAL
WINDSOR	0	113	1386	0	0	102	0	0	0	0	0	43	237	1881
LONDON	372	0	0	0	399	1884	0	0	0	0	281	70	217	3223
KITCHENER	0	388	0	114	0	412	0	55	163	0	0	0	291	1423
NIAGARA	0	77	0	0	220	1118	0	190	577	0	0	0	104	2286
HAMILTON	0	393	0	307	0	0	0	0	0	0	0	0	96	796
METRO TORONTO	1137	1262	1465	977	745	0	0	0	1272	105	141	615	623	8362
OSHAWA	0	0	157	0	0	0	0	0	0	0	0	73	0	230
KINGSTON	0	0	0	0	0	1027	0	0	172	0	0	0	120	1319
OTTAWA	0	44	20	0	378	83	0	30	0	0	0	0	0	555
SUDBURY	0	0	0	0	0	393	46	0	0	0	28	0	0	467
TIMMINS	0	0	0	0	0	12	0	0	0	0	0	0	0	12
T. BAY	0	38	0	0	0	0	0	0	0	0	0	0	0	38
MONTREAL	49	33	39	0	41	977	0	156	243	0	24	14	0	1576
TOTAL	1558	2348	3067	1418	1783	6008	46	431	2427	105	474	815	1688	22168

Table A.10 Commodity flows for forecast year 1996, FOODSTUFFS (NON-PERSHABLES) GROUP # 3

	WIN.	LON.	KIT.	NIA.	HAM.	M.T.	OSH.	KIN.	OTT.	SUD.	TIM.	T.B.	MTL.	TOTAL
WINDSOR	0	115	1474	0	0	107	0	0	0	0	0	40	241	1976
LONDON	385	0	0	0	415	2034	0	0	0	0	287	67	226	3413
KITCHENER	0	420	0	119	0	463	0	61	179	0	0	0	316	1557
NIAGARA	0	77	0	0	221	1165	0	195	588	0	0	0	105	2350
HAMILTON	0	416	0	165	0	246	0	0	0	0	0	0	37	832
METRO TORONTO	1203	1341	1632	1025	791	0	0	0	1371	103	147	598	663	8875
OSHAWA	0	0	187	0	0	0	0	0	0	0	0	76	0	263
KINGSTON	0	0	0	0	0	1082	0	0	177	0	0	0	122	1382
OTTAWA	0	46	22	0	397	90	0	32	0	0	0	0	0	587
SUDBURY	0	0	0	0	0	380	53	0	0	0	26	0	0	459
TIMMINS	0	0	0	0	0	12	0	0	0	0	0	0	0	12
T. BAY	0	37	0	0	0	0	0	0	0	0	0	0	0	37
MONTREAL	50	34	42	0	42	1038	0	163	252	0	24	13	0	1658
TOTAL	1638	2486	3357	1458	1865	6372	53	450	2568	103	484	794	1774	23403

APPENDIX - B

COMPUTER PROGRAMS

The computer programs developed in this thesis are listed here. There are three main sections in this Appendix. The programs written in BASIC are listed first. A brief description explaining the objectives of each program is provided at the beginning of each one. Second, the dBASEIII+ programs are listed afterwards (from SETUP01 to SETUP08). Third, the structured program MATRIX is given at the end of this Appendix.

```
' PROGRAM # 1: WTAVG.BAS

---------------------------------------------------------------------
' This program is written to compute the estimated average tare weight
'(V70av) of trucks having the same combination of vehicle configuration
'(V48), body style (V49), and the trucks total axles (V69).
' Assumption: When the truck is recorded empty (V59=1), the GVW (V70) is
'equal to the tare weight (V51).
' The input of this  program is the "T05.txt" file.
' The output of this program is "MXAVG.TXT" 5 columns; V48, V49, V69,
'V70AV, N, where N is the number of occurrences of each combination.
---------------------------------------------------------------------
' By Antoine Chemali
' June 18th, 1991.
---------------------------------------------------------------------
CLS
' $DYNAMIC
DIM WT(9, 16, 10)
DIM N(9, 16, 10)
 OPEN "I", #1, "t05.txt"
WHILE NOT EOF(1)
 LINE INPUT #1, l$
 GOSUB in
  IF v59$ = "1" THEN
  IF v48& <> 0 AND V49& <> 0 AND v69& <> 0 AND v70 <> 0 THEN
  WT(v48&, V49&, v69&) = WT(v48&, V49&, v69&) + v70
   N(v48&, V49&, v69&) = N(v48&, V49&, v69&) + 1
   M& = M& + 1
                                                          ELSE
   MM& = MM& + 1
                                                          END IF
  LOCATE 1, 1: PRINT M&, MM&
                END IF
WEND
 CLOSE
OPEN "o", #100, "MXAVG.TXT"
 FOR I& = 1 TO 9
 FOR J& = 1 TO 16
 FOR K& = 1 TO 10
 IF N(I&, J&, K&) <> 0 THEN
 AV& = WT(I&, J&, K&) / N(I&, J&, K&)
 N& = N(I&, J&, K&)
 I$ = RIGHT$("  " + STR$(I&), 2)
 J$ = RIGHT$("  " + STR$(J&), 2)
 K$ = RIGHT$("  " + STR$(K&), 2)
 AV$ = RIGHT$("      " + STR$(AV&), 6)
 N$ = RIGHT$("      " + STR$(N&), 6)
 PRINT #100, I$ + J$ + K$ + AV$ + N$
                    END IF
 NEXT K&
 NEXT J&
 NEXT I&
CLOSE
END
```

PROGRAM # 1: CONTINUED.

```
in:
'v1$ = MID$(1$, 1, 5)
'V31$ = MID$(1$, 6, 4)
'V33$ = MID$(1$, 10, 4)
'V37 = VAL(MID$(1$, 14, 14))
'v38 = VAL(MID$(1$, 28, 14))
'v39 = VAL(MID$(1$, 42, 14))
'v40 = VAL(MID$(1$, 56, 14))
'v41$ = MID$(1$, 70, 3)
'v42$ = MID$(1$, 73, 4)
'v43$ = MID$(1$, 77, 2)
'v44$ = MID$(1$, 79, 2)
'v45$ = MID$(1$, 81, 1)
'v46$ = MID$(1$, 82, 1)
v48& = VAL(MID$(1$, 83, 2))
V49& = VAL(MID$(1$, 85, 2))
'v51 = VAL(MID$(1$, 87, 6))
'v53 = VAL(MID$(1$, 93, 6))
'v55$ = MID$(1$, 99, 3)
'v57 = VAL(MID$(1$, 102, 6))
v59$ = MID$(1$, 108, 1)
v69& = VAL(MID$(1$, 109, 2))
v70 = VAL(MID$(1$, 111, 6))
'v55b = VAL(MID$(1$, 117, 3))
'nzo& = VAL(MID$(1$, 120, 4))
'nzd& = VAL(MID$(1$, 124, 4))
'ncg$ = MID$(1$, 128, 3): ncg& = VAL(ncg$)
'v57b = VAL(MID$(1$, 131, 6))
'v51b = VAL(MID$(1$, 137, 6))
'location$ = MID$(1$, 143, 10)

IF LEN(1$) <> 152 THEN STOP
RETURN
```

```
' PROGRAM # 2 STATION.BAS

-------------------------------------------------------------------------
' This program is written to subdivide the data file (T04SCOD.TXT) into
'57 smaller files by corresponding station #  (one txt file per station)
' This read "T04SCOD.txt" which is a sorted copy of "T04.dbf".
' T04SCOD.txt HAS 12 COLUMNS and is sorted by (V41,NCG,V31,V33) "SCOD"
' T04.dbf does not contain NCG=0 or NZO=0 or NZD=0 or V57b=0.
-------------------------------------------------------------------------
'BY : Antoine Chemali
'July 18th, 1991
-------------------------------------------------------------------------

OPEN "I", #1, "T04SCOD.txt"
WHILE NOT EOF(1)
 LINE INPUT #1, l$
 st$ = MID$(l$, 28, 3)
 IF st$ < prest$ THEN STOP
 IF st$ <> prest$ THEN GOSUB process
 PRINT #2, l$
 prest$ = st$
WEND
CLOSE
END

process:
CLOSE 2
OPEN "O", #2, "stn" + LTRIM$(RTRIM$(st$)) + ".txt"
PRINT "stn" + st$ + ".txt"
RETURN
```

```
CLS

' PROGRAM # 3: HEADER.BAS

-------------------------------------------------------------------------
'This program is written to create a "HDR" file which identifies & 'stores
only existing origin rows and destination columns for each 'commodity
group.
'The input for this program is "t04cods.txt" or any other "stn#.txt"
'file.
'The output is a "HDR" file.
-------------------------------------------------------------------------
'By; ANTOINE CHEMALI
'Sept 23rd, 1991.
-------------------------------------------------------------------------

  station$ = COMMAND$
 '  "stnxxx"  -  one  station(sorted  by  COD)  ,    "T04cods"  -  all
stations(sorted by CODS)

DIM ex1%(300), ex2%(300)

 OPEN "I", #1, station$ + ".TXT"
 OPEN "o", #2, station$ + ".HDR"

           PRINT station$

DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, l$
 GOSUB in
 COD$ = ncg$ + V31$ + V33$
              ELSE
 COD$ = "99999999999"
              END IF
 IF MID$(COD$, 1, 3) <> MID$(OCOD$, 1, 3) THEN GOSUB process

 IF COD$ = "99999999999" THEN GOTO 200

 ex1%(VAL(MID$(COD$, 4, 4))) = 1
 ex2%(VAL(MID$(COD$, 8, 4))) = 1

 OCOD$ = COD$
LOOP

200 :
CLOSE
END


process:
IF OCOD$ = "" THEN RETURN
PRINT #2, MID$(OCOD$, 1, 3);
FOR O& = 1 TO 300
```

```
' PROGRAM # 3: CONTINUED

IF ex1%(O&) = 1 THEN
O$ = RIGHT$("    " + STR$(O&), 4)
PRINT #2, O$;
                END IF
NEXT O&
PRINT #2, ""

PRINT #2, MID$(OCOD$, 1, 3);
FOR D& = 1 TO 300
IF ex2%(D&) = 1 THEN
D$ = RIGHT$("    " + STR$(D&), 4)
PRINT #2, D$;
                END IF
NEXT D&
PRINT #2, ""
ERASE ex1%, ex2%
RETURN



'SUBROUTINE IN:
'-------------

in:
'v1$ = MID$(1$, 1, 5)
V31$ = MID$(1$, 6, 4)
V33$ = MID$(1$, 10, 4)
'v40 = VAL(MID$(1$, 14, 14))
v41$ = MID$(1$, 28, 3)
'v70 = VAL(MID$(1$, 31, 6))
'v55b = VAL(MID$(1$, 37, 3))
'nzo& = VAL(MID$(1$, 40, 4))
'nzd& = VAL(MID$(1$, 44, 4))
ncg$ = MID$(1$, 48, 3): ncg& = VAL(ncg$)
'v57b = VAL(MID$(1$, 51, 6))
'v51b = VAL(MID$(1$, 57, 6))
 IF LEN(1$) <> 62 THEN STOP
RETURN
```

```
'$DYNAMIC
CLS

'PROGRAM # 4: MXPSTN.BAS

-----------------------------------------------------------------------
'This program is written to develop an O/D matrix (in tons per day) for '
each commodity group and any selected station.
' The input for this program are the files "stn#.txt" & "stn#.hdr"
' The output of this programs is 15 O/D tables.
-----------------------------------------------------------------------
'By: ANTOINE CHEMALI
'Sept. 23rd, 1991.
-----------------------------------------------------------------------

station$ = COMMAND$
DIM wt(250, 250)
DIM r%(300), c%(300), o&(300), d&(300)
 OPEN "I", #1, station$ + ".txt"
 OPEN "i", #3, station$ + ".HDR"
INPUT "Printer or Screen (P/S): ", ans$
10 :
INPUT "Enter # of columns: ", c&
c& = c& - 1
INPUT "Enter 1st column: ", sc&
IF UCASE$(ans$) = "P" THEN OPEN "O", #2, "lpt1:" ELSE OPEN "O", #2,
"scrn:"
WIDTH #2, 255
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, "ORIGIN - DESTINATION MATRICES FOR STATION:  ";
station$
 GOSUB ou: PRINT #2, "----------------------------------------"
DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, l$
 GOSUB in
 COD$ = ncg$ + V31$ + V33$
              ELSE
 COD$ = "99999999999"
             END IF
 IF MID$(COD$, 1, 3) <> MID$(ocod$, 1, 3) THEN GOSUB process 'if commodity
changes
 IF COD$ = "99999999999" THEN GOTO 200
  o& = VAL(V31$)
  d& = VAL(V33$)
  wt(r%(o&), c%(d&)) = wt(r%(o&), c%(d&)) + tons  '+++++
 ocod$ = COD$
LOOP
200 :
CLOSE
END
process:
IF ocod$ = "" THEN GOTO READTBL
 IF LEFT$(ocod$, 3) <> com$ THEN STOP
```

PROGRAM # 4: CONTINUED

```
IF sc& + c& > col% THEN maxcol% = col% - sc& ELSE maxcol% = c&
IF maxcol% < 0 OR VAL(com$) = 0 THEN GOTO skip


          'WE USE ELEMENT(0,X) OR (X,0) TO STORE THE TOTAL
TT& = 0
FOR j% = 1 TO col%
t& = 0
FOR I% = 1 TO row%
t& = t& + wt(I%, j%)
NEXT I%
wt(0, j%) = t&
TT& = TT& + t&
NEXT j%
wt(0, 0) = TT&  'TOTAL OF TOTALS
FOR I% = 1 TO row%
t& = 0
FOR j% = 1 TO col%
t& = t& + wt(I%, j%)
NEXT j%
wt(I%, 0) = t&
NEXT I%
TT& = 0
GOSUB ou: PRINT #2, ""
GOSUB ou: PRINT #2, ""

GOSUB ou: PRINT #2, "O / D (IN TONS PER DAY) FOR COMMODITY GROUP: ";
com$
GOSUB ou: PRINT #2, "-----------------------------------------"
GOSUB ou: PRINT #2, ""
GOSUB ou: PRINT #2, ""
h$ = "O\D      "                                                '&&
FOR c% = sc& TO sc& + maxcol%
d$ = RIGHT$("000" + LTRIM$(STR$(d&(c%))), 3)
h$ = h$ + " z" + d$ + "  "                '&
NEXT c%
GOSUB ou: PRINT #2, h$ + "others     TOTAL"
GOSUB ou: PRINT #2, ""
FOR r% = 1 TO row%
o$ = RIGHT$("000" + LTRIM$(STR$(o&(r%))), 3)
GOSUB ou
PRINT #2, "z" + o$ + "    ";                                     '&&
FOR c% = sc& + 0 TO sc& + maxcol%
t$ = LTRIM$(STR$(CINT(wt(r%, c%))))
PRINT #2, SPACE$(7 - LEN(t$)) + t$;       '&
NEXT c%
t& = 0
FOR c% = 1 TO sc& - 1
t& = t& + wt(r%, c%)
NEXT c%
FOR c% = sc& + maxcol% + 1 TO col%
t& = t& + wt(r%, c%)
```

PROGRAM # 4: CONTINUED

```
 NEXT c%
 t$ = LTRIM$(STR$(t&))
 PRINT #2, SPACE$(7 - LEN(t$)) + t$;       '&
 TT& = TT& + t&
 t& = wt(r%, 0)'TOTAL
 t$ = LTRIM$(STR$(t&))

 PRINT #2, SPACE$(11 - LEN(t$)) + t$;      '&
 PRINT #2, ""
 NEXT r%
 h$ = "TOTAL  "                                                    '&&
 FOR c% = sc& + 0 TO sc& + maxcol%
 d$ = RIGHT$("       " + LTRIM$(STR$(wt(0, c%))), 7)
 h$ = h$ + d$                                    '&
 NEXT c%
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, h$;
 TT$ = LTRIM$(STR$(TT&))
 PRINT #2, SPACE$(7 - LEN(TT$)) + TT$;       '&
 TT$ = LTRIM$(STR$(wt(0, 0)))
 PRINT #2, SPACE$(11 - LEN(TT$)) + TT$      '&
IF UCASE$(ans$) = "S" THEN INPUT "press ENTER to continue", garbage$
CLS
skip:
ERASE wt
DIM wt(250, 250)
READTBL:
ERASE r%, c%, o&, d&
DIM r%(300), c%(300), o&(300), d&(300)
IF NOT EOF(3) THEN
LINE INPUT #3, HD$
com$ = LEFT$(HD$, 3)
row% = (LEN(HD$) - 3) / 4
FOR r% = 1 TO row%
o&(r%) = VAL(MID$(HD$, 4 + 4 * (r% - 1), 4))
r%(o&(r%)) = r%
NEXT r%
LINE INPUT #3, HD$
IF LEFT$(HD$, 3) <> com$ THEN STOP
col% = (LEN(HD$) - 3) / 4
FOR c% = 1 TO col%
d&(c%) = VAL(MID$(HD$, 4 + 4 * (c% - 1), 4))
c%(d&(c%)) = c%
NEXT c%
END IF
RETURN
ou:
IF j& = 59 AND UCASE$(ans$) = "P" THEN
PRINT #2, CHR$(12): j& = 0
          END IF
 j& = j& + 1
RETURN
```

PROGRAM # 4: CONTINUED

```
'SUBROUTINE IN:
'-------------
in:
v1$ = MID$(l$, 1, 5)
V31$ = MID$(l$, 6, 4)
V33$ = MID$(l$, 10, 4)
v40 = VAL(MID$(l$, 14, 14))
v41$ = MID$(l$, 28, 3)
v70 = VAL(MID$(l$, 31, 6))
v55b = VAL(MID$(l$, 37, 3))
nzo& = VAL(MID$(l$, 40, 4))
nzd& = VAL(MID$(l$, 44, 4))
ncg$ = MID$(l$, 48, 3): ncg& = VAL(ncg$)
v57b = VAL(MID$(l$, 51, 6))
v51b = VAL(MID$(l$, 57, 6))
tons = v40 * v57b / 1000
 IF LEN(l$) <> 62 THEN STOP
RETURN
```

```
CLS

'PROGRAM # 5: CODST.BAS

'-------------------------------------------------------------------
'This program is written to add the tonnage of the same O/D pair 'produced
from each station, i.e: the total tonnage for any O/D pair is 'printed.
'The input of this program is "TO4CODS.TXT"
'The output is "CODST.TXT". 5 columns (c,o,d,s,tons) for O.W.T.S zone
'system.
'ORIGINAL TONNAGE IS PRINTED HERE. (before taking the weighted average).
'-------------------------------------------------------------------
' By: ANTOINE CHEMALI
' June 18th, 1991.
'-------------------------------------------------------------------

station$ = "TO4CODS"
OPEN "O", #2, "SCRN:"
'OPEN "O", #2, "CODST.TXT"
OPEN "I", #1, station$ + ".txt"


WHILE NOT EOF(1)
 LINE INPUT #1, 1$
 GOSUB in
 nkey$ = ncg$ + V31$ + V33$ + v41$
 IF nkey$ <> key$ THEN GOSUB outdata


           'accumulate data for each commodity group for this station
           '---------------------------------------------------------

  wt = wt + tons
 key$ = nkey$
WEND
 GOSUB outdata
CLOSE
END

outdata:

                  'process accumulated data
                  '------------------------

IF key$ = "" THEN RETURN
wt% = wt
wt$ = STR$(wt%): wt$ = SPACE$(5 - LEN(wt$)) + wt$
PRINT #2, key$ + wt$
wt = 0
RETURN
```

```
'PROGRAM # 5: CONTINUED

'SUBROUTINE IN:
'-------------
in:
'v1$ = MID$(1$, 1, 5)
V31$ = MID$(1$, 6, 4)
V33$ = MID$(1$, 10, 4)
v40 = VAL(MID$(1$, 14, 14))
v41$ = MID$(1$, 28, 3)
v70 = VAL(MID$(1$, 31, 6))
'v55b = VAL(MID$(1$, 37, 3))
'nzo& = VAL(MID$(1$, 40, 4))
'nzd& = VAL(MID$(1$, 44, 4))
ncg$ = MID$(1$, 48, 3): ncg& = VAL(ncg$)
v57b = VAL(MID$(1$, 51, 6))
'v51b = VAL(MID$(1$, 57, 6))
 tons = v57b * v40 / 1000
 IF LEN(1$) <> 62 THEN STOP
RETURN
```

```
CLS

' PROGRAM # 6: AVGWT.BAS

'This program is written to calculate the weighted average of tons
'occurring from multiple stations and assign the new average to the
'station having the largest number of records.
'The inputs of this program are the files "T04CODS.TXT", and '"SREF2.TXT".
' The output of this program "AVGWT.TXT" is (4) columns in the following
'form: commodity, origin, destination, new average tons.
' THE OUTPUT "AVGWT.TXT" IS TO BE COPIED LATER TO "AVGWT.DBF". (dBASE
'FILE)

' BY: ANTOINE  CHEMALI
' Oct. 1st, 1991.

'$DYNAMIC
 station$ = "T04CODS"
'"T04CODS" - all stations sorted by (CODS)
 DIM f(1000)
 OPEN "I", #5, "sref2.txt"
 WHILE NOT EOF(5)
 LINE INPUT #5, rec$
 IF LEFT$(rec$, 1) <> "M" THEN st = VAL(LEFT$(rec$, 3)) ELSE st =
VAL(MID$(rec$, 2, 2))
 f(st) = VAL(MID$(rec$, 4, 5))
 WEND
 st = 0
 CLOSE 5
 fst = -1
 OPEN "I", #1, station$ + ".txt"
 'OPEN "o", #2, "AVGWT" + ".txt"
 OPEN "o", #2, "scrn:"
DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, 1$
 GOSUB in
 cods$ = ncg$ + V31$ + V33$ + v41$
              ELSE
 cods$ = "99999999999999"
              END IF
 IF cods$ <> ocods$ THEN
 IF MID$(ocods$, 12, 1) = "M" THEN st = VAL(MID$(ocods$, 13, 2)) ELSE st
= VAL(MID$(ocods$, 12, 3))
 IF f(st) > fst THEN fst = f(st): st$ = MID$(ocods$, 12, 3)
  f1 = f1 + f(st) * w
  f2 = f2 + f(st)
  w = 0
 IF LEFT$(cods$, 11) <> LEFT$(ocods$, 11) THEN       'not same cell
```

```
' PROGRAM # 6: CONTINUED

  o& = VAL(MID$(ocods$, 4, 4))
  d& = VAL(MID$(ocods$, 8, 4))
  IF ocods$ <> "" THEN
  t$ = LTRIM$(STR$(CINT(f1 / f2)))
  t$ = SPACE$(5 - LEN(t$)) + t$
  PRINT #2, MID$(ocods$, 1, 11); t$; " "; st$
                    END IF
  f1 = 0: f2 = 0
  fst = -1
                                              END IF
                      END IF
 IF cods$ = "99999999999999" THEN GOTO 200
 w = w + TONS
 ocods$ = cods$
LOOP

200 :
CLOSE
END

'SUBROUTINE IN:
'-------------
in:
'v1$ = MID$(1$, 1, 5)
V31$ = MID$(1$, 6, 4)
V33$ = MID$(1$, 10, 4)
v40 = VAL(MID$(1$, 14, 14))
v41$ = MID$(1$, 28, 3)
'v70 = VAL(MID$(1$, 31, 6))
'v55b = VAL(MID$(1$, 37, 3))
'nzo& = VAL(MID$(1$, 40, 4))
'nzd& = VAL(MID$(1$, 44, 4))
ncg$ = MID$(1$, 48, 3): ncg& = VAL(ncg$)
 v57b = VAL(MID$(1$, 51, 6))
'v51b = VAL(MID$(1$, 57, 6))
 TONS = v57b * v40 / 1000
 IF LEN(1$) <> 62 THEN STOP
RETURN
```

```
CLS

'PROGRAM # 7: STATION2.BAS

'This program is written to subdivide the data file (mx2stn.TXT) into new
'57 adjusted files by corresponding station # (one txt file per stn)
'This read "mx2stn.txt"

'BY : ANTOINE CHEMALI
'June 18th, 1991 .

OPEN "I", #1, "mx2stn.txt"
WHILE NOT EOF(1)
 LINE INPUT #1, 1$
 st$ = MID$(1$, 17, 3)
 IF st$ < prest$ THEN STOP
 IF st$ <> prest$ THEN GOSUB process
 PRINT #2, 1$
 prest$ = st$
WEND
CLOSE
END

process:
CLOSE 2
OPEN "O", #2, "Astn" + LTRIM$(RTRIM$(st$)) + ".txt"
PRINT "Astn" + st$ + ".txt"
RETURN
```

```
CLS

'PROGRAM # 8: HEADER2.BAS

'This program is written to create an "HDR" file which identifies &
'stores only existing origin rows and destination columns for each
'commodity group.
'The input for this program is "AVGWT.TXT" or any other "Astn#.txt" file.
'The output is a "HDR" file.

' By: ANTOINE CHEMALI
' Sept, 23th, 1991.

  station$ = COMMAND$
'"Astnxxx" - one station(sorted by COD) ,"AVGWT" all stations(sorted by
CODS)
DIM ex1%(300), ex2%(300)
 OPEN "I", #1, station$ + ".TXT"
 OPEN "o", #2, station$ + ".HDR"
 PRINT station$
DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, l$
 GOSUB in
 COD$ = ncg$ + V31$ + V33$
               ELSE
 COD$ = "99999999999"
               END IF
 IF MID$(COD$, 1, 3) <> MID$(OCOD$, 1, 3) THEN GOSUB process
 IF COD$ = "99999999999" THEN GOTO 200
 ex1%(VAL(MID$(COD$, 4, 4))) = 1
 ex2%(VAL(MID$(COD$, 8, 4))) = 1
 OCOD$ = COD$
LOOP
200 :
CLOSE
END
process:
IF OCOD$ = "" THEN RETURN
PRINT #2, MID$(OCOD$, 1, 3);
FOR O& = 1 TO 300
IF ex1%(O&) = 1 THEN
O$ = RIGHT$("     " + STR$(O&), 4)
PRINT #2, O$;
                END IF
NEXT O&
PRINT #2, ""
PRINT #2, MID$(OCOD$, 1, 3);
FOR D& = 1 TO 300
IF ex2%(D&) = 1 THEN
D$ = RIGHT$("     " + STR$(D&), 4)
```

PROGRAM # 8: CONTINUED

```
PRINT #2, D$;
                END IF

NEXT D&
PRINT #2, ""
ERASE ex1%, ex2%
RETURN

'SUBROUTINE IN:
'-------------
in:
ncg$ = MID$(1$, 1, 3): ncg& = VAL(ncg$)
V31$ = MID$(1$, 4, 4)
V33$ = MID$(1$, 8, 4)
TONS = VAL(MID$(1$, 12, 5))
v41$ = MID$(1$, 17, 3)
'IF LEN(1$) <> 19 THEN STOP
RETURN
```

```
'$DYNAMIC
CLS

' PROGRAM # 9: MXPSTN2.BAS

'This program is written to develop an O/D matrix (in tons per day) for
'each commodity group and any selected station.
'The input for this program are the files "stn#.txt" & "stn#.hdr"
'The output of this programs is 15 ADJUSTED O/D tables for each station.

'By: ANTOINE CHEMALI
' Sept,  23th, 1991.

 station$ = COMMAND$
DIM wt(250, 250)
DIM r%(300), c%(300), o&(300), d&(300)
 OPEN "I", #1, station$ + ".txt"
 OPEN "i", #3, station$ + ".HDR"
INPUT "Printer or Screen (P/S): ", ans$
10 :
INPUT "Enter # of columns: ", c&
c& = c& - 1
INPUT "Enter 1st column: ", sc&
IF UCASE$(ans$) = "P" THEN OPEN "O", #2, "lpt1:" ELSE OPEN "O", #2,
"scrn:"
WIDTH #2, 255
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, "O - D MATRICES FOR STATION:  "; station$
 GOSUB ou: PRINT #2, "-------------------------"
DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, 1$
 GOSUB in
 COD$ = ncg$ + V31$ + V33$
              ELSE
 COD$ = "99999999999"
              END IF
 IF MID$(COD$, 1, 3) <> MID$(ocod$, 1, 3) THEN GOSUB process 'if commodity
changes
 IF COD$ = "99999999999" THEN GOTO 200
  o& = VAL(V31$)
  d& = VAL(V33$)
  wt(r%(o&), c%(d&)) = wt(r%(o&), c%(d&)) + TONS  '+++++
 ocod$ = COD$
LOOP
200 :
CLOSE
END
process:
IF ocod$ = "" THEN GOTO READTBL
 IF LEFT$(ocod$, 3) <> com$ THEN STOP
```

```
' PROGRAM # 9: CONTINUED

IF sc& + c& > col% THEN maxcol% = col% - sc& ELSE maxcol% = c&
 IF maxcol% < 0 OR VAL(com$) = 0 THEN GOTO skip

                              'WE USE ELEMENT(0,X) OR (X,0) TO STORE THE TOTAL
 TT& = 0
 FOR j% = 1 TO col%
 t& = 0
 FOR I% = 1 TO row%
 t& = t& + wt(I%, j%)
 NEXT I%
 wt(0, j%) = t&
 TT& = TT& + t&
 NEXT j%
 wt(0, 0) = TT&  'TOTAL OF TOTALS
 FOR I% = 1 TO row%
 t& = 0
 FOR j% = 1 TO col%
 t& = t& + wt(I%, j%)
 NEXT j%
 wt(I%, 0) = t&
 NEXT I%
 TT& = 0
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, "O / D (TONS PER DAY) FOR COMMODITY GROUP: "; com$
 GOSUB ou: PRINT #2, "----------------------------------------"
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, ""
 h$ = "O\D       "                                                  '&&
 FOR c% = sc& TO sc& + maxcol%
 d$ = RIGHT$("000" + LTRIM$(STR$(d&(c%))), 3)
 h$ = h$ + " z" + d$ + "   "                    '&
 NEXT c%
 GOSUB ou: PRINT #2, h$ + "others     TOTAL"
 GOSUB ou: PRINT #2, ""
 FOR r% = 1 TO row%
 o$ = RIGHT$("000" + LTRIM$(STR$(o&(r%))), 3)
 GOSUB ou
 PRINT #2, "z" + o$ + "    ";                                       '&&
 FOR c% = sc& + 0 TO sc& + maxcol%
 t$ = LTRIM$(STR$(CINT(wt(r%, c%))))
 PRINT #2, SPACE$(7 - LEN(t$)) + t$;          '&
 NEXT c%
 t& = 0
 FOR c% = 1 TO sc& - 1
 t& = t& + wt(r%, c%)
 NEXT c%
 FOR c% = sc& + maxcol% + 1 TO col%
 t& = t& + wt(r%, c%)
 NEXT c%
 t$ = LTRIM$(STR$(t&))
```

```
' PROGRAM # 9: CONTINUED


 PRINT #2, SPACE$(7 - LEN(t$)) + t$;        '&
 TT& = TT& + t&
 t& = wt(r%, 0)'TOTAL
 t$ = LTRIM$(STR$(t&))
 PRINT #2, SPACE$(11 - LEN(t$)) + t$;       '&
 PRINT #2, ""
 NEXT r%
 h$ = "TOTAL   "                                                    '&&
 FOR c% = sc& + 0 TO sc& + maxcol%
 d$ = RIGHT$("       " + LTRIM$(STR$(wt(0, c%))), 7)
 h$ = h$ + d$                                  '&
 NEXT c%
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, h$;
 TT$ = LTRIM$(STR$(TT&))
 PRINT #2, SPACE$(7 - LEN(TT$)) + TT$;        '&
 TT$ = LTRIM$(STR$(wt(0, 0)))
 PRINT #2, SPACE$(11 - LEN(TT$)) + TT$       '&

IF UCASE$(ans$) = "S" THEN INPUT "press ENTER to continue", garbage$
CLS
skip:
 ERASE wt
 DIM wt(250, 250)

READTBL:
ERASE r%, c%, o&, d&
DIM r%(300), c%(300), o&(300), d&(300)

IF NOT EOF(3) THEN
LINE INPUT #3, HD$
com$ = LEFT$(HD$, 3)
row% = (LEN(HD$) - 3) / 4
FOR r% = 1 TO row%
o&(r%) = VAL(MID$(HD$, 4 + 4 * (r% - 1), 4))
r%(o&(r%)) = r%
NEXT r%

LINE INPUT #3, HD$
IF LEFT$(HD$, 3) <> com$ THEN STOP
col% = (LEN(HD$) - 3) / 4
FOR c% = 1 TO col%
d&(c%) = VAL(MID$(HD$, 4 + 4 * (c% - 1), 4))
c%(d&(c%)) = c%
NEXT c%
END IF
RETURN
```

```
' PROGRAM # 9: CONTINUED


ou:
IF j& = 59 AND UCASE$(ans$) = "P" THEN
PRINT #2, CHR$(12): j& = 0
          END IF
 j& = j& + 1
RETURN

'SUBROUTINE IN:
'-------------
in:
ncg$ = MID$(1$, 1, 3): ncg& = VAL(ncg$)
V31$ = MID$(1$, 4, 4)
V33$ = MID$(1$, 8, 4)
TONS = VAL(MID$(1$, 12, 5))
v41$ = MID$(1$, 17, 3)
'IF LEN(1$) <> 19 THEN STOP
RETURN
```

```
CLS

' PROGRAM # 10: HEADER3.BAS

'This program is written to create a NEW "HDR" file which identifies &
'stores only existing origin rows and destination columns for each
'commodity group.
'The input for this program is "GROUP.TXT" .
'The output is "GROUP.HDR" file for grouped zones (50x50).

' By; ANTOINE CHEMALI
' Sept, 23th, 1991.

  station$ = COMMAND$
' "Astnxxx" - one station(sorted by COD) ,  "AVGWT" - all stations(sorted
by CODS)
DIM ex1%(300), ex2%(300)
 OPEN "I", #1, station$ + ".TXT"
 OPEN "o", #2, station$ + ".HDR"
 PRINT station$
DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, l$
 GOSUB in
 COD$ = ncg$ + no$ + nd$
                ELSE
 COD$ = "99999999999"
                END IF

 IF MID$(COD$, 1, 3) <> MID$(OCOD$, 1, 3) THEN GOSUB process
 IF COD$ = "99999999999" THEN GOTO 200

 ex1%(VAL(MID$(COD$, 4, 4))) = 1
 ex2%(VAL(MID$(COD$, 8, 4))) = 1

 OCOD$ = COD$
LOOP

200 :
CLOSE
END

process:
IF OCOD$ = "" THEN RETURN
PRINT #2, MID$(OCOD$, 1, 3);
FOR O& = 1 TO 300
IF ex1%(O&) = 1 THEN
O$ = RIGHT$("    " + STR$(O&), 4)
PRINT #2, O$;
                END IF
NEXT O&
PRINT #2, ""
```

```
' PROGRAM # 10: CONTINUED

PRINT #2, MID$(OCOD$, 1, 3);
FOR D& = 1 TO 300
IF ex2%(D&) = 1 THEN
D$ = RIGHT$("     " + STR$(D&), 4)
PRINT #2, D$;
                END IF
NEXT D&
PRINT #2, ""
ERASE ex1%, ex2%
RETURN

'SUBROUTINE IN:
'-------------
in:
ncg$ = MID$(1$, 1, 3): ncg& = VAL(ncg$)
TONS = VAL(MID$(1$, 12, 5))
v41$ = MID$(1$, 17, 3)
no$ = MID$(1$, 20, 4)
nd$ = MID$(1$, 24, 4)
IF LEN(1$) <> 27 THEN STOP
RETURN
```

```
'$DYNAMIC
CLS

' PROGRAM # 11: MXPSTN3.BAS

'This program is written to develop an O/D matrix (in tons per day) for
'each commodity group for all stations combined.
'The input for this program are the files "GROUP.TXT" & "GROUP.HDR"
'The output of this programs is 15 O/D tables.(FOR GROUPED ZONES)

' By: ANTOINE CHEMALI
' Sept, 23th, 1991.

 station$ = COMMAND$
DIM wt(250, 250)
DIM r%(300), c%(300), o&(300), d&(300)

 OPEN "I", #1, station$ + ".txt"
 OPEN "I", #3, station$ + ".HDR"

INPUT "Printer or Screen (P/S): ", ans$
10 :
INPUT "Enter # of columns: ", c&
c& = c& - 1
INPUT "Enter 1st column: ", sc&
IF UCASE$(ans$) = "P" THEN OPEN "O", #2, "lpt1:" ELSE OPEN "O", #2,
"scrn:"
WIDTH #2, 255
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, "ORIGIN - DESTINATION MATRICES FOR GROUPED ZONES:  ";
station$
 GOSUB ou: PRINT #2, "-------------------------------------------"

DO
 IF NOT EOF(1) THEN
 LINE INPUT #1, l$
 GOSUB in
 COD$ = ncg$ + no$ + nd$
                ELSE
 COD$ = "99999999999"
                END IF
 IF MID$(COD$, 1, 3) <> MID$(ocod$, 1, 3) THEN GOSUB process 'if commodity
changes
 IF COD$ = "99999999999" THEN GOTO 200
  o& = VAL(no$)
  d& = VAL(nd$)
  wt(r%(o&), c%(d&)) = wt(r%(o&), c%(d&)) + TONS  '+++++
 ocod$ = COD$
LOOP
200 :
CLOSE
END
```

PROGRAM # 11: CONTINUED

```
process:
IF ocod$ = "" THEN GOTO READTBL
 IF LEFT$(ocod$, 3) <> com$ THEN STOP
 IF sc& + c& > col% THEN maxcol% = col% - sc& ELSE maxcol% = c&
 IF maxcol% < 0 OR VAL(com$) = 0 THEN GOTO skip

                          'WE USE ELEMENT(0,X) OR (X,0) TO STORE THE TOTAL

 TT& = 0
 FOR j% = 1 TO col%
 t& = 0
 FOR I% = 1 TO row%
 t& = t& + wt(I%, j%)
 NEXT I%
 wt(0, j%) = t&
 TT& = TT& + t&
 NEXT j%
 wt(0, 0) = TT&  'TOTAL OF TOTALS
 FOR I% = 1 TO row%
 t& = 0
 FOR j% = 1 TO col%
 t& = t& + wt(I%, j%)
 NEXT j%
 wt(I%, 0) = t&
 NEXT I%
 TT& = 0
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2,"0 / D (TONS PER DAY) FOR COMMODITY GROUP: "; com$
 GOSUB ou: PRINT #2, "----------------------------------------"
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, ""
 h$ = "O\D      "                                                '&&
 FOR c% = sc& TO sc& + maxcol%
 d$ = RIGHT$("000" + LTRIM$(STR$(d&(c%))), 3)
 h$ = h$ + " z" + d$ + "  "                '&
 NEXT c%
 GOSUB ou: PRINT #2, h$ + "others     TOTAL"
 GOSUB ou: PRINT #2, ""
 FOR r% = 1 TO row%
 o$ = RIGHT$("000" + LTRIM$(STR$(o&(r%))), 3)
 GOSUB ou
 PRINT #2, "z" + o$ + "   ";                                      '&&
 FOR c% = sc& + 0 TO sc& + maxcol%
 t$ = LTRIM$(STR$(CINT(wt(r%, c%))))
 PRINT #2, SPACE$(7 - LEN(t$)) + t$;       '&
 NEXT c%
 t& = 0
 FOR c% = 1 TO sc& - 1
 t& = t& + wt(r%, c%)
 NEXT c%
 FOR c% = sc& + maxcol% + 1 TO col%
```

PROGRAM # 11: CONTINUED

```
 t& = t& + wt(r%, c%)
 NEXT c%
 t$ = LTRIM$(STR$(t&))
 PRINT #2, SPACE$(7 - LEN(t$)) + t$;        '&
 TT& = TT& + t&
 t& = wt(r%, 0)'TOTAL
 t$ = LTRIM$(STR$(t&))
 PRINT #2, SPACE$(11 - LEN(t$)) + t$;       '&
 PRINT #2, ""
 NEXT r%
 h$ = "TOTAL  "                                                  '&&
 FOR c% = sc& + 0 TO sc& + maxcol%
 d$ = RIGHT$("       " + LTRIM$(STR$(wt(0, c%))), 7)
 h$ = h$ + d$                                  '&
 NEXT c%
 GOSUB ou: PRINT #2, ""
 GOSUB ou: PRINT #2, h$;
 TT$ = LTRIM$(STR$(TT&))
 PRINT #2, SPACE$(7 - LEN(TT$)) + TT$;        '&
 TT$ = LTRIM$(STR$(wt(0, 0)))
 PRINT #2, SPACE$(11 - LEN(TT$)) + TT$       '&
 IF UCASE$(ans$) = "S" THEN INPUT "press ENTER to continue", garbage$
CLS
skip:
 ERASE wt
 DIM wt(250, 250)
READTBL:
ERASE r%, c%, o&, d&
DIM r%(300), c%(300), o&(300), d&(300)
IF NOT EOF(3) THEN
LINE INPUT #3, HD$
com$ = LEFT$(HD$, 3)
row% = (LEN(HD$) - 3) / 4
FOR r% = 1 TO row%
o&(r%) = VAL(MID$(HD$, 4 + 4 * (r% - 1), 4))
r%(o&(r%)) = r%
NEXT r%
LINE INPUT #3, HD$
IF LEFT$(HD$, 3) <> com$ THEN STOP
col% = (LEN(HD$) - 3) / 4
FOR c% = 1 TO col%
d&(c%) = VAL(MID$(HD$, 4 + 4 * (c% - 1), 4))
c%(d&(c%)) = c%
NEXT c%
END IF
RETURN
ou:
IF j& = 59 AND UCASE$(ans$) = "P" THEN
PRINT #2, CHR$(12): j& = 0
          END IF
 j& = j& + 1
RETURN
```

THE FOLLOWING IS LIST OF PROGRAMS WRITTEN IN dBASEIII+

PROGRAM # 1: SETUP01.PRG

```
use tony01
append from conc3.dat sdf
use t05
append from tony01
close all
```

PROGRAM # 2: SETUP02.PRG

```
use T05
replace all V55B with val(V55)              &&fill V55B
go top
replace all V55B with 100 for "A" $ V55
use commo
index on comcode to commo
sele 1 set relation to V55B into b
go top
replace all NCG with STR(B->COMGRP)

sele 2                                      &&fill NZO
use znagr
index on oz to zgroup
sele 1
set relation to V31 into b
go top
replace all NZO with B->NZ

set relation to V33 into b                  &&fill NZD
go top
replace all NZD with B->NZ

sele 1
copy to t05.txt sdf

close all
```

PROGRAM # 3: SETUP03.PRG

```
use mxavg
append from mxavg.txt sdf
close all
```

PROGRAM # 11: CONTINUED

```
'SUBROUTINE IN:
'-------------
in:
ncg$ = MID$(1$, 1, 3): ncg& = VAL(ncg$)
TONS = VAL(MID$(1$, 12, 5))
v41$ = MID$(1$, 17, 3)
no$ = MID$(1$, 20, 4)
nd$ = MID$(1$, 24, 4)
IF LEN(1$) <> 27 THEN STOP
RETURN
```

PROGRAM # 4: SETUP04.PRG

```
SELE 1
USE T05

SELE 2
USE MXAVG
INDEX ON STR(V48)+STR(V49)+STR(V69) TO MXAVG.NTX

SELE 1
SET RELATION TO V48+V49+V69 INTO B
REPLACE ALL V51B WITH B->V70AV
SET RELATION TO
GO TOP
REPLACE ALL V57B WITH V57 FOR V57<>0
GO TOP
REPLACE ALL V57B WITH V70-V51B FOR V57B=0
GO TOP
REPLACE ALL V57B WITH 0 FOR V57B<0
```

PROGRAM # 5: SETUP05.PRG

```
use t05
set filter to val(ncg)<>0 .and. val(v31)<>0 .and. val(v33)<>0 .and.
v57b<>0
copy to temp

use t04
append from temp
sort on v41,ncg,v31,v33 to temp

use temp
copy to t04scod.txt sdf

use t04
sort on ncg,v31,v33,v41 to temp
use temp
copy to t04cods.txt sdf

run del temp.dbf
close all
```

PROGRAM # 6: SETUP06.PRG

```
use t04
sort on v41,ncg,v31,v33 to temp

use temp
copy to t04scod.txt sdf

run del temp.dbf
close all
```

PROGRAM # 7: SETUP07.PRG

```
run copy $avgwt.dbf avgwt.dbf

use avgwt
append from avgwt.txt SDF
sort on S,C,O,D to temp

use temp
copy to mx2stn.txt SDF
run del temp.dbf
```

PROGRAM # 8: SETUP08.PRG

```
sele 1
use avgwt

sele 2
use znagr
index on OZ to zgroup

sele 1
set relation to O into B
go top
replace all NO with B->NZ
set relation to D into B
go top
replace all ND with B->NZ
sort on C,NO,ND,S to temp

use temp
copy to group.txt sdf
run del temp.dbf
close all
```

PROGRAM MATRIX

```
DO
CLS
LOCATE 2, 10
```

```
                                THE MENU
PRINT "MATRIX, A SEQUENTIAL PROCESS FOR DEVELOPING COMMODITY FLOW TABLES
PRINT TAB(10);
```

```
 PRINT ""
 PRINT TAB(10); "1> Create the file T05.DBF"
 PRINT TAB(10); "2> Create the fields: V55B, MCG, V51B, & V57B"
 PRINT TAB(10); "   Create the files : MXAVG.DBF, T04.DBF, T04SCOD &
 PRINT TAB(10); "   T04CODS.TXT"
 PRINT TAB(10); "3> Create a 'TXT' and a 'HDR' for every station"
 PRINT TAB(10); "   and/or for all stations combined"
 PRINT TAB(10); "4> PRINT O/D commodity tables for any station"
 PRINT TAB(10); "   and/or for all stations combined"
 PRINT TAB(10); "5> Eliminate multiple counts from the tables"
 PRINT TAB(10); "6> PRINT cleaned stations' commodity tables"
 PRINT TAB(10); "7> PRINT the sum of cleaned tables"
 PRINT TAB(10); "8> Group the 'O.W.T.S' zone system to a new 50 zone system"
 PRINT TAB(10); "9> PRINT O/D's for new zone system (50 x 50)"
 PRINT TAB(10); "0> END"
```

```
DO
a$ = INKEY$
LOOP WHILE a$ = ""
SELECT CASE a$

CASE "1"
SHELL "copy $conc3.dbf tony01.dbf"
SHELL "copy $t05.dbf t05.dbf"
SHELL "setup01"
KILL "tony01.dbf"

CASE "2"
SHELL "setup02"
SHELL "wtavg"
SHELL "copy $mxavg.dbf mxavg.dbf"
SHELL "setup03"
KILL "t05.txt"
SHELL "setup04"
SHELL "copy $t04.dbf t04.dbf"
SHELL "setup05"

CASE "3"
 SHELL "station"
 OPEN "I", #5, "sref2.txt"
 WHILE NOT EOF(5)
 LINE INPUT #5, rec$
 station$ = "STN" + LEFT$(rec$, 3)
```

PROGRAM MATRIX CONTINUED

```
 SHELL "header " + station$
 WEND
 CLOSE 5
 station$ = "T04CODS"
 SHELL "header " + station$

CASE "4"
1 :
 INPUT "Enter 3 char station ID 'OR' press enter for all stations: ", station$
 IF station$ = "" THEN
 station$ = "t04cods"
 ELSE
 IF LEN(station$) <> 3 THEN PRINT "Invalid ID.": GOTO 1
 station$ = "stn" + station$
 END IF

SHELL "mxpstn " + station$

CASE "5"
 SHELL "codst"
 SHELL "avgwt"
 SHELL "setup07"
 SHELL "station2"

 OPEN "I", #5, "sref2.txt"
 WHILE NOT EOF(5)
 LINE INPUT #5, rec$
 station$ = "ASTN" + LEFT$(rec$, 3)
 SHELL "header2 " + station$
 WEND
 CLOSE 5
 station$ = "AVGWT"
 SHELL "header2 " + station$

CASE "6"
2 :
 INPUT "Enter 3 char station ID : ", station$
 IF LEN(station$) <> 3 THEN PRINT "Invalid ID.": GOTO 2
 station$ = "Astn" + station$
SHELL "mxpstn2 " + station$

CASE "7"
 station$ = "AVGWT"
 SHELL "mxpstn2 " + station$

CASE "8"
 SHELL "setup08"
 station$ = "GROUP"
 SHELL "header3 " + station$

CASE "9"
 station$ = "GROUP"
```

PROGRAM MATRIX CONTINUED

```
 SHELL "mxpstn3 " + station$

CASE "0"
END

END SELECT
INPUT "Done. Press any key to continue ...", garbage$
LOOP
```

APPENDIX - C

ADDITIONAL INFORMATION

This Appendix contains some additional information about the Commercial Vehicle Survey. Figure C.1 shows stations names, codes, and locations. Figure C.2 is a copy of the questionnaire used to collect data.

Figure C.1 Selected information about the survey stations

STATION NAME	SURVEY DIRECTION	STATION CODE	HWY	APPROXIMATE LOCATION
EASTWOOD	EB	M9	2	JUST EAST OF HWY. 401
COURTLAND	WB	M11	3	HWY 3 @ COURTLAND
FERGUS	NB	M15	6	AT S TOWN LIMITS
FERGUS	SB	M15	6	4 KM. S OF TOWN
STRATFORD	EB	M16	7/8	14 KM. E. OF TOWN
KEMPTVILLE	NB	M18	16/43	32 KM. N. OF HWY. 401
KEMPTVILLE	SB	M18	16/43	32 KM. N. OF HWY. 401
PRESCOTT BORDER	NB	M41	16	AT JOHNSTOWN
WOODBRIDGE	SB	212	400	3.7 KM. N. HWY. 7
KING	NB	213	400	2 KM. N. KING SIDE RD.
TRAFALGAR	EB	221	401	BETWEEN TRAFALGER & JAMES
TRAFALGAR	WB	222	401	BETWEEN TRAFALGER & JAMES
VICTORIA	NB	224	10	.2 KM NORTH OF VICTORIA
OAKVILLE NORTH	WB	225	QEW	KERR ST. E. SIDE HWY. 25
OAKVILLE SOUTH	EB	226	QEW	KERR ST. E. SIDE HWY. 25
QUEENSTON	WB	231	405	WESTBOUND @ BORDER
FRUITLAND	WB	232	QEW	E. CHERRY BEACH RD.
FORT ERIE	WB	233	QEW	AT CONCESSION ST.
BISMARCK	NB	234	20	AT HWY 27 & 65
WINONA	EB	235	QEW	.8 KM. W. WINONA RD.
WHITBY	EB	241	401	2.2 KM. W. HWY. 12
BOWMANVILLE	WB	242	401	.8 KM. E. BOWMANVILLE
PUTNAM NORTH	WB	311	401	W. OF PUTNAM RD. 45
PUTNAM SOUTH	EB	312	401	W. OF PUTNAM RD. 45
WINDSOR NORTH	WB	321	401	2.7 KM. W. OF INT. 3
WINDSOR SOUTH	EB	322	401	4.6 KM. E. OF INT. 3
SARNIA NORTH	WB	325	402	4.8 KM. E. OF CTY. RD 26
SARNIA SOUTH	EB	326	402	4.8 KM. E. OF CTY. RD 26
GANANOQUE NORTH	WB	411	401	8.2 KM. W. OF HWY. 137
GANANOQUE SOUTH	EB	412	401	8.5 KM. W. OF HWY. 137
LANCASTER NORTH	WB	413	401	INTERSECTION HWY. 2
LANCASTER SOUTH	EB	414	401	12.8 KM. E. LANCASTER
ALFRED	EB	421	17	1.6 KM. W. ALFRED
ALFRED	WB	421	17	1.6 KM. W. ALFRED
PERTH/GLEN TAY	EB	422	7	4.8 KM. W. PERTH
PERTH/GLEN TAY	WB	422	7	4.8 KM. W. PERTH
PEMBROKE	EB	423	17	W. OF PEMBROKE
PEMBROKE	WB	423	17	W. OF PEMBROKE

Figure C.1 Continued

STATION NAME	SURVEY DIRECTION	STATION CODE	HWY	APPROXIMATE LOCATION
CASSELMAN	WB	424	417	1.6 KM. W. HWY. 138
NORTH BAY	WB	512	17	W. END OF NORTH BAY BY-PASS
PARRY SOUND/ FRENCH RIVER	NB	513	69	1.6 KM. N. PARRY SOUND
PARRY SOUND/ FRENCH RIVER	SB	513	69	1.6 KM. N. PARRY SOUND
GRAVENHURST	SB	514	11	2.7 KM. S. HWY. 69 & 11B
HUNTSVILLE	EB	516	60	12.8 KM. E. HUNTSVILLE
WASI	NB	517	11	3.2 KM. S. OF WASI RIVER
COCHRANE NORTH	WB	521	11	AT THIRD AVE, COCHRANE
COCHRANE SOUTH	EB	521	11	AT THIRD AVE, COCHRANE
HEARST	EB	522	11	HEARST
HEARST	WB	522	11	HEARST
NEW LISKEARD	NB	523	11	8 KM. N. NEW LISKEARD
NEW LISKEARD	SB	523	11	8 KM. N. NEW LISKEARD
SPRAGGE	EB	531	17/108	HWY. 17 & 108
SPRAGGE	WB	531	17/108	HWY. 17 & 108
THUNDER BAY NORTH	WB	611	11/17	6.4 KM. W. JCT 17/61
THUNDER BAY SOUTH	EB	611	11/17	6.4 KM. W. JCT 17/61
REDROCK	EB	613	11/17	.8 KM. E. JCT 17/628
REDROCK	WB	613	11/17	.8 KM. E. JCT 17/628
DRYDEN	EB	621	17	1.6 KM. E. DRYDEN
DRYDEN	WB	621	17	1.6 KM. E. DRYDEN
VERMILLION BAY	EB	622	17	JCT. HWY. 17/ 105
VERMILLION BAY	WB	622	17	JCT. HWY. 17/ 105
KEEWATIN	EB	623	17	AT KEEWATIN
KEEWATIN	WB	623	17	AT KEEWATIN
CROZIER/ FORT-FRANCES	EB	624	11	8 KM. W. OF FORT FRANCES
CROZIER/ FORT FRANCES	WB	624	11	8 KM. W. OF FORT FRANCES
HEYDON/ SAULT STE. MARIE	NB	631	17	8.8 KM. N. SAULT ST. MARIE
HEYDON/ SAULT STE. MARIE	SB	631	17	8.8 KM. N. SAULT ST. MARIE
SAULT STE. MARIE	NB	747	17	AT ONTARIO/USA BORDER
FORT FRANCES	NB	751	11	AT ONTARIO/USA BORDER
FORT FRANCES	SB	751	11	AT ONTARIO/USA BORDER
LANSDOWNE	NB	753	2	AT ONTARIO/USA BORDER
PIGEON RIVER	NB	756	61	AT ONTARIO/USA BORDER
TEMISCAMING	SB	884	63	AT ONTARIO/QUEBEC BORDER
VIRGINIATOWN	WB	885	66	AT ONTARIO/QUEBEC BORDER
KIRKLAND LAKE	WB	886	66	AT ONTARIO/QUEBEC BORDER

Figure C.2 The Survey Questionnaire

1988 COMMERCIAL VEHICLE SURVEY QUESTIONNAIRE

Record | Location | Hour Ending | YY | MM | DD | Dow | Direction (1N, 2E, 3S, 4W) | 20

A. OBSERVATIONS

I. VEHICLE

1. Name (Power Unit) [ ] 39

- do not copy if it is an Ontario plate
Plate Number [ ] 45

2. Base Province/State of Registration (Power Unit) [ ] 47

3. Configuration [ ] 48

1. Tractor & Semi Trailer
2. A-Train
3. B-Train
4. C-Train
5. Straight Truck
6. Truck & Trailer
7. Tractor Only
8. Other (specify) _____

[ ] 49
1. Under 30 feet
2. Over 30 feet

4. Type of Connection (F = Full S = Semi N = Not applicable)
Power Unit [ ] 50
1st Trailer [ ] 51
2nd Trailer

5. Trailer Style [ ] 53

1. Van with reefer
2. Van with out reefer
3. Hopper
4. Concrete Mixer
5. Stake
6. Dump
7. Tanker
8. Flat Bed
9. Float
10. Car Carrier
11. Other (specify) _____

6. Tractor Style

1. Conventional 2. Cab Over [ ] 54

1. Drome Box 2. Sleeper 3. Both 4. Neither [ ] 55

7. Axles

Number of engaged axles (tires on the ground) [ ] 56
Number of non-engaged (raised) axles [ ] 57

8. Tires on Rear Axles [ ] 58
Power Unit
1. Paired Dual Tires
2. Super Single Wide Tires
1st Trailer [ ] 59
2nd Trailer [ ] 60

9. Energy Attenuation Devices
Tractor [ ] Trailer [ ] 62

Tractor
1. Roof Shield
2. Side Fairings
3. Aerodynamic Sleeper Roof
4. Other or Combination of above (specify) _____

Trailer
1. Bubble
2. Leading Edge
3. Other (specify) _____

Figure C.2 Continued

10. Safety

Headlights/Foglights
1. On 2. Off ☐ 63

Light Condition
1. Normal: Day 2. Twilight 3. Evening 4. Inclement Weather ☐ 64

Pavement Condition
1. Road is Dry 2. Wet/Snowcovered ☐ 65

11. Splash and Spray Devices

1. Yes 2. No ☐ 66

II. COMMODITY

1. Dangerous Goods Placard in Evidence ☐ 67

1. Yes 2. No

PIN Number (If shown) ☐☐☐☐ 71

Class Number ☐☐☐ 74

B. QUESTIONS

1. VEHICLE

1. Registered Gross Vehicle Weight (Power Unit) ☐☐☐☐☐ 80
- for non-Ontario plates only

Unit of Measurement
1. Kilograms 2. Pounds ☐ 81

2. Tare (Empty) Weight (Power Unit) ☐☐☐☐☐ 87
- for non-Ontario plates only

Unit of Measurement
1. Kilograms 2. Pounds ☐ 88

3. Is the truck leased from a leasing company? ☐ 89

1. Yes 2. No 3. Don't know

4. Does the vehicle have an on board monitoring device or logbook to record hours of operation? ☐ 90
1. Yes 2. No

If yes: Logbook 1. Yes 2. No ☐ 91
If yes: Tachograph 1. Yes 2. No ☐ 92
On Board Computer 1. Yes 2. No ☐ 93

5. Does the vehicle have a "lift"/non-fixed axle control device? ☐ 94

1. Yes 2. No

If so, what type?

0 N/A 1. lift control 2. Belly control 3. Other ☐ 95

If "lift control" axle, is it accessible to the driver from within the cab?

1. Yes 2. No ☐ 96

Figure C.2 Continued

II. CARRIER

1. What type of carrier are you? ☐ 97

   1. For hire 2. Private 3. Contract

2. What is your (driver) employment category? ☐ 98

   1. Broker/Owner-Operator
   2. Employee
   3. Self-employed

3. If you consider yourself an "Employee" do you work for a: ☐ 99

   1. Agency 2. Company

4. Are you (the driver) a member of a union or other work related association? ☐ 100

   1. No
   2. Yes, Owner Operator Association
   3. Yes, Teamsters Union
   4. Yes, Cdn Brotherhood of Railway, Transport and General Workers (CBRTGW)
   5. Yes, Brotherhood of Railway, Airline & Steamship Clerks (BRASC)
   6. Yes, Other (specify) _____

5. Does your company have a driver incentive program with respect to energy conservation? ☐ 101

   1. No
   2. Yes, Speed control less than legal limit
   3. Yes, Other (specify) _____

6. Are you aware of the CVOR (Commercial Vehicle Operator Registration) system? ☐ 102

   1. Yes 2. No

III. COMMODITY

1. Is there a waybill or bill of lading? ☐ 103

   1. No, Electronically transmitted
   2. No, Other
   3. Yes, copied
   4. Yes, not copied

2. What is the major commodity on board? (Be specific) ☐☐ 105

   _____

   If the commodity is "General Freight", indicate whether it is: 1. Truckload (TL) or 2. Less than Truckload (LTL) ☐ 106

3. If the commodity is a "Dimensional Good" (i.e., oversize or overweight), identify whether the driver has a permit that authorizes transport? ☐ 107

   1. No permit
   2. Yes, oversize permit
   3. Yes, overweight permit
   4. Yes, both

4. If "General Freight", what is the number of shipments or consignments on board? ☐☐☐ 110
   (don't ask if all waybills are copied) (number)

Figure C.2 Continued

5. What is the total weight of all commodities on board? (don't ask if all waybills are copied) ☐☐☐☐☐☐ 116

Unit of Measurement ☐ 117
1. Kilograms 2. Pounds

6. What is the volume (space) utilization of the unit? (Total cube; not just floor space coverage) ☐ 118

1. Empty
2. 1/4 Full
3. 1/2 Full
4. 3/4 full
5. Full
6. Don't know

IV. ORIGIN - DESTINATION

1. What is the origin and destination of your trailer/truck?

		Nearest City	Province/State		
Shipper/ Origin	Unit 1			☐☐☐☐☐☐	124
	Unit 2			☐☐☐☐☐☐	130

		Nearest City	Province/State		
Consignee/ Destination	Unit 1			☐☐☐☐☐☐	136
	Unit 2			☐☐☐☐☐☐	142

2. If the origin and destination of the trailer(s) or truck is the same community, what is the name of the farthest community you will be travelling to/from on this trip?

City	Province/state		
		☐☐☐☐☐☐	148

3. How many pickups and deliveries will you have made on this trip? ☐☐ 150

4. Are you the sole driver for this load?

1. Yes 2. No ☐ 151

If not what is your origin and destination for this load?

Origin	Destination		
		☐☐☐☐☐☐	157

5. At the initial origin and destination, what type of establishment was at that location (for each trailer)?

1. Air
2. Rail
3. Marine
4. Truck

(1-4: Terminals)

5. Primary Source for Origin
Point of Sale/Consumption for Destination
6. Manufacturer
7. Warehouse
8. Distribution Centre
9. Other
10. Don't know

	Unit #1 O/D		Unit #2 O/D	
	☐☐	☐☐	☐☐	☐☐
	161		165	

Figure C.2 Continued

V. DANGEROUS GOODS

1. Are you carrying commodities that are regulated dangerous goods? ☐ 166

   1. Yes 2. No

   What type are they: _____

   PIN ☐☐☐☐ 170

   CLASS ☐☐☐ 173

VI. DRIVER

1. Have you heard of "Trucksave"? If so where? ☐ 174

   1. No
   2. Yes: Truckstops
   3. Yes: Received Publications
   4. Yes: Economy Challenge
   5. Yes: Other (specify) _____

2. Have you ever taken ...

   i) A driver education course? ☐ 175
   1. yes 2. No

   If yes, last when? ☐☐ month ☐☐ year 179
   99: don't know

   ii) A first aid course? ☐ 180
   1. yes 2. No

   If yes, last when? ☐☐ month ☐☐ year 184
   99: don't know

   iii) A spills training course? ☐ 185
   1. yes 2. No

   If yes, last when? ☐☐ month ☐☐ year 189
   99: don't know

3. With respect to driving this vehicle on this trip:

   (24 hour clock)

   At what time did your shift begin ☐☐☐☐ 193

   At what time should your shift end ☐☐☐☐ 197

   What has been/what will be your longest stretch of hours on the road without a break? ☐☐.☐ 200

4. When was your date of birth? ☐☐☐☐☐☐ 206
   (day) (month) (year)

5. How many years have you driven a truck commercially (with either a Class A or D Licence for Ontario drivers)? ☐☐ 208

6. What is your driver's licence number (left justified) ☐☐☐☐☐-☐☐☐☐☐-☐☐☐☐☐ 223

The authority to collect this information is provided by Section 179(d) of the Highway Traffic Act R.S.O. (1980). Information on the characteristics of intercity trucking trips, commodities, drivers and vehicles will be used by the Ministry of Transportation, Ontario, and Transport Canada for strategic and program planning purposes. Additional information or clarification can be provided by contacting the following Ministry of Transportation, Ontario personnel: Julius Gorys, Transportation Demand Research Office (416)235-4083, Greg Little, Truck Transportation Office (416)235-3617, Bill Raney, Goods Distribution Systems Office (416) 235-4062.