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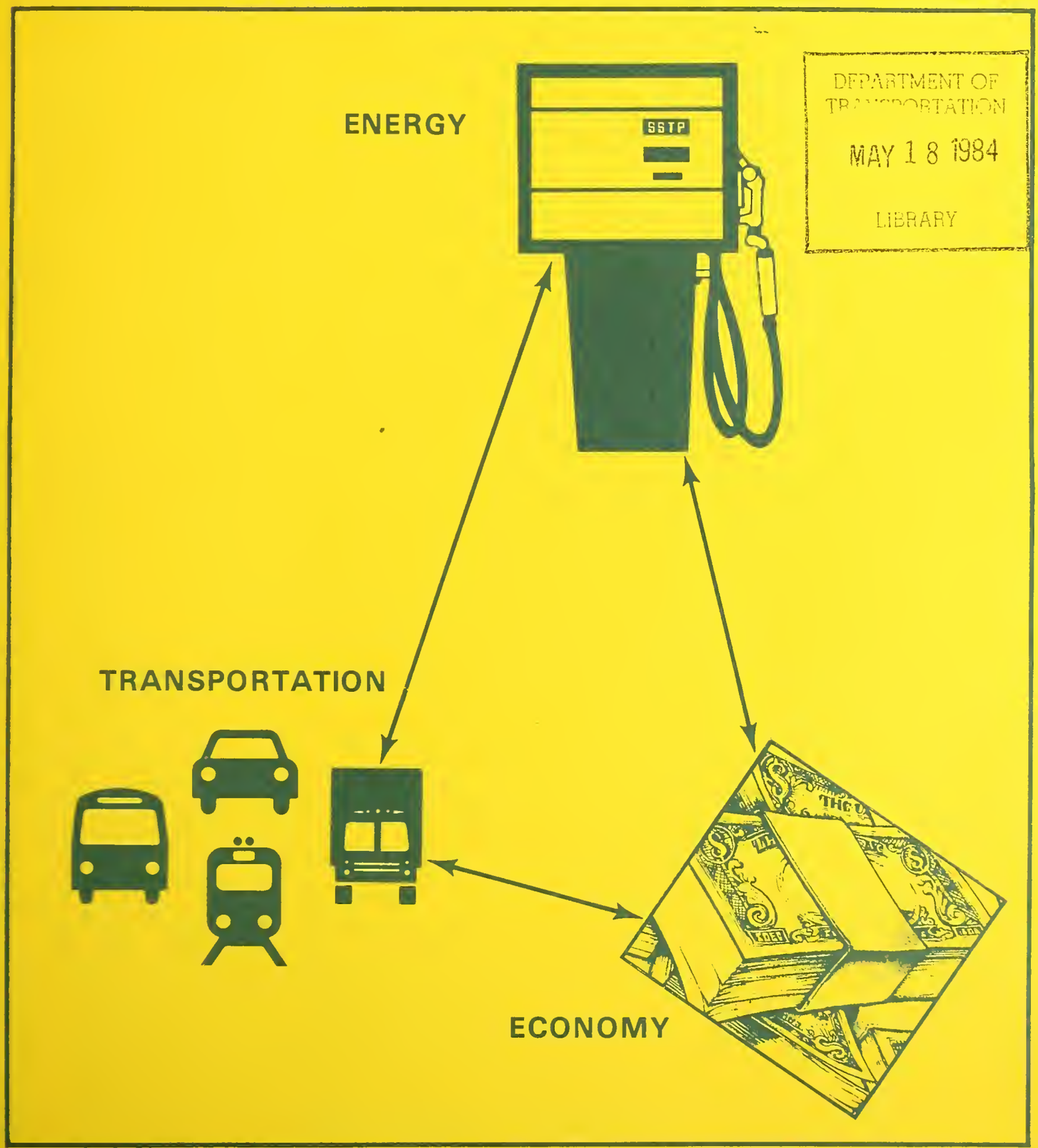
Local Economic Impacts of Transportation Fuel Consumption

Part I: Derivation of Procedure

Part II: Planning Manual

January 1984



Local Eonomic Impacts of Transportation Fuel Consumption

Part I: Derivation of Procedure

Part II: Planning Manual

January 1984

Prepared by
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Prepared for
Federal Highway Administrtion
Urban Mass Transportation Administration

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U.S. Department of Energy

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FOREWORD

In a free market environment, the price of gasoline fluctuates with changes in supply and demand. Accordingly, a change in the price of gasoline can be expected to have an impact on the local economy of urban areas. In order to trace such impacts at the urban area level and to institutionalize analyses of this type, the North Central Texas Council of Governments, which serves the Dallas-Fort Worth area, conducted a study of the application of input-output, or inter-industry, models to address this question. The result of this study was development of the procedures described in this manual.

The procedures developed rely in part on the Regional Input-Output Modeling Systems (RIMS II). This model is available for any county or collection of counties from the U.S. Department of Commerce for approximately $2,000. While this is a fairly modest cost, where only limited economic/industry variation is expected from one urban area to another within a State, urban areas could pool resources to obtain data at the State level, which could be valid for several MPO's.

It should be noted that the example application described in this manual relies on data developed in 1972. In addition, the reader should be aware of the sensitivity of the analysis method to specific local conditions. For example, the ratio of a State's highway expenditures allocated to a particular urbanized area will have a significant effect on the prediction of local area employment impacts. The local area industry composition will also have an effect. For example, in the Southwest, the predominance of the oil industry will mean that reductions in gasoline demand due to improvements in automobile efficiency and related impacts on the oil industry employment will have an overall result different than elsewhere in the country. For these reasons, the results of the specific cases described in the manual should be viewed as examples only and not indicative of the local economic impact elsewhere, under different conditions, of the events or policies described. In addition, new data for the RIMS II model will be available in 1984 using 1977 as the base year. This newer data will improve the accuracy of the modeling procedures.

We believe that, recognizing these concerns, this manual provides a powerful tool planners at the local level can use to assess the localized economic impacts of transportation fuel price changes and facilities and service improvements. Related reports are available on Transportation Energy Contingency Planning, Transportation Energy Management, Scenario Planning, Estimating Transportation Energy Consumption of Residential Land Use Types and Transportation and Energy Planning in Mid-Sized Areas. Information on

these reports is available from our offices. Additional copies of this report are available from the National Technical Information Service, Springfield, Virginia 22161. Please reference report DOT-I-84-01 on your request.

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CONVERSION FACTORS

1 gallon of automotive gasoline = 125,000 BTUs

1 gallon #1 diesel = 135,000 BTUs

1 gallon #2 diesel = 138,700 BTUs

1 gallon crude oil = 138,100 BTUs

1 kilowatt hour = 3,412 BTUs

1 joule = 0.9478×10^{-3} BTUs

ENERGY EQUIVALENTS

1 gallon of automotive gasoline =

.926 gallons #1 diesel

.901 gallons #2 diesel

.0216 barrels (42 U.S. gal.) crude oil

36.6 kilowatt hours

Source: A. Rose (1979), Energy Intensity and Related Parameters of Selected Transportation Modes: Passenger Movements. Oak Ridge, Tennessee: Oak Ridge National Laboratory.

Executive Summary

The objective of this project is to develop a mechanism for evaluating transportation fuel consumption and price impacts on a local economy. This project is derived from the observation that energy impacts of local transportation actions and policies are often not quantified in economic terms. At the present time the significance of changes in local transportation fuel expenditures on a local urban economy is generally unknown.

It is proposed that the most useful way to approach this analysis is by linking together the concepts of household expenditures and interindustry economics. Urban transportation planners and policy analysts have long recognized that the household is the basic decision-making unit wherein trade-offs are made with regard to alternative transportation services. Likewise, the household will be the focus of decision making with regard to expenditures on transportation fuels versus other needs and desires of the household. Therefore, it makes sense to analyze transportation, energy, and the household economy simultaneously.

What are the effects of these changing household expenditure patterns on the overall economy of the urban area? A widely used means of answering this question is the interindustry or input-output model. Interindustry analysis explains how each sector of an economy is linked with every other sector. An input-output model can show, for example, what happens to all of the industries in the area if households reduce their consumption of gasoline. Utilizing this approach, it is possible to quantify the impacts on the urban area through such aggregate measures of economic performance as total production, employment, and income.

Since the economies and energy situations vary from locale to locale within the United States, it should be expected that changes in transportation energy efficiency and fuel prices would have unique impacts in each particular area. Thus, a procedure which reflects these local differences is needed to estimate these impacts. The final product of this study is a planning manual for local and state officials to quantitatively assess the economic impact of changes in fuel price and consumption levels. The planning manual is represented in Volume III of this series and contains three case study examples for the Dallas-Fort Worth area.

Rising energy prices and more efficient automobiles can be expected to cause changes in household expenditure patterns. As the price of gasoline goes up, for example, households may reduce their use of the private automobile to compensate for the price increase. They may instead switch to alternative forms of transportation, reduce their expenditures in other areas, purchase a more fuel efficient automobile, or choose some combination of these and other options. In linking transportation energy and economic analysis together, it seems appropriate to investigate these basic trade-offs that the household is making, not only within the transportation area, but among transportation and

other household expenditures. Income elasticities are used to quantify this phenomenon.

This document contains the background information needed to make good use of the accompanying planning manual in Volume III. It is organized in a fashion similar to the planning manual in order to assist the transportation planner in using the manual. This report can be considered a technical reference to be used in applying the manual.

I. INTRODUCTION

PURPOSE

This report contains a review of the procedures used to estimate local economic impacts of transportation fuel consumption. This document and the accompanying executive summary (Volume I) and planning manual (Volume III) are the final products of a research contract jointly sponsored by the U. S. Department of Transportation and the U.S. Department of Energy. Both the Urban Mass Transportation Administration and the Federal Highway Administration participated in the study for the U. S. Department of Transportation. The purpose of the study is to incorporate energy considerations in urban transportation planning and decision making.

This report and the accompanying planning manual are intended to be used by state and local/regional transportation planners for the estimation of the economic impacts of transportation fuel consumption. For the purposes of this report, the economic impacts of transportation energy expenditures are of two types: direct and total. Direct impacts are defined here as the initial changes in the expenditures by various sectors of the economy which result from the increases or decreases in fuel expenditures. An example of an indirect impact is when travel is reduced due to an increase in fuel price and tire wear and tear slows down resulting in a decrease in tire sales. Total impacts are the net impacts as industries interact with each other and include both direct and indirect impacts.

APPLICABILITY

The procedures outlined in this volume can be used to address a number of issues of interest to state and local policy makers. Such policy questions include--

1. What are the economic consequences to a particular urban area of greatly increased gasoline prices?
2. Are there particular industries in an urban area which should somehow be given priority transportation fuel allocation by local agencies because of the importance of these industries for the local economy?
3. Are the projected economic impacts of transportation fuel shortages and/or price increases severe enough to warrant transportation measures by local agencies to overcome these impacts?

Clearly, the answers to these questions vary from state to state and from urban region to urban region. Thus, there is a need for methods which can be applied easily in a variety of situations and in a variety of geographic locations. Because of this, an attempt has been made to (1) rely as heavily as possible on readily available data and (2) structure the planning approach so that portions of the methodology can be used as stand-alone items.

ORGANIZATION OF REPORT

In addition to Chapter I, this document consists of the following chapters as outlined below.

Chapter II: Overview of the Procedures

This section provides an overview of the planning procedures in order for potential users to understand the complete process. It is fully anticipated

that components of the overall process may be used separately. Therefore, this chapter will contain an explanation of the various steps which can be used as stand-alone sections.

Chapter III: Energy Efficiency and Price Scenarios

The purpose of this section of the report is to provide background guidance on developing energy efficiency and price scenarios for economic analyses.

Chapter IV: Sector Energy Consumption

This section provides a methodology for estimating household and commercial sector consumption changes resulting from changes in fuel prices and fuel efficiencies.

Chapter V: Consumer Price Index Changes

The Consumer Price Index "model" is presented in this section of the manual. Also provided are methods and data to be used in estimating these index changes.

Chapter VI: Total Economic Impacts

This section synthesizes the economic impact information developed in previous steps in the process and demonstrates how this information can be combined and presented. Indirect economic impacts are explicitly estimated in this section. This chapter also explains the use of the interindustry or input-output model.

Chapter VII: Suggestions for Use of Manual

This section provides information on getting started with an analysis, suggested ways for presenting the information, and a further discussion on the types of problems which can be addressed with this methodology.

II. OVERVIEW OF THE PROCEDURE

DISCUSSION

There is a strong relationship between transportation and energy. Personal transportation is particularly dependent upon uncertain petroleum supplies. It is also known that our economy requires the availability of an effective and efficient transportation system. Economic development is dependent upon the availability of these transportation systems (Charles River Associates Inc., 1967; National Council for Urban Economic Development, 1980).

A strong interdependence between the economy and energy supplies and prices has also been found (Sonenblum, 1978; Askin, 1978). Therefore, transportation, energy, and the economy must be evaluated simultaneously in order to capture these interdependences. To some extent this has been done at the national level, but little investigation has been done at urban area levels (Bezdeck and Hannon, 1974; Patterson, 1980; U.S. Congress, 1975).

One way to approach this analysis is through linking together the concepts of household expenditures and interindustry economics. One-third of all U.S. energy consumption is direct household consumption, i.e., residential and transportation fuels (Herendeen, 1974). Urban transportation planners and policy analysts have long recognized that the household is the basic decision-making unit wherein trade-offs are made with regard to alternative transportation services. Likewise, the household is the decision-making unit with

regard to expenditures on transportation fuels versus other needs and desires of the household.

Changes in energy prices can be expected to cause changes in household expenditure patterns. As the price of gasoline goes up, for example, households may reduce their use of the private automobile to compensate for the price increase. They may instead switch to alternative forms of transportation, reduce their expenditures in other areas, purchase a more fuel-efficient automobile, or choose some combination of these and other options. In linking transportation energy and economic analysis together, trade-offs can be investigated, not only within the transportation area, but among transportation and other household expenditures (Roden, 1981).

What are the effects of these changing household expenditure patterns on the overall economy of the urban area? A widely used means of answering this question is the interindustry or input-output model. Interindustry analysis explains how each sector of an economy is linked with every other sector. An input-output model can show, for example, what happens to all of the industries in the area if households change their consumption of gasoline. Utilizing this approach, it is possible to quantify the impacts on the urban area through such aggregate measures of economic performance as total production, employment, and income (Chenery and Clark, 1969; Miernyk, 1965; Richardson, 1975).

Recently a great deal of study has taken place at the federal level, and to some extent the state level, linking these economic performance measures with

energy consumption (Alman, 1973; Joun, 1980; Melcher, 1981). Since two-thirds of the direct energy consumption in the U.S. is by the non-household sectors of the economy, it is important to estimate how rising energy prices may affect these other sectors of the economy (Cox, 1980).

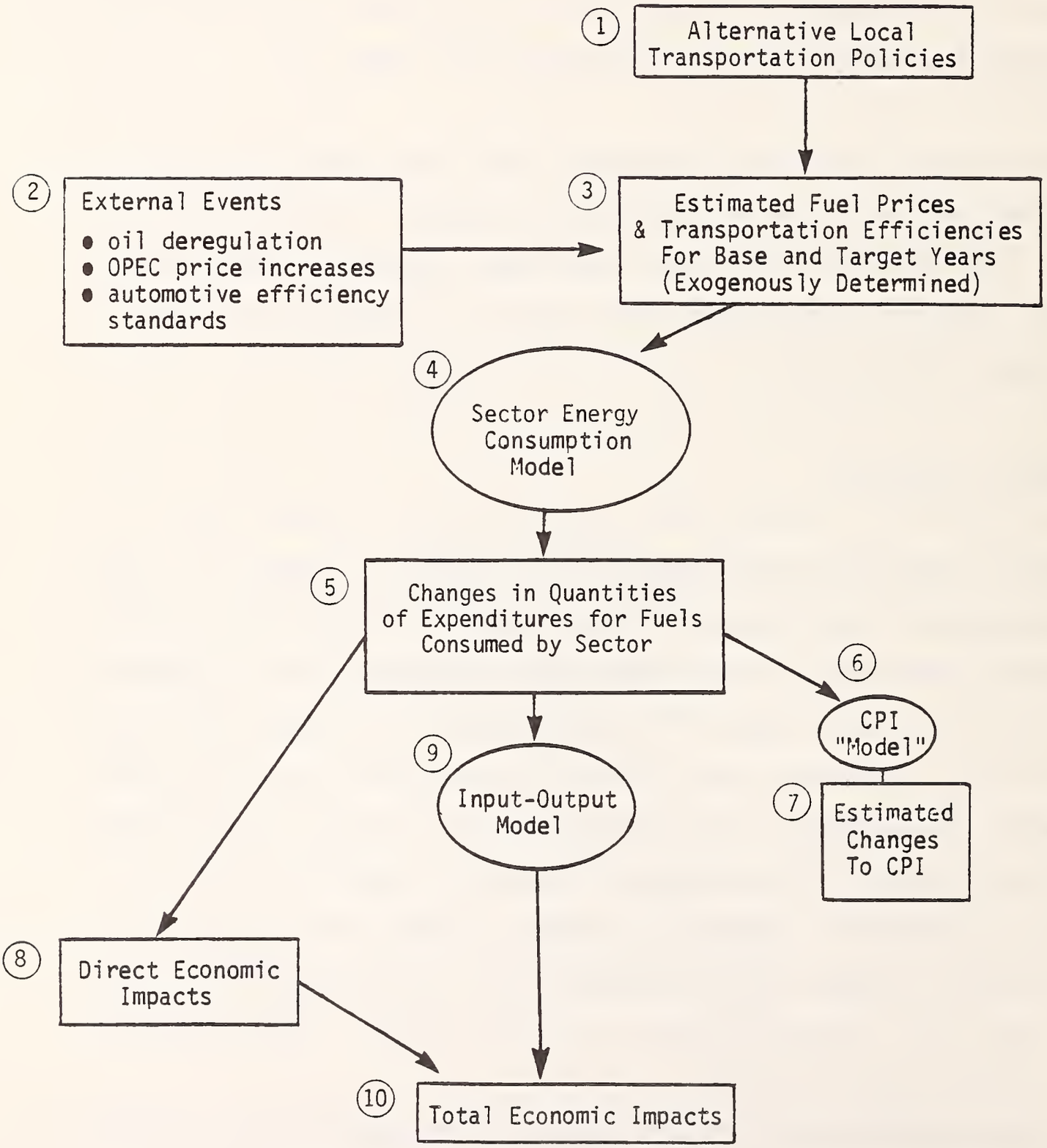
Since economies and energy situations vary from locale to locale within the United States, it could be expected that changes in transportation energy efficiency and fuel prices would have unique impacts in each particular area. Thus, a procedure which reflects these local differences is needed to estimate these impacts.

SUMMARY OF APPROACH

The approach for estimating the direct and indirect economic impacts of a change in household energy consumption is presented in Exhibit 1. This energy-economic impact methodology begins with the estimation of transportation fuel price. Quantities of these fuels consumed are also estimated on the basis of any planned or expected changes in transportation energy efficiency. Three classes of analyses can be conducted with this approach; however, the magnitude of the modeling effort varies greatly among the types of investigations. The three types of investigations are--

- Investigation of Transportation Actions in a Base Year Situation. This analysis includes the investigation of the present situation in a base year and an alternative policy for the same base year. This is the least difficult type of analysis.
- Investigation of Base Year and Future Baseline Conditions. This analysis includes the forecast of present conditions into the future. The

EXHIBIT 1 Conceptual Model of Economic Impact Analysis



temporal stability of the models is necessary for this type of investigation. This class of analysis could evaluate the long-run impact of changes in fuel price, energy conservation and/or changes in vehicle miles of travel. This effort has a medium level of difficulty.

- Investigation of Future Transportation Actions. This type of analysis entails the same amount of effort as immediately above, with the added burden of evaluating the impact of transportation policies in the future. Mechanically this is similar to the first class of investigation; however, it takes place under future conditions. This class of investigation contains components of both classes above.

Each of the key elements of the approach is discussed below.

Alternative Local Transportation Policies

The local policies of interest in this methodology are those which affect the energy consumption of the transportation system. Such actions might include traffic signalization programs, ridesharing programs, and the like. Since the effectiveness of those improvements varies among urban areas, it is difficult to provide a full account of data and tools necessary to the local planner. Nevertheless, to assist the planner/analyst in this activity, background information and the results of a literature search on the effectiveness of common transportation system actions is presented. The results of a detailed evaluation of local transportation actions in the Dallas-Fort Worth area is presented in Volume III.

External Events

The local price of transportation fuels and the efficiency with which they are used are greatly determined by events and forces outside the control of local policy-makers. Such events as OPEC oil price changes and domestic oil deregulation have significant impacts on fuel prices and consumption levels. Likewise, federal laws pertaining to automotive fuel economy probably may have more to do with transportation energy efficiency than any and all local transportation actions. Again, it is more appropriate for the local planner to determine the nature of these external factors and their influence on the local transportation situation, since these values change from time to time. Background information provided in the document will assist the planner/analyst in developing reasonable values for use in this process.

Estimated Fuel Prices and Transportation Efficiencies

Given the assumptions made above with regard to the local and outside factors affecting local transportation fuel prices and transportation efficiencies, the local planner must at this point establish fuel price and efficiency scenarios for the analysis. Background information on projected fuel prices and energy efficiency is presented to assist the local analyst in this activity. The aim of the analysis is to determine the economic impacts of some change in fuel price, efficiency, or a combination of the two. To do this, a base condition (commonly the current situation) must be established. Then differences in prices and efficiencies from the base condition are assumed for present year or future conditions.

Sector Energy Consumption Model

A mathematical model segmented by three income levels is used to show how household expenditure patterns would differ from the base condition should the fuel prices and/or efficiencies change as identified in the above step. This model estimates changes in gasoline consumption, as well as other changes in household expenditures caused by the altered gasoline purchasing. This model, which contains three income categories, is based upon published data by the Bureau of Labor Statistics. The procedure for calculating income elasticities from these data is explained in Volume III. A more general discussion on the use of elasticity values is provided here. This sensitivity to income class allows for the analysis of transportation actions from both a comprehensive and an equity perspective.

Changes in Quantities of and Expenditures for Fuels by Household Sector

These changes are the output of the above model. These estimates are used as input data to the following models.

CPI "Model"

As will be discussed later in this report, the CPI or Consumer Price Index is based upon the current prices of a market basket of goods. The quantities of goods in this market basket are updated infrequently. One of the purposes of this research is to examine the feasibility of using the CPI as a transportation performance measure along with the more traditional measures such as volume-capacity ratio, number of accidents, emissions, and delay. By varying the prices and quantities of transportation fuels as if the market basket

were updated, it is possible to estimate the impact on the CPI of changes in transportation system efficiency.

Estimated Changes in the CPI

The output of the above model would be an estimate of the change in the CPI resulting from the previous assumptions and estimates. This CPI change would be based on updated prices for a market basket of goods for the short run and updated prices and quantities for the long run. This distinction is consistent with the method by which the CPI is presently estimated. Even though the incomes and benefits of some individuals are adjusted with changes in the CPI (e.g., unions, some welfare programs), it is beyond the scope of this study to reintroduce revised income levels through the sector energy consumption model.

Direct Economic Impacts

By properly aggregating the results of the sector energy consumption model, the total expenditures by the household sector of the economy can be estimated. Total expenditures by commercial sector are also estimated in order to determine the price and efficiency impacts to truck travel. Changes in these initial expenditures represent the direct impacts.

Input-Output Model

The altered sector expenditures would be an input to an interindustry analysis which would estimate the effects of these demand changes on each sector of the local economy. Further, the input-output analysis will show any changes in total production, employment, and income. These three

measures are thought to best represent the vitality of the local economic climate. This method of analysis includes the indirect effects of changes in household and commercial sector expenditures.

Total Economic Impacts

The changes in total production, employment, and income include both direct and indirect effects. An increase in the demand for the output from one sector indirectly increases the demand for the output of other sectors which supply products to the first sector. Combining the various economic impacts estimated throughout the steps in this process allows the planner or analyst to make some overall statement as to the direction and magnitude of the economic impact of fuel price and efficiency changes.

This then is a general description of the method described in this document and embodied in the technical planning manual (Volume III). More detailed discussion on the derivation of the recommended procedure is contained in the remainder of this report.

USING THIS DOCUMENT

With this overview of the entire approach, it is important to understand how this report can be used to implement the approach. Exhibit 2 shows the location of the ten steps of the approach outlined above, within the five core chapters of this report:

- Chapter III Energy Efficiency and Price Scenarios
- Chapter IV Sector Energy Consumption
- Chapter V Consumer Price Index Changes

- Chapter VI Direct Economic Impacts
- Chapter VII Total Economic Impacts

Each of the five core chapters describes procedures which can be used in conjunction with the approaches described in other chapters or they may be used solely by themselves for a partial analysis. Depending on the scope, purpose, and scale of a particular analytical effort, a transportation planner may make effective use of any or all of the five core chapters.

EXHIBIT 2 Summary of Steps Covered in Manual

STEP IN MANUAL	CORRESPONDING CHAPTER IN THIS REPORT
1. Alternative Local Transportation Policies	III. Energy Efficiency and Price Scenarios
2. External Events	III. Energy Efficiency and Price Scenarios
3. Estimated Fuel Prices and Transportation Efficiencies	III. Energy Efficiency and Price Scenarios
4. Sector Energy Consumption Model	IV. Sector Energy Consumption
5. Changes in Quantities of and Expenditures for Fuels by Sector	IV. Sector Energy Consumption
6. CPI Model	V. Consumer Price Index Changes
7. Estimated Changes in the CPI	V. Consumer Price Index Changes
8. Direct Economic Impacts	VI. Direct Economic Impacts
9. Input-Output Model (Portion)	VI. Direct Economic Impacts
9. Input-Output Model (Portion)	VII. Total Economic Impacts
10. Total Economic Impacts	VII. Total Economic Impacts

III. ENERGY EFFICIENCY AND PRICE SCENARIOS

DISCUSSION

In the last few years research findings have outlined many methods for estimating transportation energy savings of various actions. The purpose of this project is to pick up where this guidance leaves off, in order to estimate the local economic impacts of various changes in transportation energy consumption.

To utilize the methods in this document, the transportation planner must have a good understanding of the current and future transportation energy situation for the area of interest. Specifically, the following information is needed:

1. The source of current and future transportation energies
2. The amount of travel saving (vehicle miles of travel), by transportation mode, brought about by the actions of interest
3. The prices of transportation fuels, both currently and in future years of interest
4. The baseyear and baseline vehicle miles of travel estimate by transportation mode and the energy efficiency of this travel for all years of interest

This chapter is intended to provide the transportation planner with estimates for these values as well as sources for such information. It must be noted that the estimates of these values, even for present-day situations, change

very rapidly, and the transportation planner may have to periodically update information to reflect the most recent circumstances. Sources of information to update these parameters are provided.

Necessary data and methods are shown in this chapter by focusing on the Dallas-Fort Worth metropolitan area as a case study.

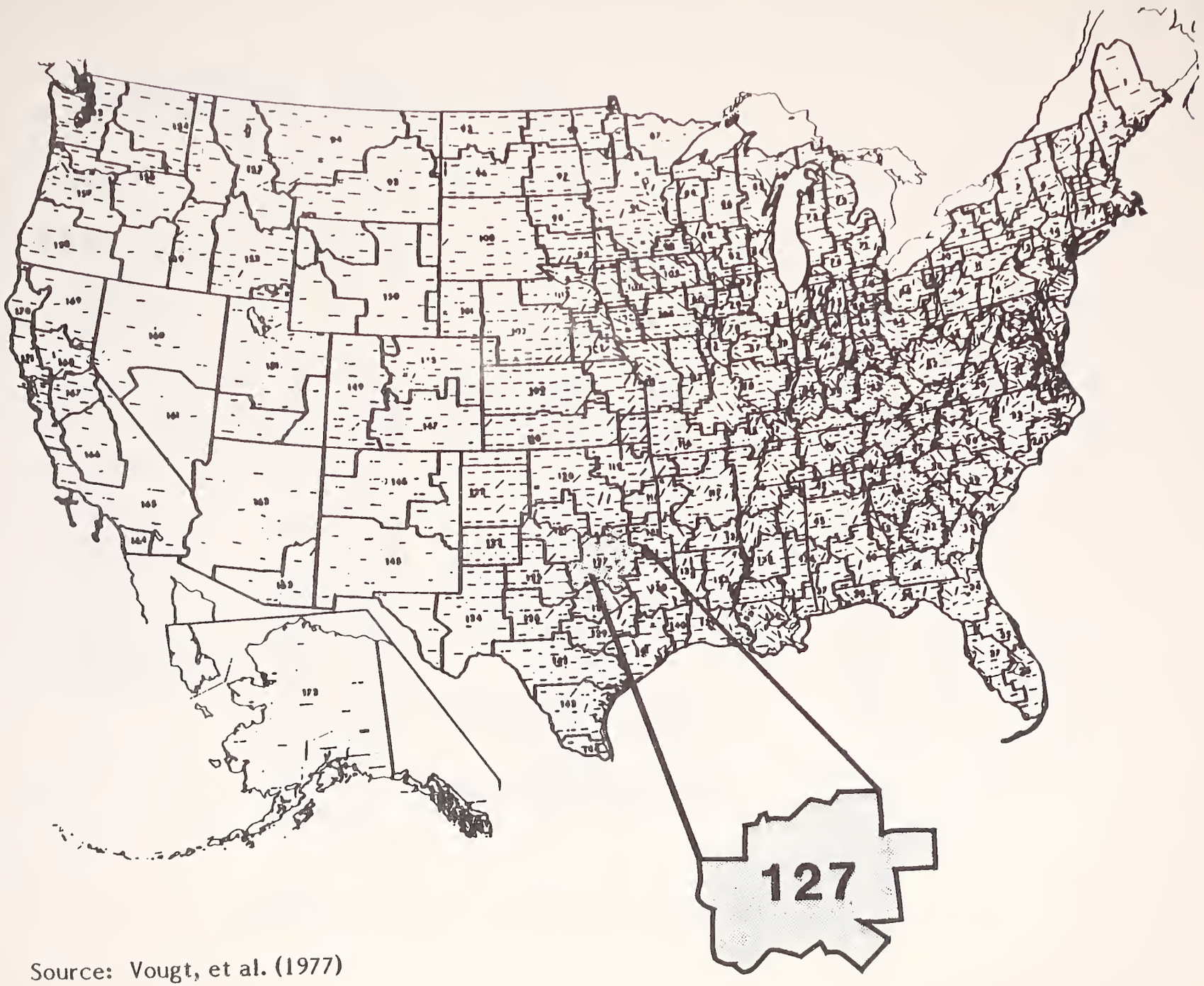
ENERGY SOURCES AND CONSUMPTION

The Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce has divided the United States into 197 economic areas (See Exhibit 3). The Dallas-Fort Worth metropolitan area dominates BEA Economic Area 127. Estimates of energy sources and consumption for this area have been made by Vougt, Rice, and Pai (1977). This information is presented for 1973 in Exhibit 4.

The above-mentioned work by Vougt et al. is an extremely useful first estimate of energy consumption by sector and source for all urban areas in the U.S. Local estimates of fuel consumption and the identification of sources have been done in the Dallas-Fort Worth area (General Motors, 1981) as well as in other areas (Hampshire College, 1979; Marshall and Kemper, 1980).

Exhibit 4, although developed in 1977, is the latest information available. This exhibit suggests that the Dallas-Fort Worth region actually exports crude oil to other parts of the country while importing refined gasoline. Natural gas is the most important fuel to the region. The sources of

EXHIBIT 3 BEA Areas in the United States



Source: Vougt, et al. (1977)

EXHIBIT 4 Area Energy Sources and Consumption

AREA ECONOMIC AREA 127 DALLAS TEXAS 1973

REGIONAL ENERGY BALANCE STATEMENT
BY SECTOR AND FUEL TYPE

(ALL UNITS IN 10**9 BTU'S)

SECTOR	DISTILLATE OIL	RESIDUAL OIL	GASOLINE	OTHER MICRO-CARBONS	CRUDE OIL	NATURAL GAS	COAL	ELECTRICITY	SECTOR TOTAL	
FINAL DEMAND SECTORS										
RESIDENTIAL,COMM.	6,732	1,730	-	93,095	-	96,390	1,491	60,178	209,620	15%
INDUSTRIAL	9,765	4,166	-	303,140	-	203,162	14,661	31,630	646,532	46%
TRANSPORTATION	63,062	1,870	223,974	89,285	-	25,384	52	65	403,000	29%
MISCELLANEOUS USES	1,778	1,009	-	1,183	-	3,683	-	870	9,316	1%
TOTAL FINAL DEMAND SECTORS	82,130	8,803	223,974	436,711	-	400,627	16,204	92,739	1,269,268	90%
TRANSFORMATION										
ELECTRICITY GEN.	34	11,529	-	-	-	197,600	-	-65,007	144,156	10%
PETROLEUM PRODUCTS	-8,032	-1,850	-16,232	-9,134	34,019	1,551	-	-	322	0%
NATURAL GAS	-	-	-	-17,105	-	19,751	-	-	2,566	0%
SYN-GAS	-	-	-	-	-	-	-	-	-	
NET FUEL USED IN TRANSFORMATION	-7,998	9,679	-16,232	-26,319	34,019	218,902	-	-65,007	147,044	10%
TOTAL GROSS FLOWS	82,164	20,482	223,974	436,711	34,019	619,529	16,204	92,739	1,416,312	101%
LOSSES & OMISSIONS	4,991	-207	-7,090	-20,633	51	2,376	269	7,446	-12,826	0%
TOTAL NET USAGE	79,123	10,354	200,651	389,758	34,070	629,905	16,473	35,148	1,403,485	
SUPPLY OF ENERGY										
FOSSIL FUEL	-	-	-	-	255,130	206,685	-	-	461,815	100%
HYDROELECTRIC	-	-	-	-	-	-	-	1,644	1,644	0%
NUCLEAR	-	-	-	-	-	-	-	-	-	
GEO.&SOLAR	-	-	-	-	-	-	-	-	-	
TOTAL SUPPLY	-	-	-	-	255,130	206,685	-	1,644	463,459	
NET IMPORTS OF REGION	79,123	10,354	200,651	389,758	-221,059	423,220	16,473	33,504	940,026	

NOTES:
1 TRANSFORMATION LOSS FOR ELECTRICITY GEN. -68.92%
2 TRANSFORMATION LOSS FOR PETROLEUM PRODUCTS - 0.91%
3 TRANSFORMATION LOSS FOR NATURAL GAS -12.99%
4 TRANSFORMATION LOSS FOR SYN-GAS - 0.0 %

Source: Vougt et al (1977)

transportation fuel as well as the consumption of this fuel in the Dallas-Fort Worth area proper have been estimated by North Central Texas Council of Governments. This information is presented in Exhibit 5.

The Dallas-Fort Worth metropolitan area receives about one-half of its natural gas from local wells. Crude oil produced in the area is transported elsewhere for refining. Compared to the energy content of the crude oil exported from the region, the region imports about three times that amount of energy in petroleum products.

While the Dallas-Fort Worth area is not dependent on foreign imported oil, there is reason to believe that any shortage originating on the East Coast would be eased by reducing supplies in the Midwest and Southwest. Exhibits 6 and 7 show that petroleum transportation networks isolate the West Coast, however.

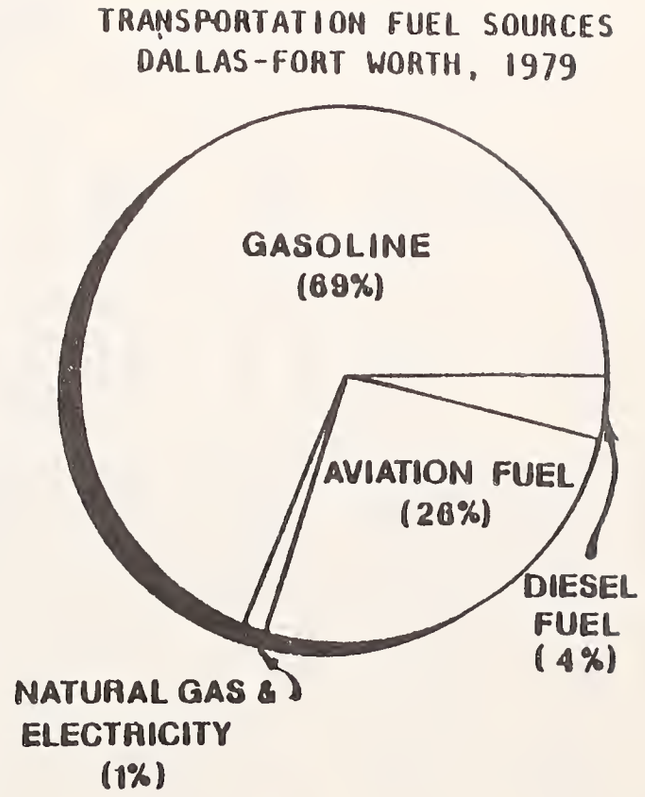
Estimated current and future fuel prices by sector are given in Exhibit 8 (U. S. DOE, 1982). Projections of gasoline price up to the year 2000 are presented in the Volume III planning manual. These values were developed from a wide range of forecasted fuel prices.

A forecast of on-road fuel economy is also presented in Volume III. These estimates have been assembled from a compilation of national sources, however, it is suggested that the midrange can be used for individual state and urban areas unless more localized projections have been developed.

EXHIBIT 5 Dallas-Fort Worth Transportation Energy Sources and Consumption

ESTIMATED DAILY TRANSPORTATION ENERGY CONSUMPTION
NORTH CENTRAL TEXAS METROPOLITAN REGION
1979

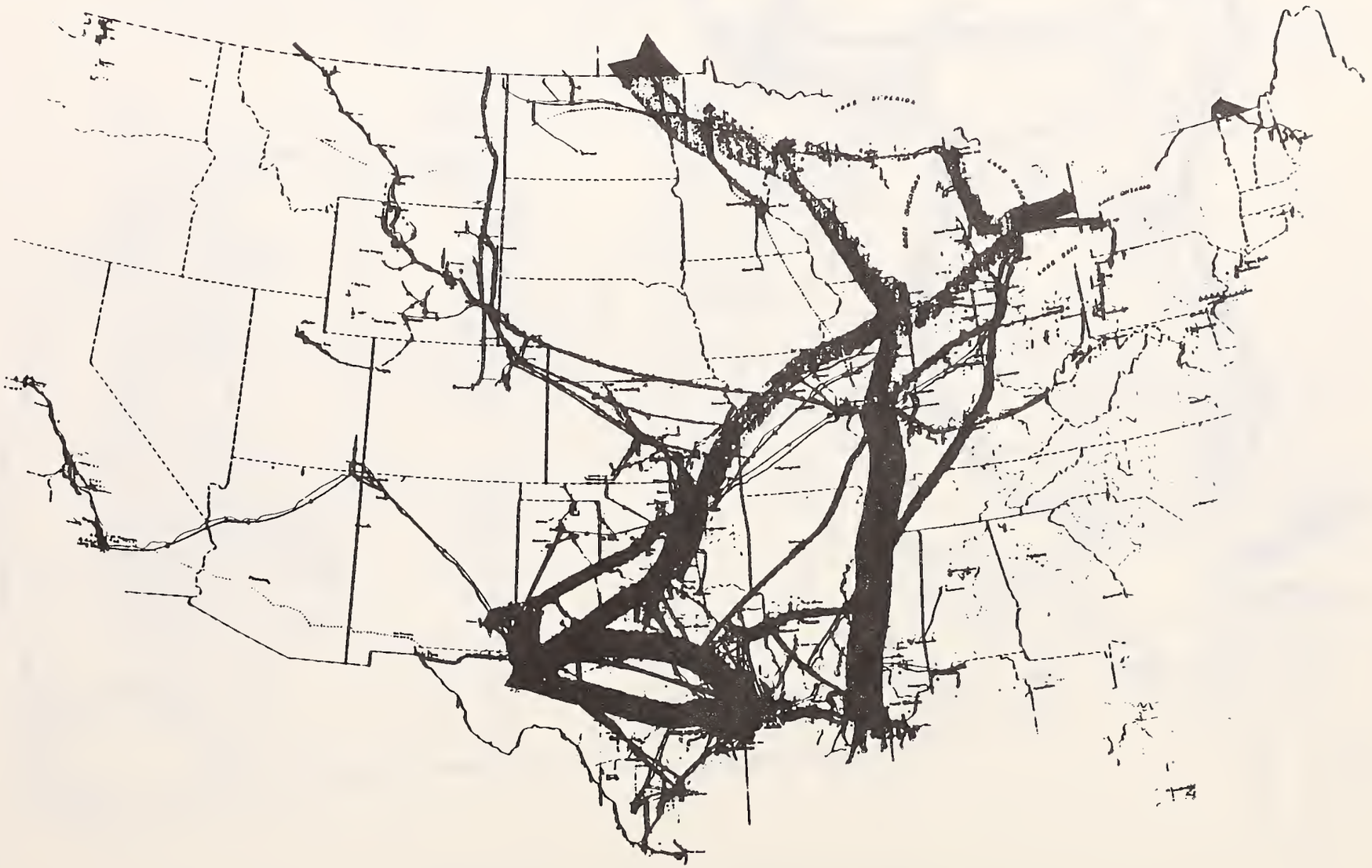
Mode	Equiv. Gal. Gasoline/Day	Percent of Total
Single-occupant auto	1,965,000	32.9
Carpool auto	1,150,000	19.2
Rental auto	14,500	0.2
Taxi	6,200	0.1
Vanpool (formal)	450	0.0
Social services	2,000	0.1
City bus	17,500	0.3
Intercity bus	5,700	0.1
School bus	20,000	0.3
Motorcycle	19,000	0.3
Truck	1,020,000	17.0
AIRTRANS	600	0.0
Light Rail (Tandy Subway)	570	0.0
Diesel rail (passenger, freight)	35,000	0.6
General aviation	110,000	1.8
Commercial aviation (passenger, freight)	1,475,000	24.7
Pipeline	15,000	0.3
Recreation/miscellaneous	123,000	2.1
TOTAL	5,979,520	100.0



Source: "6 Million Gallons Used Daily to Keep Area Moving." (1980)

EXHIBIT 6 Crude Oil Movement by Water: 1974

EXHIBIT 7 Crude Oil Movement by Pipelines: 1974



Source: Greene et al, (1978)

EXHIBIT 8 Fuel Price Summary by Sector (1981$ Per Physical Unit)[1]

	1980	1981	PROJECTED 1985 MIDRANGE	1990 MIDRANGE	1995 MIDRANGE	2000 MIDRANGE
WORLD OIL PRICE[2] (1981 $/barrel)	37[4]	37[4]	32.50	42.50	53.50	62.00
RESOURCE PRICES						
Refiner Crude Oil ($/bbl)	30.66[4]	35.64[4]	32.50	42.50	53.50	62.00
Wellhead Gas ($/Mcf)	1.74[4]	2.06[4]	3.80	5.44	6.62	7.45
Minemouth Coal ($/ton)	28.02	27.92	31.48	33.89	36.58	38.62
DELIVERED PRICES						
Residential Sector						
Distillate ($/gallon)	1.07[4]	1.21[4]	1.09	1.37	1.68	1.91
Liquid Gases ($/gallon)	0.63	0.71	0.65	0.82	1.00	1.13
Natural Gas ($/Mcf)	4.31[4]	4.56[4]	6.29	7.79	9.05	9.94
Electricity (¢/Kwh)	5.85[4]	6.20[4]	6.46	7.00	7.95	7.97
Commerical Sector						
Distillate ($/gallon)	0.96	1.09	1.00	1.26	1.55	1.77
Residual ($/barrel)	28.50[5]	32.50[5]	35.49	45.87	57.17	65.71
Liquid Gases ($/gallon)	0.61	0.69	0.63	0.81	0.99	1.14
Natural Gas ($/Mcf)	3.57	3.93	5.96	7.49	8.75	9.64
Electricity (¢/Kwh)	5.99[4]	6.29[4]	6.73	7.37	8.41	8.46
Industrial Sector						
Distillate ($/gallon)	0.94	1.07	0.98	1.23	1.51	1.73
Residual ($/barrel)	28.50[5]	32.50[5]	34.43	44.40	55.25	63.44
Liquid Gases ($/gallon)	0.61	0.69	0.63	0.81	0.99	1.14
Natural Gas ($/Mcf)	2.67	3.02	4.95	6.50	7.70	8.56
Coal ($/ton)	39.17	39.74	46.35	50.93	54.56	57.54
Electricity (¢/Kwh)	4.03[4]	4.29[4]	4.74	5.34	6.19	6.30
Transportation Sector						
Gasoline ($/gallon)	1.33[4]	1.35[4]	1.36	1.60	1.87	2.07
Distillate[3] ($/gallon)	0.95[4]	1.06[4]	1.10	1.40	1.72	1.96
Residual ($/barrel)	28.50[5]	32.50[5]	34.43	44.40	55.25	63.44
Jet Fuel[3] ($/gallon)	0.98[6]	1.05	0.98	1.28	1.60	1.85

1/ Thermal conversion factors: Liquid Petroleum Gas assumed to be 3.97 MMBtu's/Bbl; all other factors from the Energy Information Administration, Monthly Energy Review, May 1982. Except as noted, delivered prices are resource price plus estimated markups for processing and distribution.

2/ U.S. average refiner acquisition cost of imported crude oil.

3/ Excludes taxes.

4/ Energy Information Administration, Monthly Energy Review, May 1982.

5/ Data from the Monthly Energy Review, plus an estimate of taxes. The Monthly Energy Review does not give residual prices by sector.

6/ American Transport Association.

Typically urban fuel economy differs from that of the national or statewide levels, due to differences in the vehicle duty cycle.

Considering the cost of gasoline, maintenance, accessories, tires, and taxes, the cost of travel by automobile is projected to increase from 10.45 cents per mile in 1980 to 10.74 cents per mile in 2000. These costs represent variable costs and do not include fixed components (e.g., insurance, depreciation). This represents a 2.8 percent increase in constant dollars.

MODE SHIFT AND TRAVEL REDUCTION

Estimating the amount of travel which would shift to alternative modes is a subject left to other references in the transportation planning literature. Note that it is acceptable for the transportation planner to vary mode split and travel reduction in order to determine the magnitude of the economic impacts. This is the classical approach found in sensitivity analysis or parametric analysis. It is also necessary to remember that the efficiency improvements encountered by the household sector are not necessarily the same as those of the trucking sector because of possible mode shift efficiencies by individuals.

EFFECTIVENESS OF TRANSPORTATION ACTIONS

What are reasonable savings which could be expected from various transportation actions? Examples are provided from work conducted by NCTCOG. These studies were conducted on a subarea basis wherein significant detail was used to determine the impact of various TSM actions on travel time savings, energy savings, and air quality savings. These findings were then extrapolated to

cover the entire metropolitan area by a wide range of congestion and demographic performance measures (NCTCOG, 1981A, 1981B).

The TSM actions of interest are listed in Appendix I. Exhibit 9 shows the results of the NCTCOG studies for travel time savings, energy savings, and air quality savings. Also shown in Exhibit 9 are the results of a literature search on this topic. The NCTCOG results and those reported in the literature appear to be consistent in most instances. Maximum energy savings for many of these individual actions appear to amount to approximately 7 - 10 percent. Note that these effectiveness values are site-specific and do not represent areawide results.

In order to determine the areawide reductions in fuel consumption, NCTCOG examined two types of actions. These measures included both areawide transportation system management actions and localized actions. The specific projects and anticipated effectiveness of these measures are contained in Scenario 2 of Volume III. The economic impact of these actions are also presented in Volume III.

The effectiveness of various transportation actions on air quality, fuel consumption, and travel time will vary over time. These adjustments are developed from the product of the emission rate, fuel consumption rate or anticipated change in speed with the anticipated change in vehicle miles of travel. As automobiles emit less pollutants per vehicle mile over time, reductions in vehicle miles have less and less impact on fuel consumption.

EXHIBIT 9 Results of Literature Review

Action	Travel Time Savings		Energy Savings		Air Quality Savings	
	NCTCOG Results	Literature Results	NCTCOG Results	Literature Results	NCTCOG Results	Literature Results
Signal Progression	29.0 %	25.0%	6.6 %	1.0 - 7.0%	5.4 %	4.0%
HOV Preferential Treatment	0.2 %	0.4%	0.01%	1.0 - 3.0%	0.01%	0.0 - 1.0%
Intersection Upgrade	0.6 %	10.0%	0.1 %	0.0 - 5.0%	0.1 %	0.5 - 1.5%
Widen Roadway	0.6 %	14.0%	0.1 %	0.0 - 4.0%	0.2 %	3.0%
Grade Separation (R-R)	2.7 %	3.0 - 7.0%	0.6 %	1.0 - 2.0%	0.5 %	2.0 - 3.0%
Grade Separation (R-RR)	0.7 %	-	0.1 %	-	0.1 %	-
New Roadway	0.03%	10.0%	0.01%	10.0%	0.01%	0.5%
Ramp Changes	0.2 %	0.0%	0.01%	0.0%	0.02%	0.0%
Park-and-Ride	-0.3 %	slight loss	0.2 %	0.5 - 2.5%	0.2 %	0.5%
Parking Removal	2.2 %	14 %	0.2 %	0.0 - 2.0%	0.5 %	3.0%
Information Systems	0.04%	0.5%	0.003%	0.5%	0.01%	0.5%
Roadway Realignments	0.3 %	0.5%	0.04%	0.5%	0.04%	0.5%
Geometric Changes	0.01%	0.5%	0.001%	0.5%	0.01%	0.5%
Bus Stop Frequency	0.2 %	0.5%	0.01%	-.5%	0.01%	0.5%
Headway Changes	-0.4 %	0.0%	0.1 %	0.5 - 1.5%	0.1 %	0.5 - 2.0%
Crosstown Bus Routes	-1.6 %	slight loss	0.4 %	0.5 - 1.5%	0.4 %	0.5 - 2.0%
Signal Removal	0.6 %	2.0%	0.1 %	0.2%	0.1 %	1.5%
Bus Stop Relocation	0 %	0.5%	0 %	0.5%	0 %	0.5%

Sources:

Energy Impacts of Urban Transportation Improvements, prepared for the Institute of Transportation Engineers (Washington, D.C.: Wagner-McGee Associates, Inc., August 1980).

Fred A. Wagner and Keith Gilbert, TSM, An Assessment of Impacts, prepared for U.S. DOT, UMTA, Office of Policy and Program Development, and FHWA (Washington, D.C.: Alan M. Voorhees, Inc., November 1978).

Denver Regional Council of Governments, TSM Sensitivity Report (Denver, Colorado, March 1979).

Metropolitan Council of the Twin Cities Area, Air Quality Control Plan for Transportation (St. Paul, Minnesota, January 1980).

Montgomery & Green County Transportation & Development Planning Program, Assession Implementation Efforts and Emissions Benefits of the Adopted 28 TCM's for Montgomery and Green Counties (Cleveland, Ohio, July 1980).

Therefore, it is very important to associate the evaluation year with the correct levels of anticipated savings.

Besides the shorter-range transportation management actions, longer-range, more capital intensive rail actions may need evaluation. Default energy requirements of these modes are presented in Exhibit 10, and selected energy sources to power these modes are presented in Exhibit 11. It is suggested that these values be used only when local information is not available because of the possible large difference in results between these estimates and those which would be obtained from local study (Morris, 1979).

Contained in Chapter II of the Volume III report of this series are detailed examples of this portion of methodology. This approach is conducted for both household and truck travel demand.

EXHIBIT 10 Components Used to Calculate Energy Requirements for Various Modes

COMPONENTS OF LINE-HAUL ENERGY	Single Occupant Auto	Average Auto	Carpool	Vanpool	Diel-A-Ride	Conventional Bus	Express Bus	Light Rail	Heavy Rail (old)	Heavy Rail (new)	Commuter Rail
Vehicle Propulsion Energy (BTU/VM)	11,000	11,000	11,000	14,000	15,500	30,000	30,000	75,000	61,000	75,000	105,000
Station and Maintenance Energy (BTU/VM)	2,000	2,000	2,000	2,000	2,000	900	7,000	7,000	9,000	15,000	7,000
Guideway Construction Energy (BTU/VM)	125	125	125	200	200	370	500	926	3,000	4,000	1,200
Guideway Construction Energy 1/	20	20	20	20	20	37	50	50	105	140	42
Guideway Life 2/	160	160	160	100	100	100	100	54	35	35	35
Vehicle Manufacture Energy (BTU/VM)	1,100	1,100	1,100	2,000	2,000	3,400	3,400	4,000	1,500	1,500	2,500
Vehicle Manufacture Energy 3/	110	110	110	200	200	1,020	1,020	4,000	4,095	4,095	6,825
Vehicle Life 4/	100	100	100	100	100	300	300	1,000	2,730	2,730	2,730
Occupancy (PM/VM)	1.0	1.4	3.0	9.0	1.6	11.5	13	20	24	28	40
COMPONENTS OF MODAL ENERGY											
Circuity 5/	1.00	1.00	1.25	1.20	1.40	1.40	1.20	1.20	1.20	1.20	1.30
Percentage of Trip in Access (%)	0	0	0	0	0	10	10	10	15	15	18
Distribution of Access-Modes (%)	N/A	N/A	N/A	N/A	N/A	-					
Average Auto						25	30	30	40	30	80
Conventional Bus						-	20	20	20	20	5
Walk						75	50	50	40	50	15
COMPONENTS OF PROGRAM ENERGY											
Distribution of Otherwise Modes	N/A	N/A							N/A		
Single Occupant Auto			60	55	-	-	-	-		-	-
Average Auto			-	-	45	55	35	35		35	40
Conventional Bus			15	5	10	25	45	45		45	30
Carpool			25	40	-	-	-	-		-	-
Walk			-	-	25	-	-	-		-	-
New Trips			-	-	20	10	10	10		10	10
Other			-	-	-	10	10	10		10	20

N/A NOT APPLICABLE OR AVAILABLE

1/ Energy required to construct the guideway and related structures (10^9 BTUs per guideway mile)

2/ Life of the guideway (10^6 vehicle miles per guideway mile)

3/ Energy required to manufacture the vehicle (10^6 BTUs per vehicle)

4/ Life of the vehicle (10^3 vehicle miles per vehicle)

5/ Circuity values in this table represent the total trip length by the mode in question relative to the corresponding average auto trip. For example, on the average trips via conventional bus are 1.25 times as long as the corresponding average auto trip.

SOURCE: "Energy and Public Transit." An OST Staff Paper, March, 1978, page A-4 (The revised CBO Base Case), and Urban Transportation and Energy: The Potential Savings of Different Modes, Congressional Budget Office, September, 1977, pages 32-33.

EXHIBIT 11 1979 Sources of Electricity for Selected Electrified Transit Operations

City	System	Source of Electricity	Generating Sources							Peak Demand Reliance	Oil Source
			Oil	Coal	Hydro	Nuclear	Nat Gas	Pur-chased	Other		
New York	MTA	purchased from utility	44%	3%	13%	28%	12%	*	—	Oil	N/A
Boston	MBTA	60% self-generated; 40% purchased from utilities	100%		—	—	—	—	—	Gas turbine	Venezuela
Chicago	CTA	Purchased from utility	11%	42%	—	44%	3%	—	—	Use #2 & even #1 oil	50% Domestic 41% Import
Cleveland	GCRTA	Purchased from utility	3%	87%	—	10%	—	—	—	No peak reached: would have used oil & coal	
Dayton	MVRTA	Purchased from utility	4%	95%	—	—	1%	—	—	Oil & Gas	N.A
Atlanta	MARTA	Purchased from utility	—	100%	—	—	—	—	—	Hydro (from other regions)	
Philadelphia	SEPTA	Purchased from utility	21.5%	30%	4.2%	32%	13	—	—	o 0.1 o pump storage hydro	N/A
Washington	WMATA	Purchased from utility	22%	78%	—	—	—	—	—	Oil	Carribean
San Francisco	BART	Purchased from utility	48%	—	20%	—	1%	30%	1%	oOil. currently onear future: pump storage	Indonesia
San Francisco	MUNI	Self-Generated	—	—	100%	—	—	—	—	Hydro	

Source: Telephone conversations with various officials of respective transportation authorities, Fall 1979.

*Purchased amount for New York is calculated in Oil/Coal/Hydro/Nuclear/Nat. Gas mix.

Source: McShane, William R.; Bloch, Arnold; and Ihlo, William, The Energy Advantages of Public Transportation, prepared for U.S. Department of Transportation, Urban Mass Transportation Administration, Office of Policy Research, University Research and Training Program, (Washington, D.C., March 1980), p. 24.

IV. SECTOR ENERGY CONSUMPTION

DISCUSSION

In this chapter the estimation of transportation energy consumption and expenditure by sectors of the local economy is discussed. Consumption by the household sector is of particular interest.

It is interesting to note that the first quantitative analysis of household expenditures was done in England in the 1790s (Stigler, 1965). Two independent researchers working at the time found that fuel expenditures amounted to anywhere from 2.6 percent to 4.9 percent of household expenditures (depending on the type of family and income).

According to the recent report Interrelationships of Energy and the Economy (U.S. Department of Energy, 1981d), the median household in the United States in 1980 spent 11.4 percent of its income on direct energy expenditures. This can be observed in Exhibit 12. Almost half of this amount, 5.8 percent, was spent on gasoline alone. This is an increase over the Bureau of Labor Statistics family expenditure survey findings from 1972-73 (Exhibit 13). This same report projects that by 1990, the median household will spend fully 14 percent of its income on direct energy expenditures. The Micro Analytic Transfer to Households/Comprehensive Human Resources Data System (MATH/CHRDS) model was used by the Energy Information Administration to determine these estimates. As a result of these studies, the cost of energy has been and

EXHIBIT 12 All Direct Energy Expenditures (in 1981$ as a Percentage of Income) For All Households -- 1980 and 1990)

	ALL FUELS	HOME FUELS	ELECTRICITY	HEATING OIL	NATURAL GAS	GASOLINE
EXPENDITURES[1] (In 1981 Dollars)						
1980	2,060	1,008	513	678	347	1,111
1990	2,209	1,306	630	762	612	1,001
Change: 1980-90[2]	149 (7)	298 (30)	117 (23)	84 (12)	265 (76)	-110 (-10)
PERCENTAGE OF INCOME EXPENDED						
1980	11.4	5.5	2.7	3.5	1.8	5.8
1990	14.0	8.1	3.8	4.6	3.5	5.6
Change: 1980-90[2]	2.6 (23)	2.6 (47)	1.1 (41)	1.1 (31)	1.7 (94)	-0.2 (-3)

1/ These are median expenditures for all households that purchase the respective fuels; for example, only households that purchase gasoline are considered in computing the median expenditure for that fuel.

2/ Percentage changes in parentheses.

Source: U.S. DOE (1981d)

EXHIBIT 13 Average U.S. Family Expenditures, 1972-1973

Expenditure Category	Annual Expenditure	Transportation Expenditure	Energy Expenditure
Food	$1,595.57		
Housing, Total	$2,550.87		
Fuels	346.28		$346.28
Other Housing	2,204.59		
Transportation, Total	$1,597.16	$1,597.16	
Fuels	347.61		347.61
Other Transportation	1,249.55		
Recreation, Total	$ 707.95		
Transportation for Vacations	86.50	86.50	
Gasoline	32.03		32.03
Other Transportation	54.47		
Other Recreation	621.45		
Other	$1,818.93		
Total	$8,270.48	$1,683.66	$725.92
Percent of Total	100	20.4	8.8

Source: U.S. Department of Labor (1979)

in the future apparently will be responsible for a growing share of the household expenditure budget.

Personal consumption is approximately two-thirds of the gross national product (Gilboy, 1968), and, therefore, it is not surprising that the National Academy of Science has estimated that households consume two-thirds of all energy (National Academy of Science, 1977). About one-half of this energy consumption is used directly by families for their households and for personal transportation, and the other half is indirectly consumed through the purchase of goods and services.

The Bureau of Labor Statistics conducts expenditure surveys, and Dallas is one of the cities for which low, intermediate, and high budgets for a family of four and a retired couple are provided. Energy expenditures are not provided at the city level but can be estimated from national statistics. The most recent data for the Dallas metropolitan area are for Autumn 1976 (U.S. Department of Labor, 1979).

More recent data on residential energy consumption (excluding gasoline and other motor vehicle fuels) have been collected by the Energy Information Administration (U.S. Department of Energy, 1981a). Data is disaggregated only to four geographic regions of the United States. However, the data collected in the survey is useful in developing models of residential energy use. Exhibit 14 contains energy information on the South Census Region of the country.

EXHIBIT 14 Residential Energy Consumption and Expenditure, South Census Region, April 1979 through March 1980

	Average Consumption per Household (Millions of BTU's)	Average Expenditure per Household ($)
All Households	92	744
Type of Housing		
Single Family Detached	100	802
Single Family Attached	112	694
2-4 Unit Multi	67	565
5+ Unit Multi	54	487
Mobile Home	76	673
Family Income (1978)		
< $5,000	75	534
$5 - 9,999	83	615
$10 - 14,999	93	732
$15 - 19,999	91	823
$20 - 24,999	100	881
$25 - 34,999	116	942
$35+	111	979

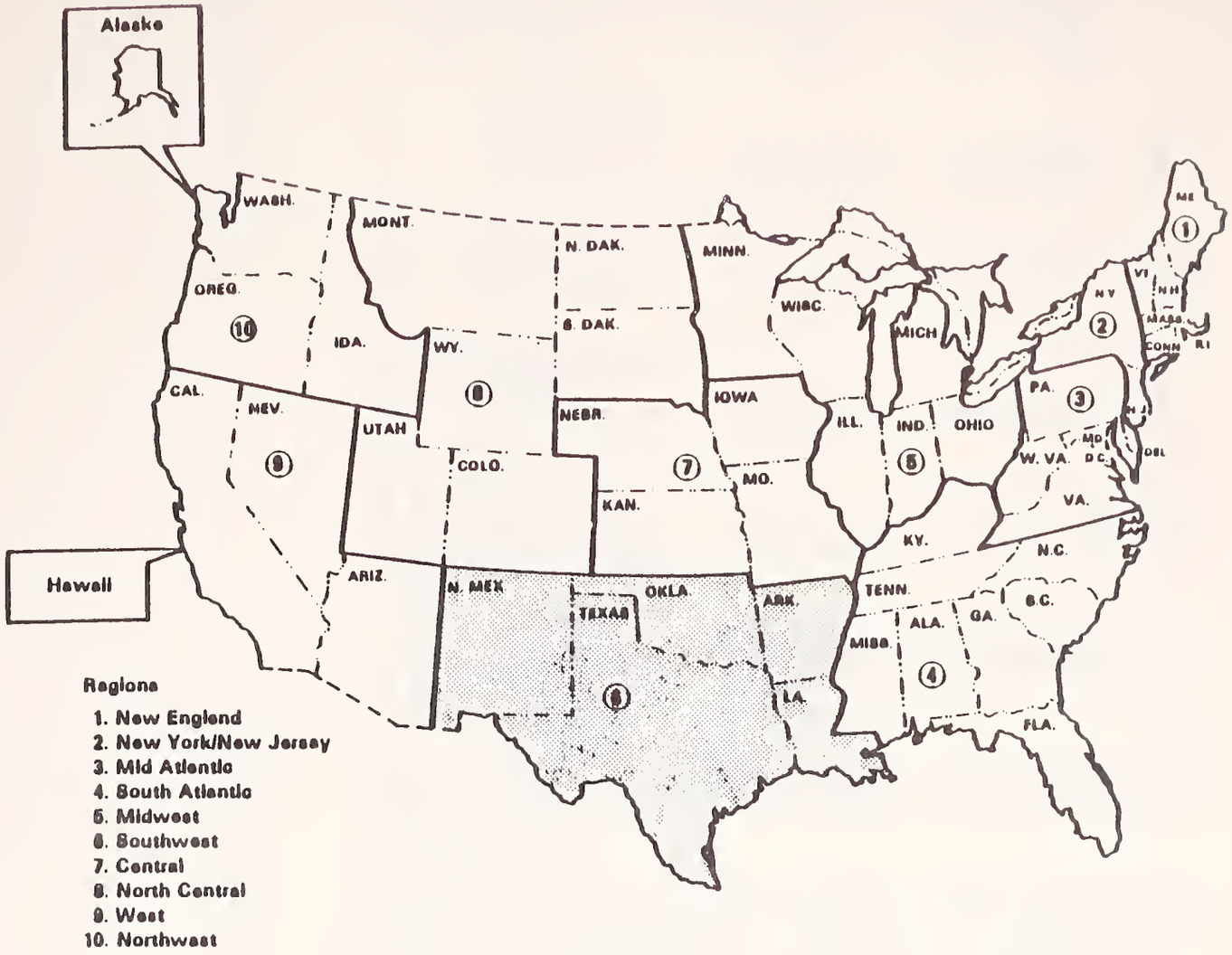
Source: U.S. Department of Energy (1981a)

Microanalytic modeling of household energy demand has been done at Cornell University (Caldwell, 1979). This modeling work forecasts energy consumption at the household level as a function of a number of variables including: number of rooms, type of heating equipment, type of structure, type of foundation, presence of insulation, age of house, number of persons in the household by age, age and education of head, homeowner or not, and specific information on appliance ownership (air conditioning, washing machine, dish washer, food freezer, clothes dryer, stove, TVs). Clearly developing the distribution of households with these characteristics becomes a difficulty. In addition, this model does not include motor vehicle fuel expenditures.

This Cornell work has been used in the state of New York to analyze the growth of the demand for energy as well as the distributional impacts of energy policies. This work also appears to be an important part of the previously mentioned MATH/CHRDS model used by the Energy Information Administration. This latter model "analyzes the impacts of changing energy prices and broader energy policy changes on household direct energy expenditures by various population subgroups" (U.S. Department of Energy, 1981b). Model estimates for the 10 federal regions, as shown in Exhibit 15, are provided in Exhibits 16 and 17.

Archibald and Gillingham (1981) provide a household gasoline consumption model which could be used with MATH/CHRDS. No examples of models which include all forms of household energy expenditures have been found to date. However, Cunningham and Lopreato (1977) provide a list of several current

EXHIBIT 15 Regional Breakdown Used in Comparing Relative Energy Impacts



Source: DOE (1981a)

EXHIBIT 16 Household Energy Expenditures by Region, 1980 and 1990 (1981$)

	ALL FUELS	HOME FUELS	ELECTRICITY	HEATING OIL	NATURAL GAS	GASOLINE
1980						
New England	2,306	1,353	461	813	342	1,046
New York/New Jersey	2,342	1,342	484	803	421	1,071
Mid-Atlantic	2,098	1,127	573	639	340	1,046
South Atlantic	1,867	906	622	329	253	1,060
Midwest	2,227	1,081	500	735	487	1,193
Southwest	1,862	873	542	287[2]	280	1,075
Central	2,087	1,005	461	744[2]	445	1,129
North Central	1,992	842	432	646	334	1,158
West	1,846	738	481	632	216	1,147
Northwest	1,901	784	351	484	478	1,177
1990						
New England	2,538	1,723	697	865	552	949
New York/New Jersey	2,523	1,712	647	826	676	981
Mid-Atlantic	2,334	1,462	685	735	603	990
South Atlantic	1,978	1,115	701	532	513	987
Midwest	2,329	1,384	594	763	764	1,047
Southwest	2,173	1,301	773	378[2]	522	997
Central	2,211	1,320	542	719[2]	735	1,003
North Central	2,026	1,110	456	681	653	1,003
West	1,956	1,037	546	555[2]	446	994
Northwest	1,912	916	485	631[2]	728	1,003
Differences, 1980-90 (percentage changes in parentheses)						
New England	232 (10)	370 (27)	236 (51)	52 (6)	210 (61)	-97 (-9)
New York/New Jersey	181 (8)	370 (28)	163 (34)	23 (3)	255 (61)	-90 (-9)
Mid-Atlantic	236 (11)	335 (30)	112 (20)	116 (20)	263 (77)	-56 (-5)
South Atlantic	111 (6)	209 (23)	79 (13)	203 (62)	260 (103)	-73 (-7)
Midwest	102 (5)	303 (28)	94 (19)	8 (1)	277 (57)	-146 (-12)
Southwest	311 (17)	428 (49)	231 (43)	91 (32)[2]	242 (86)	-78 (-7)
Central	124 (16)	315 (31)	81 (18)	-25 (-3)[2]	290 (65)	-126 (-11)
North Central	34 (2)	268 (32)	24 (6)	35 (5)[2]	319 (96)	-155 (-13)
West	110 (6)	299 (41)	65 (14)	-77(-12)[2]	230 (106)	-153 (-13)
Northwest	11 (1)	132 (17)	233 (66)	145 (30)[2]	250 (52)	-174 (-15)

1/ Median of expenditures per household for those using each fuel.

2/ Figures are not reliable on account of the small number of households using heating oil in the region.

Source: DOE (1981d)

EXHIBIT 17 Energy Expenditures as a Percentage of Household Disposable Income by Region in 1980 and 1990

	ALL FUELS	HOME FUELS	ELECTRICITY	HEATING OIL	NATURAL GAS	GASOLINE
1980						
New England	11.6	6.6	2.2	3.9	1.7	4.9
New York/New Jersey	11.3	6.4	2.2	4.0	1.9	4.9
Mid-Atlantic	11.4	6.0	3.0	3.4	1.7	5.4
South Atlantic	12.3	5.8	4.0	2.1	1.5	6.6
Midwest	11.4	5.4	2.4	3.8	2.3	5.7
Southwest	12.0	5.6	3.4	2.3	1.6	6.5
Central	12.6	6.0	2.7	4.9	2.6	5.9
North Central	11.5	4.9	2.5	4.6	1.8	6.4
West	9.3	3.7	2.3	3.3	1.0	5.6
Northwest	10.5	4.3	2.0	2.5	2.6	6.1
1990						
New England	14.7	9.6	3.8	4.7	3.0	4.8
New York/New Jersey	14.4	9.4	3.4	4.6	3.5	4.8
Mid-Atlantic	14.2	8.7	4.0	4.7	3.3	5.4
South Atlantic	14.9	8.0	5.1	4.0	3.5	6.6
Midwest	13.6	7.8	3.2	4.6	4.1	5.4
Southwest	16.2	9.4	5.4	4.3	3.5	6.5
Central	16.0	9.3	3.6	6.1	5.0	6.3
North Central	14.0	7.5	3.0	6.0	4.1	6.2
West	11.4	5.9	3.1	3.7	2.5	5.2
Northwest	11.8	5.8	3.1	3.9	4.4	5.7
Differences, 1980-90 (percentage changes in parentheses)						
New England	3.1 (27)	3.0 (45)	1.6 (73)	0.8 (21)	1.3 (76)	-0.1 (-2)
New York/New Jersey	3.1 (27)	3.0 (47)	1.2 (55)	0.6 (15)	1.6 (84)	-0.1 (-2)
Mid-Atlantic	2.8 (25)	2.7 (45)	1.0 (33)	1.3 (38)	1.6 (94)	0 (0)
South Atlantic	2.6 (21)	2.2 (38)	1.1 (28)	1.9 (90)	2.0 (133)	0 (0)
Midwest	2.2 (19)	2.4 (44)	0.8 (33)	0.8 (21)	1.8 (78)	-0.3 (-5)
Southwest	4.2 (35)	3.8 (68)	2.0 (59)	2.0 (87)	1.9 (119)	0 (0)
Central	3.4 (27)	3.3 (55)	0.9 (33)	1.2 (24)	2.4 (92)	0.4 (7)
North Central	2.5 (22)	2.6 (53)	0.5 (20)	1.4 (30)	2.3 (128)	-0.2 (-3)
West	2.1 (23)	2.2 (59)	0.8 (35)	0.4 (12)	1.5 (150)	-0.4 (-7)
Northwest	1.3 (12)	1.5 (35)	1.1 (53)	1.4 (56)	1.8 (69)	-0.4 (-7)

Source: DOE (1981d)

consumer survey efforts regarding household energy consumption, a few of which are highly relevant to this project.

METHODOLOGY AND INPUT DATA

Because none of these existing models addressed the needs of this planning manual, income elasticities were used. This approach assumes an increase in household expenditures for energy has the effect of lowering the purchasing power for other commodities if there is, in fact, no change in the household's income. Income elasticities can be used to estimate the change in household expenditures for items other than energy.

Mullendore et al. (1974) estimated the income elasticities in the North Central Texas Region for 71 industrial sectors and six final payment sectors. These elasticities allow changes in household expenditures in these different categories to be estimated on the basis of increased household expenditures on fuels.

The methodology for developing these elasticities uses Bureau of Labor Statistics survey data (U.S. Department of Labor, 1966) which makes this approach applicable to other areas of the country. The measures of the income elasticities were estimated by the following regression equation:

$$\ln E_{ij}^{k} = \ln a + b \ln Y_{ij}$$

where

$\ln$ = base of natural logrithms

E_{ij}^{k} = expenditures for industry sector k by the ith age and jth income group

Y_{ij} = income of households in the ith age and jth income group

a, b = regression coefficients

These income elasticities were reestimated for this project using 1977 data and are reported in the Volume III planning manual. Other data and example methods used for the household sectors are presented in Chapter III of the planning manual. Data and example methods for the truck sector are presented in Chapter IV of the Volume III manual.

SUMMARY

The household energy consumption modeling procedure is the central model in the proposed approach. The basic function of this model is to replicate the decisions a household makes with regard to purchasing goods and services. As a result, the conversion of transportation policies into economic choices can take place. The household decision-making unit is gaining support as not only a major component of economic decision making, but the central decision-making component in several other transportation related decisions (e.g., residential choice, trip generation, mode split, and route choice). The trucking sector energy consumption model adds completeness to the overall approach.

V. CONSUMER PRICE INDEX CHANGES

DISCUSSION

The Bureau of Labor Statistics began the production of a cost of living index in 1913 to be used in determining fair wage scales and settling labor disputes (U.S. Department of Labor, 1967). Through consumer surveys done on approximately 10-year intervals, the Bureau of Labor Statistics determines an average market basket (i.e., quantities) of household purchases. Between updates of the market basket surveys, the quantities of goods purchased stay fixed while the prices of these goods are adjusted according to current price surveys.

Over the years the makeup of this market basket has changed. For example, automobiles, gasoline, and other automotive products were first included in the 1940 survey, and, in 1950, the television set was added to the market basket.

The Consumer Price Index (CPI) is only a measure of price change for items purchased by urban wage and clerical workers for their own consumption. It does not include, for example, investments. As mentioned earlier, a major orientation of the index is toward use in collective bargaining and determining cost of living adjustments.

Two CPIs are published: (1) a CPI for all urban consumers (CPI-U) which includes about 80 percent of the total noninstitutional civilian population,

and (2) a CPI for urban wage earners and clerical workers (CPI-W). Since no significant difference between these two indexes exists, the CPI-W will be used in this study.

One feature of the Consumer Price Index to be aware of is that the total purchase price of an item is included in the calculation even though the item may be purchased with credit. This is particularly significant when dealing with houses and automobiles. For such items an adjustment is made for any trade-in and the total cost of credit is included in the purchase price.

With the recent variation in the prices of fuels and the increase in automobile efficiency, households have cut back on energy consumption, particularly in the last few years. Exhibit 18 demonstrates this point. However, since the last update of the market basket was in 1972-73, the CPI currently overestimates expenditures for energy. A recent editorial in the Wall Street Journal (1981) made a succinct, yet compelling, argument for revising the CPI. Since the CPI is the basis for so many labor contract negotiations, an inflated CPI can have far-reaching implications for the national economy.

METHODOLOGY AND INPUT DATA

In January 1983, the Bureau of Labor Statistics revised its basic index to treat housing costs as if the owner were renting the dwelling.

> The change in the CPI will directly affect an estimated 90 million Americans whose incomes are tied to rises in the index. About 9 million union members are covered by labor contracts that provide cost of living wage increases based on the CPI and another 81 million people receive

EXHIBIT 18 Retail Petroleum Product Prices and Consumption, 1978-1981

	Motor Gasoline		Fuel Oil	
Year	Price[a]	Consumption[b]	Price[a]	Consumption[c]
1978	41.7	2,651	32.9	533
1979	52.7	2,517	40.3	407
1980	67.1	2,362	55.1	353
1981(est)	74.4	2,269	66.7	295

[a]Cents per gallon, including tax, 1972 dollars.

[b]Millions of barrels

[c]Distillate fuel oil provided directly to residential and commercial sector, millions of barrels

(1 Barrel = 158.97 liters)

Source: U. S. Department of Energy (1981c)
U. S. Department of Energy (1982)

Social Security, government pensions, food stamps, and other Federal benefits that increase based on rises in the CPI ("U.S. to Alter Price Index for Housing," 1981).

In general, the CPI is calculated by the following equation:

$$I_t = \frac{\Sigma(P_n - t_b)}{\Sigma(P_b\ t_b)} \times \frac{\Sigma(P_{t-1}\ t_s)}{\Sigma(P_n\ t_s)} \times \frac{\Sigma(P_{t-1}\ t_s)\ \frac{P_t}{P_{t-1}}}{\Sigma(P_{t-1}\ t_s)} \times 100$$

where

I_t = the CPI for time t;

P_n = average price of specific commodities during the month preceding a weight revision;

P_t = average price of specific commodities during the current month;

P_{t-1} = average price of specific commodities during the month preceding the current month;

P_b = a composite of the specific commodities during the base period;

t_b = a composite of the annual quantities of specific commodities during the base year; and

t_s = a composite of the annual quantities of specific commodities during the period of the most recent weight revision.

It appears feasible to adjust the Consumer Price Index based upon expected quantities of fuel consumption in some future year as if the Bureau of Labor Statistics were to update their expenditure surveys in that year. Also, projected fuel prices could also be used to estimate future CPI values.

The question here seems to be not whether the CPI could be calculated or adjusted to reflect changes in the amounts of fuel consumed but rather whether these changes would be accurate as well as significant. As noted in the Wall Street Journal editorial, housing costs constitute 44 percent of the CPI at this time. Reducing the dominance of housing costs in the CPI, by not including the total cost of credit in the housing sector, may increase the importance of other expenditures in the CPI, such as gasoline prices.

The CPI is not a cost-of-living index. It should not be compared with household budget statistics. It is an indicator of price changes. There is, however, a certain popular appeal to the CPI, and, given the current public concern over the economy, the CPI could be a more attention-getting indicator of transportation costs than "total transportation costs," or even "percentage of household budget spent on transportation." The use of the CPI as a measure of the economic efficiency resulting from changes in the transportation system could demonstrate the relationship of transportation energy efficiency to the overall economy. This evidence, along with changes in employment and income levels, may result in decision makers' acting on the basis of more complete information. The approach has wide application since separate indexes are published for 28 different urban areas, and it is possible for an index to be produced locally for those areas not covered by the federal program (Perry and Tandet, 1980).

CPI data for the Dallas area and the nation are provided in Volume III. National data on the effect of energy prices on the CPI are shown in Exhibit 19.

EXHIBIT 19 Annual Rates of Change in the Producer and Consumer Price Indexes, Energy Price Indexes and Direct Contribution of Energy to Total Price Index Changes (Percent per Year)

	1974	1975	1976	1977	1978	1979	1980	AVERAGE 1973-80
Increase in Producer Price Index								
All Commodities	18.9	9.3	4.6	6.2	7.9	12.6	14.1	10.4
Energy Price Increase	55.1	17.7	8.3	13.8	6.8	26.6	40.6	23.1
Energy's Direct Contribution to Total PPI Change (percentage points)	3.7	1.6	0.8	1.4	0.7	2.8	4.7	2.2
Percentage Share of PPI	20	17	17	23	9	22	33	21
Increase in Consumer Price Index - Urban								
All Commodities	11.1	9.1	5.7	6.5	7.8	11.3	13.5	9.2
Energy Price Increase	29.3	10.6	7.2	9.5	6.3	25.1	30.9	16.6
Energy's Direct Contribution to Total CPIU Change (percentage points)	2.0	0.9	0.6	0.8	0.5	2.1	3.0	1.4
Percentage Share of CPIU	18	10	11	12	6	19	22	15

Source: U.S. DOE (1981d)

The use of the CPI is demonstrated in Chapter V of the technical planning manual.

VI. TOTAL ECONOMIC IMPACTS

DISCUSSION

Professor Wassily Leontief of Harvard published the first input-output table for the American economy (Leontief, 1936). Since that time, input-output or interindustry analysis has become a widespread analytical approach in economics. Input-output tables have been prepared for many nations, states in the United States, and some urban areas in the U.S. (Bourque and Cox, 1970). The structure of an input-output or transaction table is shown in Exhibit 20. An input-output table contains the dollar amount of goods produced by each of the sectors in this particular economy. The table also shows the dollar amounts purchased by each of the sectors of the economy.

Note that one of the rows is the value of imports which is purchased by each industry sector. Note also that households appear as a row in the table as "compensation of employees." This row represents the salaries paid to workers in these industries. Households will again appear as a column in the table as an ultimate purchaser of finished goods and services. In a manner analogous to imports, net exports will be listed as a column in the table.

The input-output table offers a mechanism for determining the level of economic activity in the urban area at an aggregate level. The total income of the urban area would be contained in the table as well as the total expenditures. These expenditures are by industry, and, should household expenditure patterns change, then the elements within these industrial

sectors must also change in response to changing household purchasing patterns. Total production for the urban area would also be indicated in the table.

METHODOLOGY AND INPUT DATA

The table shown in Exhibit 20 is a "transaction table." A transaction table describes the flow of goods and services between all sectors of an economy for a stated period of time. It is a conceptual representation and shows the amount of goods and services produced and/or consumed by each sector. From a transaction table, a table of "technical coefficients" can be developed. A "technical coefficient" is the ratio of the amount of input required from each industry to produce one dollar's worth of output for a given industry. These coefficients are useful to determine the impacts on other industries of a change in the output of a particular industry.

The above reflects only direct purchases, however. Since the various sectors are linked together, there are secondary or indirect changes in output levels of various sectors as the impact of the direct sales change works its way through the economy. A standard result of an interindustry analysis is a matrix which represents the total direct and indirect requirements per dollar of final demand. Using this matrix, it is possible, for example, to calculate the direct and indirect changes in output for each sector of the economy resulting from a change in gasoline consumption by the household and commercial sectors.

EXHIBIT 20 Structure of Input-Output Table

		CONSUMERS									FINAL DEMAND (GNP)				
		Agricul-ture	Mining	Construc-tion	Manufac turing	Trans-por-tation	Trade	Finance	Services	Other	Personal consumption expenditures	Gross private domestic investment	Net exports	Government purchases	GROSS OUTPUT
CONSUMERS	Agriculture														
	Mining														
	Construction														
	Manufacturing														
	Transportation														
	Trade														
	Finance														
	Services														
	Other														
VALUES ADDED (Charges Against GNP)	Imports														
	Credit type Income (net interest & capital consumption allowances)														
	Compensation of Employees														
GROSS INPUT															

If the household row and column is included in the transaction table used to develop the matrix of direct and indirect requirements per dollar of final demand, income multipliers can be calculated. Different levels of income are generated by equal expansions of different industries. Thus, the income effects of changes in regional production can be estimated.

Multipliers which do not include the household sector are called Type 1 multipliers. Those that include the household sector are commonly called Type 2. Type 2 multipliers will be used in this approach since it is desirable to reflect the full direct and indirect effects of changes in fuel expenditures.

There are two possible input-output models which can be applied to the Dallas-Fort Worth metropolitan area. The first was developed by Mullendore et al. (1972) and contains 69 sectors for the North Central Texas Region. Appendix IV of the third volume contains a listing of the transaction table from this model. This information was generated locally and is already available; however, the information is somewhat dated because of the significant changes in the local economy since it was developed. A second input-output approach is called the Regional Input-Output Modeling System (RIMS II). This system estimates the coefficients and multipliers (not the transactions) for an input-output analysis for any county or collection of counties in the U.S. (U.S. Department of Commerce, 1981a). RIMS II provides up-to-date coefficients or multipliers at a cost ($2,000 for this particular study) much less than updating the local input-output model.

The advantage of RIMS II is the compatibility of the model between areas of the country as well as its more recent estimation. RIMS II uses the 1972 national input-output model (Ritz, 1979) which is regionalized with the 1979/1980 earnings by industry in the Dallas-Fort Worth area. While RIMS II multipliers do not permit detailed investigations of the transactions among specific industries, the overall impacts (calculated from the multipliers) are of most interest to policymakers. Therefore, this distinction is not a serious limitation.

Input-output analysis has been applied to transportation problems at the local, state, and federal level for some time. Goldstein (1969) highlighted a variety of applications along these lines over a decade ago. More recently, the National Cooperative Highway Research Program (NCHRP) sponsored the development of two handbooks for state departments of transportation.* These handbooks provide the techniques useful in applying input-output concepts to transportation policy analysis.

This step in the planning manual pulls together the economic impact information developed in previous steps in the process and demonstrates how this information can be combined and presented. Indirect economic impacts are explicitly estimated in this section.

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*NCHRP Project 8-15A "Regional Economic Analysis for Transportation Planning." The final reports are available on loan from the Transportation Research Board in Washington, D.C.

Input-output models have been used to examine economic impacts of energy related developments. This has been done in a variety of ways. For example, in the state of Hawaii an input-output model was used to determine the direct and indirect economic effects (labor required and income produced) associated with the construction and operation of an electrical system projected to be needed by the year 2005 (Lawrence Berkeley Laboratory and State of Hawaii, 1981).

The input-output model can also be used to estimate employment.

> By translating these levels of economic activity into numbers of jobs (e.g., through the use of technical coefficients which define the number of labor-hours required to produce one unit in the respective sectors), these models can thus be used to predict employment levels. (Oppenheim, 1980).

Thus, the use of input-output analysis at the local level to estimate economic impacts (production, employment, etc.) is an accepted methodology. Recent developments and applications have improved on the facility and utility associated with this methodology.

Conventional input-output methodologies have been extended to the calculation of total energy costs of goods and services. This is accomplished by converting existing input-output data which is in terms of dollars to energy units. Herendeen (1974) has been particularly active in this area.

Using this type of analysis, Bezdek and Hannon (1974) have analyzed the energy impacts of alternative federal expenditures. In the reference cited, the authors analyze the net energy consumption and manpower impacts resulting

from a reallocation of $5 billion from the Highway Trust Fund to six other types of government programs: railroad and mass transit, educational facilities, water and waste treatment facilities, the law enforcement program, a national health insurance program, and a tax relief program. While this type of analysis is not meaningful for urban policy studies since governmental expenditures at the local level do not have the economic impact that they do at the federal level, this method could be applied in estimating overall current energy consumption and forecasting future energy demands in an urban area.

Another use of this information is in determining the total energy costs, i.e., both direct and indirect, of a transportation project or program. An example of the information available is provided in Exhibit 21. This type of analysis has been suggested as a means to calculate construction energy impacts for the evaluation of high capital transit alternatives (Charles River Associates, Incorporated, 1979).

This particular line of thinking has led to the development of the TECNET model for use in analyzing not only the direct and indirect energy consumption impacts but also the pollution emissions (direct and indirect) and employment impacts of transportation programs (Doggett et al., 1979; Patterson, 1980). The TECNET model can be used to estimate both passenger (intercity) and freight (intercity and local) travel based on economic activity. This relationship is also explored in a recent paper by researchers at the Argonne National Laboratory (Johnson et al., 1981).

EXHIBIT 21 Energy Impact of the Automobile, 1963

	Dollar Flow (10 $)	I/O Sector	I/O Coefficient (Btu/$)	Energy 10 Btu	% of Total
Gasoline					
Production	5.86	31.01		5,860	57.2
Refining		31.01	(0.208 Btu/Btu)	1,220	11.9
Retail Markup	4.05	69.02	32,700	130	1.3
Oil					
Production	0.83	31.01		50	0.5
Retail Markup	0.55	69.02	32,700	20	0.2
Auto					
Manufacture	14.43	59.03	70,000	1,010	9.9
Retail Markup	10.67	69.02	32,700	350	3.4
Repairs, Maintenance, Parts	10.0	75.00	33,700	340	3.3
Parking, Garaging	11.7	75.00	33,700	390	3.8
Tires					
Manufacture	0.83	32.01	99,100	80	0.8
Retail Markup	0.55	69.02	32,700	20	0.2
Insurance	8.96	70.04	31,400	280	2.7
Taxes (Highway Construction)	4.9	11.04	98,500	490	4.8
Total	73.3			10,240	100.0
	(12.4 % of GNP)			(20.5% of total)	

Source: Herendeen (1974)

Kutscher and Bowman (1974) have determined the amount of refined petroleum products required to support the average worker in various industries.

Thus it appears that the use of an input-output model would lead to improved energy analysis as well as provide a means for estimating freight travel demand at the macroscopic level. The input-output procedure allows for the estimation of total economic impacts.

The use of the input-output model is demonstrated for three example applications in Chapters III and V of the Volume III technical planning manual.

VII. SUGGESTIONS FOR USE OF THE MANUAL

This report is concluded with some general points regarding this approach. Such questions as how to get started with an analysis, suggested ways of presenting the information, and a further discussion on the types of problems which can be addressed with the methodology are addressed in this section. The following information highlights the major components and problems with this recommended approach.

SUMMARY OF PROCESSS

This energy-economic impact methodology begins with the estimation of transportation fuel price. Quantities of these fuels consumed are also estimated on the basis of any planned or expected changes in transportation energy efficiency. Three classes of analyses can be conducted with this approach; however, the magnitude of the modeling effort varies greatly between the types of investigations. All three examples of the recommended procedure are demonstrated in the Volume III report. This methodology is applied for both personal travel as well as truck travel.

The developed procedure operates best under two conditions. They are:

(1) short run (less than 5 years)

This mode of operation is best because of the need for fixed economic multipliers over time. The further the baseline year is away from the baseyear, the greater the pressure put on this assumption.

(2) same year

This type of evaluation better utilizes the comparative nature of the methodology.

Volume III contains planning manual applications for 1982 and 1987. These scenarios meet both of the above two recommendations. However, to demonstrate the full use of the manual, a 1980-2000 evaluation over time is presented. The results of this evaluation should be scrutinized more closely because it violates both of the above recommendations. In this case, the absolute value obtained from the manual should be used carefully.

From this step in the analysis a dollar amount is known which can be spent on transportation fuels for a base period. Gasoline price elasticities are used to estimate how much money is spent on transportation fuels in the target year (i.e., present year or future year). Because of the relative inelasticity of gasoline demand, total transportation fuel expenditures increase in real terms during a price increase. Depending on the target year, automobile fuel efficiency improvements may be significant enough to overcome this effect, however.

These values of fuel price and consumption are used to estimate the change in the CPI from the base year condition. Adjustments are made to household income and commercial revenue based upon the net increase or demand in transportation fuel expenditures. Income elasticities are used to estimate changes in household expenditures for other goods. No elasticities are used for commercial sectors.

These changes in expenditures are then used as input to an interindustry analysis. Using the techniques demonstrated earlier in this report, the income, total production, and employment for the area are estimated for the base and target year. These measures constitute the total direct and indirect economic impacts of the fuel price and efficiency scenario originally defined by the analyst.

COMPONENTS OF FUEL PRICE

It should be recognized that increases in the pump price of gasoline can be brought about by petroleum price increases as well as taxes. The local economic impacts are different for these two types of price increases. In general, petroleum price increases will result in money being exported from the local economy while tax increases may result in an increase in government expenditures in the local economy. The amount of government expenditures depends on which level of government executes the tax. This aspect of the analysis can vary greatly around the country.

It is assumed that the consumer responds to a price increase in the same way regardless of the nature of the increase, i.e., whether it is due to a tax increase or a crude oil price increase. Thus, the changes in household consumption can be calculated in the same way regardless of the source of price increase.

The explanations thus far have treated the gasoline price increase as simply a price increase. In order to simulate the impact of a gasoline tax increase, a slightly different approach is necessary.

As an example, assume that a five cent per gallon tax on gasoline has been imposed in order to fund highway construction, repair, and maintenance. This would have a different impact on the local economy from that of a gasoline price increase because government expenditures would increase in the construction sector of the local economy. Thus, the historical ratio of highway construction in the local areas to the amount of gasoline tax collected is factored into the analysis.

Currently there is a five cents per gallon state tax on gasoline in Texas. The federal gasoline tax is nine cents per gallon. Of this tax burden, how much is returned to the Dallas-Fort Worth area in highway projects? This question would need to be answered for each local/regional area if a gasoline tax change is to be evaluated.

For the State of Texas, past experience tells us that for every $1.00 additional tax money collected, $0.90 would be available for the highway program. The remaining $0.10 would go to administration of the tax, statewide safety programs and interest payments.

NCTCOG studies on long-range transportation system management indicate that the Dallas-Fort Worth area has historically averaged about 11 percent of the allocated federal and state highway expenditures in the State of Texas. There is no concrete reason to suspect that this ratio will change in the near future.

It is estimated that 22 percent of the travel and gasoline consumption in the state of Texas takes place in the Dallas-Fort Worth area. Thus, if the gasoline tax is increased such that $1.00 is collected from the Dallas-Fort Worth area, $4.55 is collected from all over the state.

Thus, it can be estimated that a $1.00 increase in state gasoline taxes collected in the Dallas-Fort Worth area would result in $0.45 (1.00 x 0.90 x 4.55 x 0.11) return to the area for roadway building and maintenance.

If a local gasoline tax were administered, we would assume that this would be collected by the state at an administrative cost of 10 percent. Thus, a $1.00 increase in a local gasoline tax would result in $0.90 increase in local highway expenditures.

This approach is to first determine the changes in sector expenditures as usual. The amount of gasoline tax generated is initially assumed to leave the local economy. The gasoline tax revenue is then adjusted for funding not returning to the study area. This value is then treated as a government expenditure in highway construction in the local economy. The multipliers are used to determine the impact of this effect. The two sets of impacts are then summed to determine the net results.

REMAINING PROBLEMS

The geographic area covered by various statistical reports varies. Some data are reported for the BEA area, some for the SMSA, some by the county, and some by other geographic areas. These are not, however, new problems to

analysts, and reasonable adjustments can be made to make the data geographically compatible. For all applications throughout the country, care must be taken in selecting a specific geographic area for analysis. The analysis conducted thus far suggests that all analysis should be conducted at the SMSA level or higher. This includes single or multi-SMSA evaluations.

Perhaps more difficult than the spatial issue is the issue of time frame. It must be recognized that short- and long-term price elasticities exist. All models tend to be more accurate in either the short range or the mid-to-long range, but not both. There must be a consistency in the technical approach with regard to time frame. As the examples demonstrate in Volume III, the issue of time frame has resulted in a few additional steps and factors that otherwise would not be necessary. However, these steps greatly increase the sensitivity and, hopefully, accuracy of investigations for future years.

A third concern is the comprehensiveness of the approach. If local analysts do not understand or have confidence in the tool being used, little if any use will develop. The examples presented in Volume III explain the use of this process. They also demonstrate its complexity.

There are some weaknesses in the approach. The use of input-output models, for example, has not been widespread at the local level due to the difficulties in collecting data at this level of analysis. This limitation is offset, however, by the availability of the RIMS II multipliers which can be substituted for locally developed data.

While economic impact data are familiar to local policy leaders, it is not clear how information provided from this economic analysis will be accepted in all cases. There is a chance that the information may be viewed as being too abstract. Also, in some cases the economic impacts of minor transportation actions and policies may be too small to affect adjustments in household and commercial purchasing behavior. From the analysis conducted and presented in Volume III, it is clear at least in the Dallas-Fort Worth case that the information is very useful and transportation actions/prices significantly impact household purchasing behavior. Volume III contains three example scenarios for the Dallas-Fort Worth SMSA which demonstrate the full use of this methodology.

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APPENDIX I

TSM Actions of Interest

APPENDIX I

TSM Actions of Interest

Action	Example Applications
Transit route modifications	path change, route extension, additional routes either radial or crosstown
Changes in transit fare structure	general reduction, more equitable pricing
Transit bus stop amenities	benches, shelters
Transit priority signals	signal preemption, timing for bus movements
Transit schedule modifications	increase in frequency, change in arrival times
Transit service modifications	fleet improvement, service-time extension
Improved bus stopping operation	side stops, bus bays, reduced bus stop frequency
Improved bus flow	widened curb radii, improve channelization, prioritized transit bus stop pull-out
Improve transit management operations	improvements in marketing, programming, supervision, security, and safety
Improved transit maintenance operations	programmed maintenance, engine modifications
Intermodal integration	park-and-ride, park-and-pool, bike-and-ride
Initiation of transportation brokeraging	jitney, para-transit, express service, subscription service, shuttle service
Exclusive facilities for high-occupancy vehicles	with-flow exclusive lanes, contra-flow exclusive lanes, exclusive ramp treatments
Increased roadway capacity	elimination of on-street parking, additional lanes, truck restrictions, freeway/arterial incident response management
Additional roadway facilities	extension of roadway, connection of disjointed facilities
Motorist Information System	specification of underutilized routes, roadway·marketing strategies
Highway system pricing	tolls, tax on fuel, congestion pricing

Action	Example Applications
Traffic flow improvements	double left turns, widened intersections, closed freeway ramps, metered ramps, turning restrictions, turning lanes, retimed signals, removed signals, progressive signals, rail signal/traffic signal inter-connection, computer monitoring of traffic flow, modified geometrics, reversible lanes, one-way streets, closed streets, limited median and curb access, roadways grade-separated from other roadways or railways
Demand modification	staggered work hours, shorter work week, flexible-time
Provisions for non-motorized travel	bikeways, pedestrian walkways/crossovers, pedestrian streets
Vehicle restrictions	auto-restricted zones, reduced parking availability, increased parking cost
Programs to encourage carpooling/vanpooling	rideshare matching, employer-based ridesharing
Vehicle hardware modifications	controls on extended vehicle idling, alternate fuels or engines, extreme cold-start emission reduction, inspection and maintenance

U.S. Department of Transportation

Local Economic Impacts of Transportation Fuel Consumption:

Planning Manual

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CONVERSION FACTORS

1 gallon of automotive gasoline = 125,000 BTUs

1 gallon #1 diesel = 135,000 BTUs

1 gallon #2 diesel = 138,700 BTUs

1 gallon crude oil = 138,100 BTUs

1 kilowatt hour = 3,412 BTUs

1 joule = 0.9478×10^{-3} BTUs

ENERGY EQUIVALENTS

1 gallon of automotive gasoline =

.926 gallons #1 diesel

.901 gallons #2 diesel

.0216 barrels (42 U.S. gal.) crude oil

36.6 kilowatt hours

Source: A. Rose (1979), Energy Intensity and Related Parameters of Selected Transportation Modes: Passenger Movements. Oak Ridge, Tennessee: Oak Ridge National Laboratory.

Executive Summary

The purpose of this planning manual is to present a mechanism to evaluate transportation fuel consumption and price impacts on a local economy. In order to demonstrate this procedure three scenarios are presented. The first represents a change in fuel tax, the second represents changes in fuel price and efficiency over the long run, and the third scenario represents an improvement in fuel efficiency alone.

The methodology is outlined in a series of ten steps and addresses both the household and trucking related sectors of the economy. The procedure is arranged to allow for the examination of the impacts on the household and trucking sectors separately. This enhances the flexibility of the analysis by allowing the planner or engineer to evaluate only those sectors that are of most interest.

Another demonstration of the flexibility of the planning manual is its applicability to a particular planning region. Any planning area, whether it be at the local, regional, or state level can undertake this method of analysis by utilizing the area-specific factors supplied within this manual. The only major piece of information that the manual does not supply is an input-output model for the area of interest. If an input-output model is not available, estimates of household expenditures by economic sector are necessary along with economic multipliers supplied by the Bureau of Economic Analysis.

Through the application of this analysis it is possible to determine changes in employment and regional income in a study area, as a result of different transportation-related policy decisions. It is important to realize, however, that this methodology is more accurate for the short range (i.e., less than 5 years) than the long range. In order to allow the use of this tool in long-range evaluations, adjustments are made to the economic multipliers since the coefficients cannot be assumed constant over time. Even though some of the scenarios presented for demonstration are for different years, it is suggested that the most accurate use of this methodology is to compare alternative policies for the same year. Therefore, it is recommended that the comparative versus absolute nature of the methodology be utilized.

I. INTRODUCTION

PURPOSE

The purpose of this planning manual is to present the overall methodology and background data necessary for the estimation of local economic impacts resulting from changes in transportation fuel consumption. This manual, along with the companion documents entitled, "Local Economic Impacts of Transportation Fuel Consumption: Volume I Executive Summary" and "Volume II Derivation of Procedure," represent the final product of a research contract jointly sponsored by the Urban Mass Transportation Administration, U.S. Department of Energy, and the Federal Highway Administration. The overall objective of this investigation is to incorporate energy considerations in urban transportation planning and decision making.

This manual is intended for use by local, regional, and state transportation planners and engineers for the estimation of the economic impacts of transportation fuel consumption on both the household and trucking sectors of the economy. Of the 59,839,875 annual vehicle miles of travel (VMT) in the Dallas-Fort Worth Standard Metropolitan Statistical Area (SMSA), household or personal travel composes 48,877,636 VMT per weekday (77.6 percent) and trucking travel composes 9,512,609 VMT per day (15.8 percent). The remaining 1,449,630 VMT (6.6 percent) is made up of "other" users consisting of public service vehicles, such as police cars and fire trucks, and business/rental cars. The methodology contained in this planning manual addresses 93.4 percent of all roadway travel. Essential services and business/rental car

travel are not included in this analysis because of their relative insensitivity to fuel price and efficiency.

MANUAL ORGANIZATION

The contents of this manual are outlined below. The flow of information presented here explicitly demonstrates the process developed to evaluate the economic impacts of transportation energy consumption. The order is consistent with that of the material presented in the Volume II companion document.

Chapter II: Energy Efficiency and Price Scenarios

The purpose of this chapter is to present the energy efficiency and price scenarios that were chosen for this analysis. These scenarios serve as case studies for the planning manual and demonstrate the use of the procedures developed in this document.

Chapter III: Sector Energy Consumption - Households

This chapter presents the methodology by which changes in household expenditures for each household-related sector can be determined. Two points need to be emphasized. First, the household transportation costs modeled here are out-of-pocket costs (i.e., gasoline, maintenance and fuel taxes). Fixed costs, such as insurance, are not considered because these costs do not vary significantly with changes in the urban transportation system. Second, in order to carry out this portion of the analysis, an input-output table for the desired study region is required. The total household expenditure for each sector is a necessary component of the methodology and is available from an input-output model.

Chapter IV: Sector Energy Consumption - Trucks

This section presents the methodology necessary to determine the changes in trucking expenditures for each trucking related-sector. The methodology used to evaluate truck sectors is similar to the approach used to evaluate the household sectors. The major difference between the two approaches deals with the issue of budgets. It is assumed in this study that households possess fixed budgets while trucking sectors adjust their prices to meet changes in the cost of business. These assumptions result in changes in economic activity due to both changes in household expenditures as well as changes in trucking costs.

Chapter V: Resulting Changes and Impacts

The purpose of this chapter is to relate the changes in expenditures from Chapters III and IV to the multipliers obtained from the RIMS-II analysis conducted for the study region. The products of this procedure are changes in the Consumer Price Index, income levels, and employment participation levels in the study area. This chapter also presents the methodology necessary to trace the tax dollar, paid out by the consumer in fuel tax to the government, back into the local economy.

Chapter VI: Summary

This chapter presents a summary of the results obtained from this demonstrative analysis.

USE OF MANUAL

Three different approaches can be taken in this methodology, depending on the purpose of the local/regional study. First, if the economic impacts of only the household sector are desired, Chapter IV can be ignored. Second, if the economic impacts of fuel price and efficiency changes are desired for the household sectors and an approximation of the impacts from the trucking sectors is adequate, Chapter IV can still be bypassed and the approximation factor developed in Chapter V can be applied to obtain a measure of the economic impacts resulting from the trucking sectors. Finally, if both the household and trucking sector impacts are necessary, the complete analysis should be carried out.

There are two final points that clarify the methodology contained in this planning manual. First, all dollar related values are in 1977 dollars. This particular year is not important but having constant-year dollars is. Second, this methodology is much more accurate for the short range (i.e., less than five years) than the long range. In order to allow this tool to be used for long-range evaluations, adjustments are made to the economic multipliers since these coefficients cannot be assumed constant over time. Even though some of the scenarios presented in this manual are for different years it is suggested that the most accurate use of this methodology is to compare alternative policies for the same year. Therefore, it is recommended that the comparative versus absolute nature of the methodology be adopted. This is especially true when evaluating policies in the long run.

II. ENERGY EFFICIENCY AND PRICE SCENARIOS

This chapter documents the first three steps in the planning manual. To demonstrate the full range of capabilities in this methodology, three scenarios are presented. All three examples are evaluated throughout the ten steps of the planning manual. Exhibit 1 contains a diagram of the model process and the associated step number.

STEP 1 - ALTERNATIVE LOCAL TRANSPORTATION POLICIES

The transportation policies or scenarios chosen to demonstrate the components of the planning manual are outlined in Exhibit 2. As demonstrated in this Exhibit, three types of analyses have been selected for evaluation. Scenario 1, an example of the first type of analysis, measures the economic impact of a 5 cent increase in the fuel tax for the present year. Scenario 2 estimates the long-run impact of rising fuel prices and anticipated efficiency improvements. Scenario 3 evaluates the economic impact of a 10 percent energy efficiency improvement by 1987 resulting from implementation of a large number of transportation system management actions. All scenarios are examined at the SMSA level in order to be consistent with necessary demographic and economic input data.

STEP 2 - EXTERNAL EVENTS

There are a variety of circumstances, outside the control of the local policy-maker, that influence fuel price and energy efficiency. Such events as OPEC oil price increases, domestic oil deregulation, and energy-efficiency related

EXHIBIT 1 Conceptual Model of Economic Impact Analysis

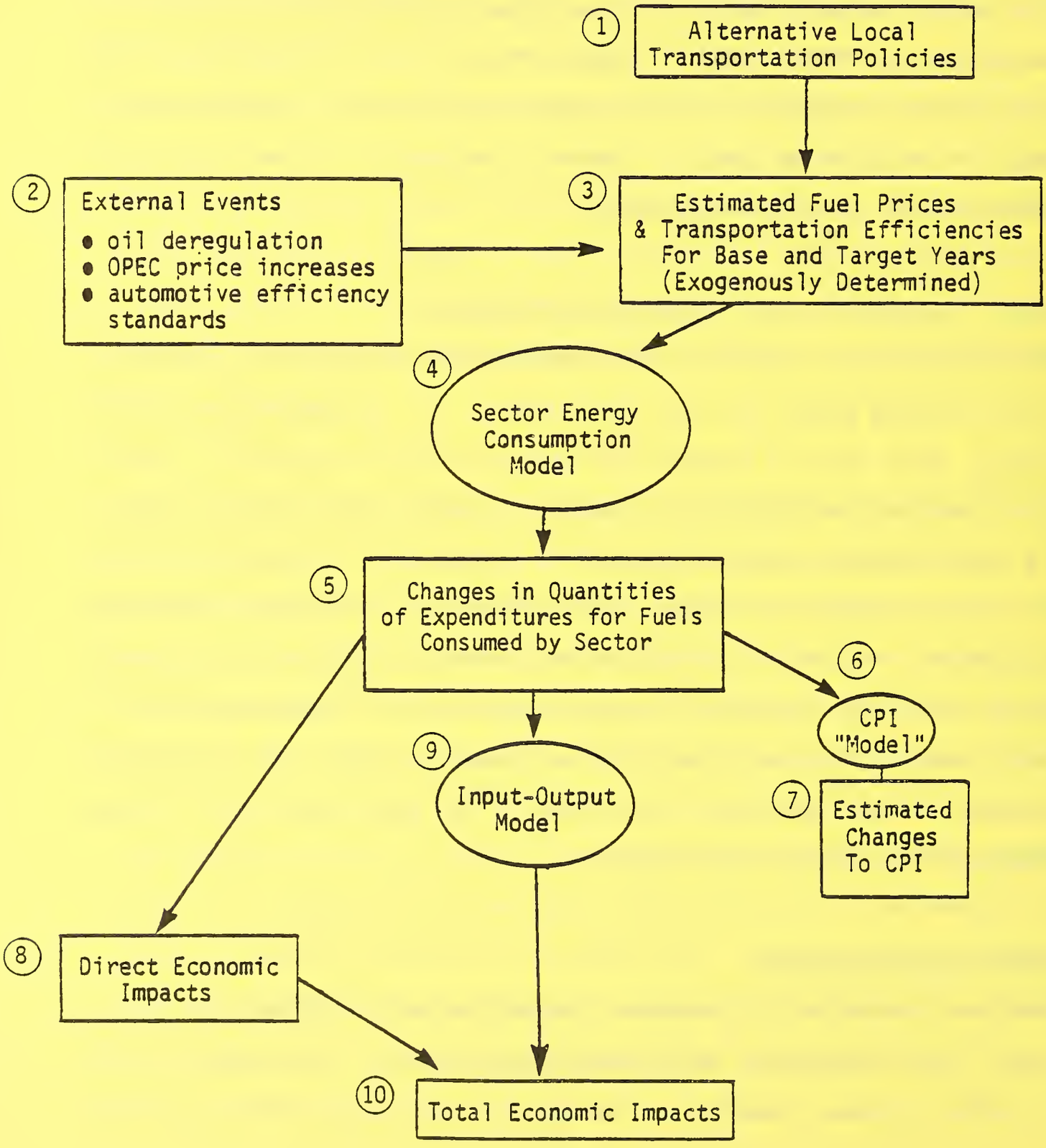


EXHIBIT 2 Three Selected Scenarios Tested in the Dallas-Fort Worth SMSA

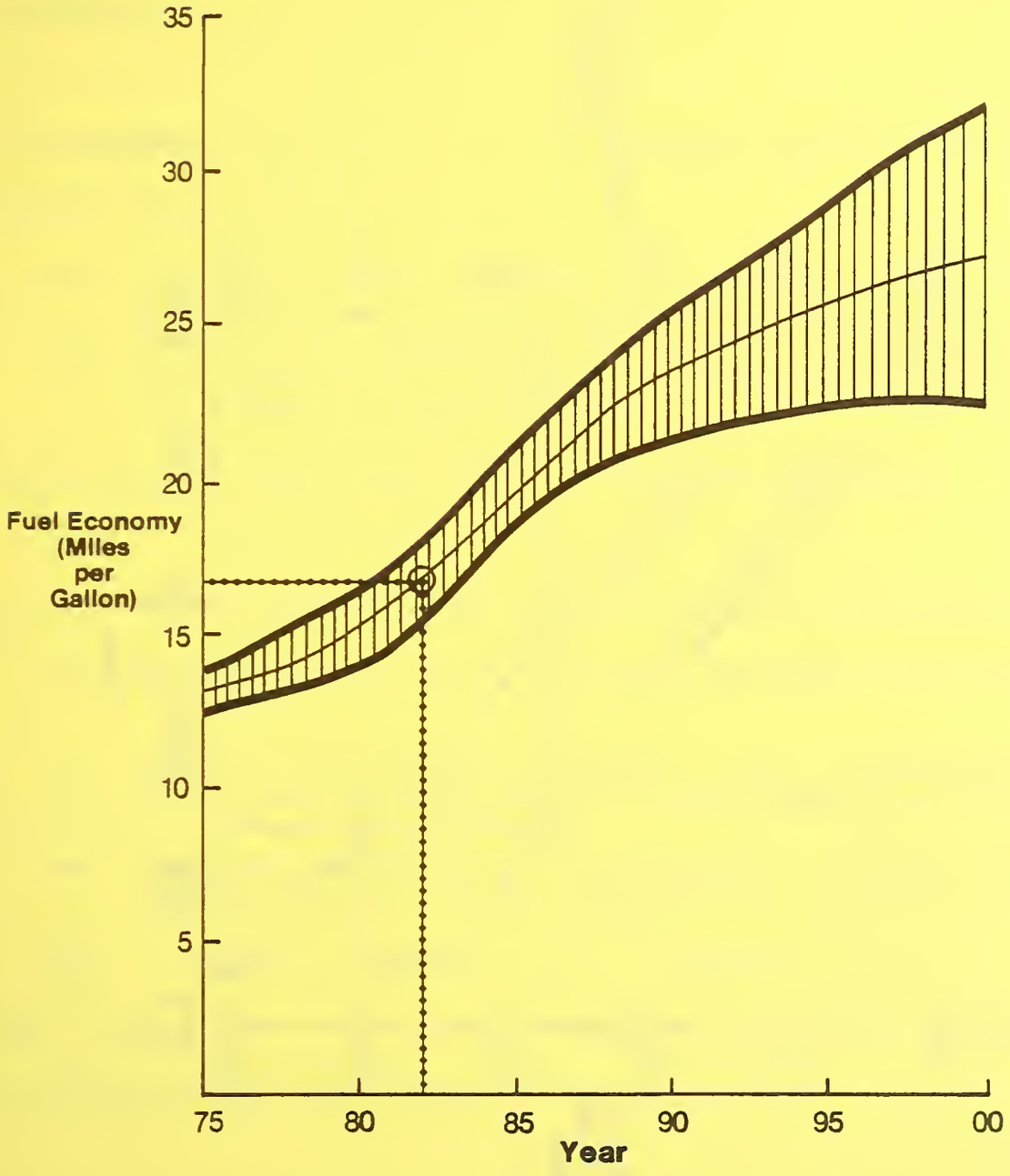
TYPE OF ANALYSIS	VARIABLES CHANGED: ENERGY PRICE	ENERGY EFFICIENCY	ENERGY PRICE AND ENERGY EFFICIENCY
1. Base Year Alternative	Scenario 1: Short-run impact of a 5¢ increase in fuel tax (state) in 1982.		
2. Base Year and Future Year Projection			Scenario 2: Long-run price and efficiency impact between 1980 and 2000.
3. Future Alternative		Scenario 3: Medium Range 10 percent fuel efficiency improvement above anticipated 1987 levels.	

automobile controls are all factors that affect the local energy environment. The local planner is responsible for determining the influence of these external events on local transportation in order to accurately identify the impact of locally tested alternatives. This planning manual contains "middle-of-the-road" projections and assumptions. Actual values for each projection are presented in detail throughout the remainder of this report. Important assumptions used in this manual are contained in Appendix I. Different perspectives on the direction of external events can be considered by adjusting the input data. Examples of typical input data which are sensitive to external events are demonstrated in Step 3.

STEP 3 - ESTIMATED FUEL PRICES AND TRANSPORTATION EFFICIENCIES

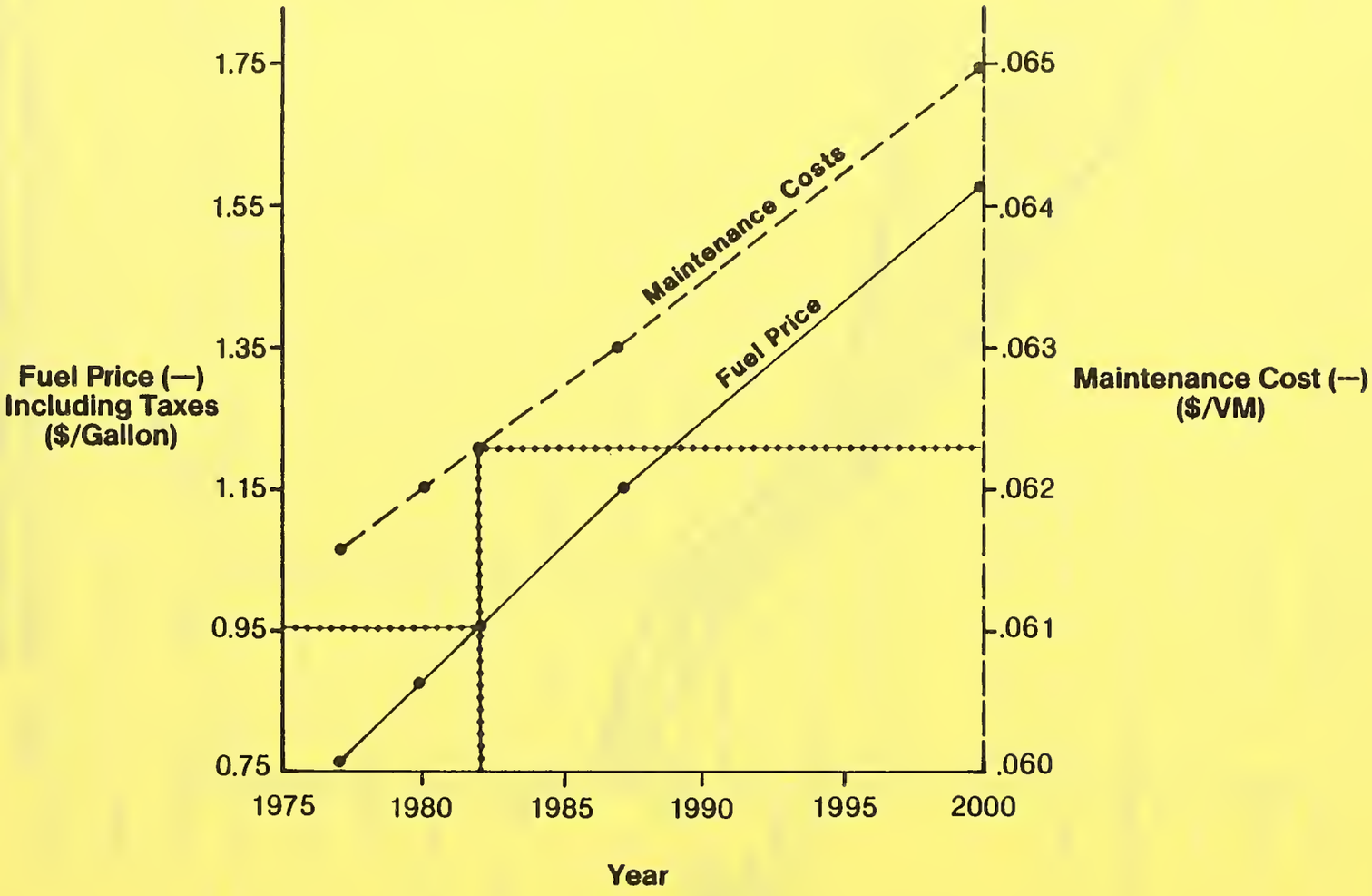
In order to allow the local planner to determine the economic impact of local transportation decisions, projections on fuel price and fuel economy are needed. Exhibit 3 contains projections of fuel economy between 1975 and 2000 and Exhibit 4 demonstrates background data on components of automobile operating cost, including fuel price, for the same time frame. It is assumed in this analysis that fuel price, on a per gallon basis, is the same for both automobiles and trucks. Work conducted by Argonne National Laboratory (1982) predicts that the cost of diesel fuel will be 6 percent less than the gasoline price by 1990 and 3 percent less than gasoline by the year 2000. This small difference is minimized even further when consideration is given to the gasoline and diesel mix of truck travel. All values have been developed for the Dallas-Fort Worth area. Suitability of these values for other areas of the country is a responsibility of the local planner.

EXHIBIT 3 Estimates of Automobile On-Road Fleet Economy



Source: North Central Texas Council of Governments, William G. Barker and Associates, **Issues and Constraints in the Long-Range Planning**, Draft Technical Report, July 1982

EXHIBIT 4 Estimated Fuel and Automobile Maintenance Costs (1977$)



Source: North Central Texas Council of Governments

Some values not directly transferable to other areas relate to truck economy and truck maintenance costs. Because of the uniqueness of each urban area's economy, data on the trucking components of this methodology need more local attention. This information is presented for the Dallas-Fort Worth area, later in the manual, on an economic sector basis (e.g., farm products, mining products).

To demonstrate the use of Step 3, energy efficiency and cost values for Scenario 1 are defined as follows:

- Efficiency = 16.9 miles/gallon (See Exhibit 3 and Column B of Exhibit 10)
- Fuel Price = $0.96/gallon (See Exhibit 4 and Column D of Exhibit 10)
- Maintenance Cost = $0.0623/vehicle mile (See Exhibit 4, Exhibit 9, and Column I of Exhibit 10)

Values for the other scenarios follow the same methodology.

At this point in the analysis three basic questions have been answered:

- What is going to be investigated and what is the time frame for the analysis?
- What are the background "external events" impacting the alternatives to be studied? What are appropriate assumptions for the analysis?
- What are reasonable fuel price and fuel economy values for the years in which impacts will be analyzed?

If only a household component is to be studied, proceed with Chapter III and skip Chapter IV. If both the household and truck components are to be examined, proceed with Chapter III and Chapter IV.

III. SECTOR ENERGY CONSUMPTION - HOUSEHOLDS

The purpose of this chapter is to determine the change in household income resulting from a change in either the price or the efficiency of travel in the region and, given a change in household income, to determine the change in household expenditures for the various sectors of the economy. This chapter contains these next two steps in the planning manual for the household sectors. Economic sectors affected by truck travel are evaluated in Chapter IV.

STEP 4 - SECTOR ENERGY CONSUMPTION MODEL

In this step of the procedure the household consumption model is estimated for the three previously specified scenarios. Before the model can be developed, the following five pieces of information are needed.

Average Annual Vehicle Miles of Travel by Income Group for the Study Region

The national average annual vehicle miles of travel (VMT) per household (HH) by income group can be found in Exhibit 5. The three income classes chosen for this manual are also listed. Exhibit 6 contains a list of VMT-multipliers that were developed for urban areas of various size in five regions of the United States. By multiplying the appropriate VMT-multiplier by the national average household VMT per income group, values for average annual VMT per household by income group can be obtained for any study region in the country.

EXHIBIT 5 Vehicle-Miles of Travel Per Household for the U.S. in 1977

Income Group (1977$)	Annual Average VMT/Household
0 - $9,999	7,571
$10,000-$19,999	14,558
$20,000 +	18,154

Source: G. Kulp, D.B. Shonka, M.C. Holcomb, Transportation Energy Conservation Data Book: Edition 5, ORNL-5765 Special, November 1981.

EXHIBIT 6 Multipliers for Annual Average VMT by Region and Urban Area Size

United States Region	Urban Area Population (in millions)	VMT-Multiplier*
NORTHEAST	2+	1.05
	1-2	0.88
	0.5-1	0.92
	0.2-0.5	1.11
SOUTHEAST	2+	1.18
	1-2	1.18
	0.5-1	1.14
	0.2-0.5	1.24
NORTHERN MIDWEST	2+	0.98
	1-2	0.95
	0.5-1	0.95
	0.2-0.5	0.98
PLAINS AND ROCKIES	2+	1.14
	1-2	1.21
	0.5-1	1.24
	0.2-0.5	1.08
WEST	2+	1.21
	1-2	1.21
	0.5-1	1.11
	0.2-0.5	1.11

* Values estimated from 1974 National Transportation Report, Urban Data Supplement, DOT, May 1976 and Transportation Energy Conservation Data Book: Edition 5, ORNL-5765 Special, November 1981.

For this analysis, the assumption is made that, unless there is some external event, vehicle miles of travel per household will remain constant over time. This is a "middle of the road" assumption based on projections of both increases and decreases in VMT per household shown in Exhibit 7. As shown in this exhibit, the discrepancy in VMT per household between Projection 1 and Projection 2 is approximately fifteen vehicle miles per household per day by the year 2000. Since these two local projections are in disagreement by roughly the same magnitude, a stable value of VMT per household over time was adopted.

To demonstrate the use of this travel data, the VMT per household for the lowest income group is presented for each scenario:

$$\text{VMT/Household}_i = 7571 \text{ (from Exhibit 5)}_i * 1.14 \text{ (from Exhibit 6)}$$
$$= 8631 \text{ (See Column A of Exhibit 10)}$$

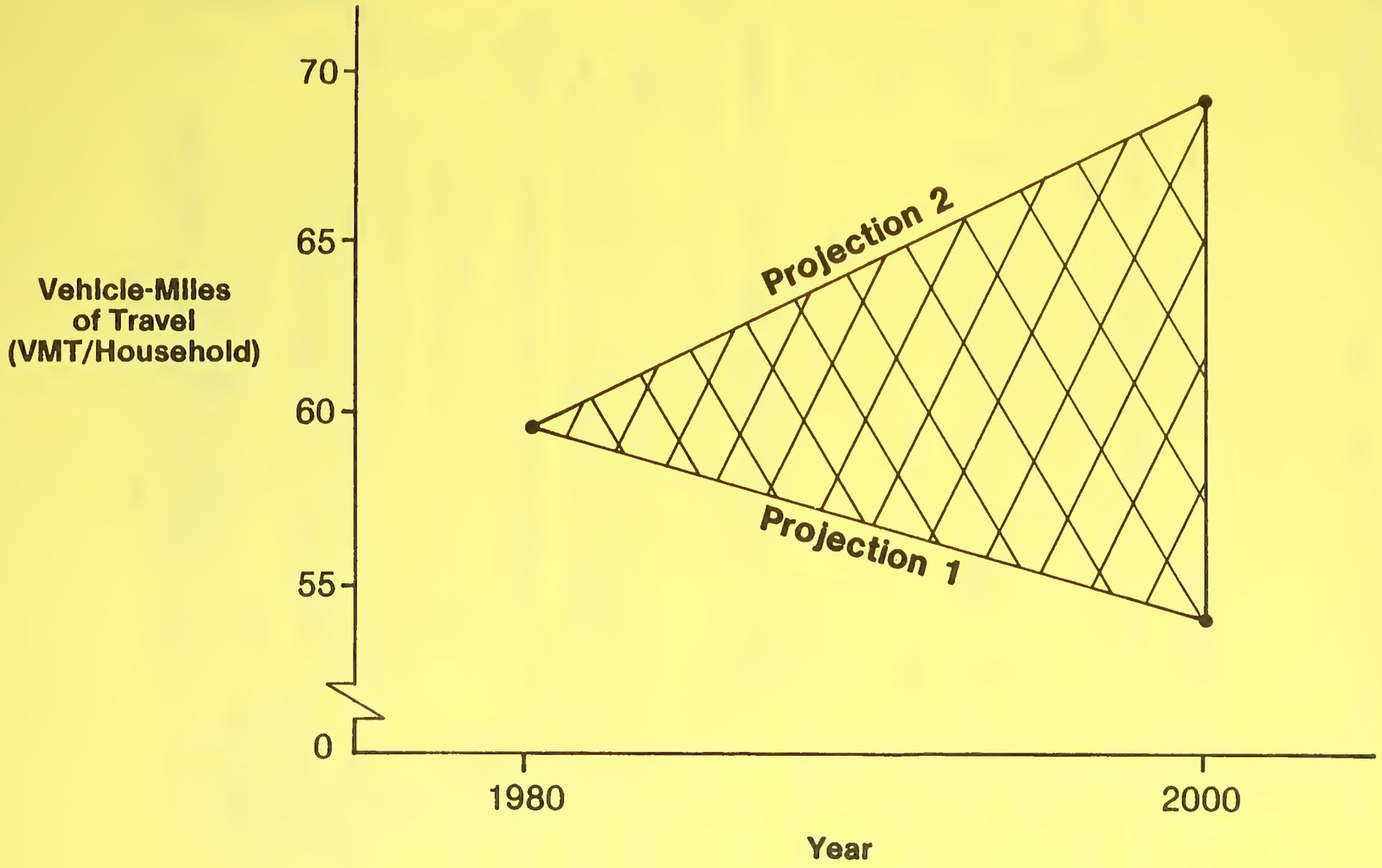
i = lowest income group

Since this value is assumed stable over time, all scenarios use this number. The values for the other income groups follow the same methodology.

Automobile Fuel Efficiency

The fuel efficiency information contained in the previously presented Exhibit 3 is necessary in this step. It is assumed in this analysis that fuel efficiency does not vary significantly by income group (U. S. Department of Energy, 1982b). Potential users of this methodology for study areas in the western part of the United States may want to vary fuel efficiency rates, since higher income users in that area of the country demonstrate higher efficiency values than lower income households.

EXHIBIT 7 Vehicle Miles of Travel, Per Household Per Day, Projected to the Year 2000 (Dallas-Fort Worth)



Sources: Projection 1: North Central Texas Council of Governments, 1981 VMT Study

Projection 2: Data from the Texas State Department of Highways and Public Transportation Year 2000 Regional Assignment, 2020-1.

Gasoline Price

The gasoline price information in Exhibit 4 is used in this step of the planning manual. Again, it is assumed in this analysis that gasoline prices do not vary significantly by income group (U. S. Department of Energy, 1982b).

Tax Rate for the Study Region

The values for state gasoline tax rates, in cents per gallon, can be obtained from Exhibit 8. The Texas state gasoline tax is 5 cents per gallon bringing the total gasoline tax for Texas to 9 cents per gallon. Note that it may be necessary to transfer these values into dollars for different years, depending on the nature of the analysis.

Vehicle Maintenance Costs

The average maintenance costs per vehicle mile can be obtained from the previously cited Exhibit 4. In order to adjust the maintenance costs so they are income group specific, the multipliers found in Exhibit 9 can be multiplied by the average maintenance cost from Exhibit 4. This multiplication results in maintenance cost estimates per vehicle mile for each income group.

To demonstrate the use of this vehicle maintenance cost methodology, the lowest income value for Scenario 1 is presented below:

$$\text{Maintenance Cost } (¢/VM)_i = 0.0623 \text{ (from Exhibit 4)} * 0.906 \text{ (from Exhibit 9)}$$
$$= 0.0564 \text{ (See Column I of Exhibit 10)}$$

i = lowest income group

EXHIBIT 8

MOTOR FUEL CONSUMPTION - 1980

COMPILED FOR THE CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES AND OTHER SOURCES

(IN THOUSANDS OF GALLONS EXCEPT AS NOTED)

TABLE MF-8
REPTEMBER 1981

STATE	GROSS AMOUNT REPORTED 1/	GALLONS EXEMPTED FROM PAYMENT OF TAX 1/	GROSS GALLONS ASSESSED FOR TAXATION	GALLONS SUBJECT TO REFUND OF ENTIRE TAX	NET AMOUNT TAXED — AT PREVAILING RATES — NET TOTAL GALLONS	GASOLINE — TAX RATE ON DEC. 31 IN CENTS PER GALLON 2/	GASOLINE — NUMBER OF GALLONS	GASOLINE — PERCENT CHANGE 1980 OVER 1979	SPECIAL FUELS — TAX RATE ON DEC. 31 IN CENTS PER GALLON 2/ 3/	SPECIAL FUELS — NUMBER OF GALLONS	SPECIAL FUELS — PERCENT CHANGE 1980 OVER 1979	ALL MOTOR FUELS — NUMBER OF GALLONS 1980	ALL MOTOR FUELS — NUMBER OF GALLONS 1979	ALL MOTOR FUELS — PERCENT CHANGE 1980 OVER 1979	ALL OTHER DATA 4/ — RATE ON DEC. 31 IN CENTS PER GALLON	ALL OTHER DATA 4/ — NUMBER OF GALLONS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(6)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
ALABAMA	2,261,437	14,329	2,247,108	710	2,246,398	11	1,933,284	-6.9	18	301,648	6.8	2,238,232	2,398,742	-9.2	VARIOUS	11,198
ALASKA	246,488	32,941	213,547	64	213,483	8	164,248	-9.8	8 & 0	21,120	86.9	189,388	131,952	+2.4	VARIOUS	20,249
ARIZONA	1,350,353	6,931	1,843,822	15,164	1,828,308	8	1,237,931	-9.3	8	221,882	-1.9	1,919,603	1,596,690	-4.8	1	8,999
ARKANSAS	1,294,877	40,136	1,254,741	303	1,294,438	9.0	1,144,283	-8.0	10.5 & 7.0	208,011	-5.4	1,392,314	1,451,980	+4.9	0	2,224
CALIFORNIA	12,140,513	14,076	12,128,937	91,059	12,034,078	7	10,084,197	-6.1	7 & 6	1,803,706	-1.3	11,967,036	12,444,201	-5.7	1 & 0	87,042
COLORADO	1,446,881	97,678	1,083,203	26,291	1,849,812	7	1,409,346	-2.6	7	140,466	-4.6	1,549,812	1,999,247	-3.1	-	-
CONNECTICUT	1,432,192	44,672	1,387,179	9,234	1,241,998	11	1,230,347	-4.5	11	104,575	0.0	1,343,917	1,431,920	-4.1	9 & 15	16,038
DELAWARE	328,284	7,290	320,994	2,907	318,487	9	284,094	-3.3	9	34,433	27.9	318,487	330,674	-0.7	-	-
DIST. OF COL.	186,318	20,557	165,758	-	165,758	11	161,694	-16.4	11	4,104	-41.9	165,798	200,321	-17.3	-	-
FLORIDA	9,315,385	65,224	9,250,161	-	8,200,161	8	4,638,874	-1.9	8	4M9,851	11.3	8,184,729	9,194,44M	-0.2	3 & 4	65,434
GEORGIA	3,320,383	13,088	3,307,095	-	9,307,095	7.5	2,849,496	-4.6	7.0	446,059	-3.6	3,295,519	3,459,748	-4.7	1	12,380
HAWAII	262,635	33,858	228,781	-	920,781	8.0	301,219	-6.9	8.5 & 8	19,076	7.4	820,295	939,382	-5.6	1	8,486
IDAHO	542,817	4,883	537,924	26,871	511,363	3.5	451,416	-10.5	9.0	54,484	-32.1	505,900	3M4,813	-13.5	2.0	0,443
ILLINOIS	9,423,484	207,046	9,222,430	169,706	9,053,529	7.5	4,493,817	-3.5	7.0	834,912	-17.0	8,053,529	8,344,394	-5.4	-	-
INDIANA	2,262,465	79,296	3,184,163	35,622	2,148,247	8.5	9,575,094	-2.1	8.5	972,352	4.1	3,148,247	3,321,489	-5.2	-	-
IOWA	1,936,311	101,495	1,634,836	166,223	8,488,527	13	1,910,324	-10.4	11.5 & 10	273,203	0.0	1,488,527	1,745,159	-14.7	0	-
KANSAS	1,545,262	19,224	1,526,028	66,674	1,489,364	9	1,187,024	-8.9	10 & 7	244,959	3.0	1,421,979	1,828,686	+7.0	4	37,749
KENTUCKY 5/	2,004,338	13,845	1,984,433	3,649	1,980,844	6	1,722,133	-6.5	6	248,942	9.5	1,971,070	2,057,850	-4.2	VARIOUS	9,769
LOUISIANA	2,254,230	15,118	2,273,112	12,138	2,266,917	9	1,974,269	-0.5	9	292,648	4.2	2,266,917	2,400,123	+5.5	-	-
MAINE	572,907	2,676	569,928	296	569,272	6	804,721	-4.9	6	85,482	-0.5	560,202	586,342	-4.6	1 & 4	8,049
MARYLAND	2,110,053	26,593	2,082,460	12,776	2,070,684	6	1,900,375	-9.5	6	160,049	8.4	2,063,220	2,066,239	0.1	9 & 5	1,444
MASSACHUSETTS	2,456,673	33,595	2,423,084	6,056	2,414,028	9.0	8,263,406	-8.4	6.0	150,622	-14.3	2,414,028	2,568,621	-6.0	-	-
MICHIGAN	4,586,813	135,360	4,451,453	87,123	4,364,224	11	4,027,717	-10.6	11	312,776	-11.2	4,390,432	4,966,432	-10.6	3	13,831
MINNESOTA	2,256,247	33,351	2,299,896	94,220	2,205,676	11	1,951,186	-9.6	11	253,976	-14.0	2,203,162	2,261,454	-6.6	2.7	514
MISSISSIPPI	1,409,461	19,816	1,390,648	-	1,390,648	6	1,164,301	-8.5	10 & 5	215,357	17.0	1,379,658	1,449,708	-4.8	1	10,987
MISSOURI	2,966,710	36,573	2,620,142	92,779	2,832,363	2	2,468,274	-8.3	7	344,099	-1.9	2,832,363	2,931,437	-5.3	-	-
MONTANA	858,330	-	558,360	21,143	827,921	6	422,268	-8.9	11 & 0	99,028	-2.6	522,204	549,644	-5.8	1	5,515
NEBRASKA	939,557	11,106	988,401	371	388,038	19.6	762,906	-6.5	19.6	153,233	4.2	917,239	963,670	-4.8	VARIOUS	70,791
NEVADA	570,727	6,432	864,268	8,848	850,458	6	483,088	-1.1	8	72,367	-8.8	599,490	560,823	-1.0	-	-
NEW HAMPSHIRE	423,187	10,447	418,740	6,902	412,238	11	970,834	-15.7	11	28,418	7.7	407,292	450,400	-6.6	4 & 6	4,986
NEW JERSEY	2,604,162	34,762	3,506,400	13,620	3,483,788	8	2,144,618	-1.7	8 & 4	343,170	1.4	9,489,788	3,540,066	-1.4	-	-
NEW MEXICO	501,483	14,464	586,365	8,723	881,256	8	723,102	-0.8	8	158,102	-0.6	881,256	926,331	-4.9	-	-
NEW YORK	6,015,208	920,283	5,684,528	84,306	5,638,463	8	5,258,048	-7.0	10 & 8	326,842	3.5	5,579,987	5,967,865	-6.9	2	80,582
NORTH CAROLINA	2,315,426	71,146	3,244,280	120	3,244,160	8	2,770,398	-6.7	6	980,672	-4.0	9,159,320	2,274,848	-6.4	1 & 5	84,830
NORTH DAKOTA	487,218	7,476	476,742	71,317	405,425	8	314,946	-12.4	8	79,968	1.1	394,934	438,458	-9.9	4	12,491
OHIO	5,682,627	71,580	5,610,747	124,727	8,486,020	2	4,778,847	-8.4	7	691,052	-0.8	8,469,899	8,912,938	-7.8	1	16,121
OKLAHOMA	2,157,852	156,606	2,001,246	-	2,001,246	6.5	1,663,890	-1.5	8.5	993,779	-0.7	1,956,829	1,996,141	-9.1	0.5 & 2	44,423
OREGON 5/	1,575,204	232,507	1,342,697	22,145	1,220,052	7	1,239,809	-9.6	7	12,894	40.8	1,313,747	1,342,677	-2.6	2	6,805
PENNSYLVANIA	8,440,310	122,620	8,217,390	20,413	8,231,667	11	4,971,249	-6.4	11	704,460	-6.4	8,201,802	5,442,566	-6.4	1.5	10,168
RHODE ISLAND	410,203	10,013	400,190	8,313	331,277	10	365,712	-8.9	10	25,565	10.7	391,977	407,717	-4.0	-	-
SOUTH CAROLINA	1,796,775	15,264	1,781,511	11,433	1,770,078	11	1,521,728	-6.1	11	234,468	-1.4	1,756,206	1,858,424	-5.8	1 & 6	12,872
SOUTH DAKOTA	436,778	2,921	483,244	60,988	428,253	12	338,846	-13.2	12 & 16	73,258	-8.4	412,104	470,049	-12.2	4 & 8	16,130
TENNESSEE	2,810,460	43,322	2,761,132	67,621	2,633,511	7	2,297,900	-8.8	8 & 7	299,663	-0.1	2,691,871	9,812,820	-4.3	1	1,640
TEXAS	3,310,438	201,118	8,067,280	133,276	8,328,104	8	2,674,872	-9.0	6.5 & 8	1,130,371	0.3	8,843,042	3,421,142	-7.9	4 & 6	62,061
UTAH	845,602	63,341	776,261	7,168	766,066	6	651,781	-6.4	8	110,612	2.4	762,363	804,477	-5.2	4	6,733
VERMONT	238,842	1,622	237,221	-	237,221	8	237,221	-6.5	8	-	0.0	237,221	252,238	-6.8	-	-
VIRGINIA 5/	2,320,815	80,723	2,840,035	20,221	2,813,974	11	2,485,913	-8.2	11	321,618	-2.6	2,807,421	9,952,841	-4.9	VARIOUS	12,449
WASHINGTON	2,108,414	23,296	2,073,118	32,257	2,845,761	12	1,803,401	-2.5	12	216,028	-8.5	2,021,426	2,175,624	-7.1	2 & 10	24,335
WEST VIRGINIA	369,722	8,846	360,887	5,422	385,465	10.5	890,941	-8.2	10.5	124,435	27.9	953,376	974,244	-1.6	6 & 8	89
WISCONSIN	2,488,106	25,482	2,462,623	76,182	2,286,441	3	2,079,300	-7.2	8	907,141	-1.5	9,284,441	2,551,926	-6.5	-	-
WYOMING	461,577	6,277	455,700	16,236	423,264	8	939,654	-9.6	0	83,333	-0.3	492,997	445,903	-2.9	VARIOUS	6,377
TOTAL	120,108,261	8,857,690	117,250,571	1,712,957	118,597,614	8.28	101,514,728	-6.9	8.46	12,960,007	-1.2	114,774,739	121,712,555	-5.7	2.62	762,879
PERCENTAGE	100.00	2.38	97.62	1.42	66.13	-	84.52	-	-	11.04	-	95.56	-	-	-	0.63

1/ THIS TABLE INCLUDES DATA ON ALL MOTOR-FUELS SUBJECT TO STATE MOTOR-FUEL TAXES, EXCEPT SPECIAL FUELS (FUELS OTHER THAN GASOLINE AND GASOHOL) USED FOR NONHIGHWAY PURPOSES. IT IS NOT INTENDED TO REFLECT THE AMOUNT OF FUEL USED ON HIGHWAYS. FOR AN ANALYSIS OF MOTOR-FUEL USAGE, SEE OTHER TABLES IN THIS SERIES.

2/ EXPORT SALES AND OTHER AMOUNTS NOT CONSUMED AS MOTOR FUEL IN STATE HAVE BEEN EXCLUDED WHEREVER POSSIBLE.

3/ INCLUDES FEDERAL USE, OTHER PUBLIC USE, CERTAIN TRANSIT USE, NONHIGHWAY USE WHERE INITIAL EXEMPTIONS RATHER THAN REFUNDS ARE MADE, AND ALLOWANCES FOR EVAPORATION AND OTHER LOSSES. THE MAXIMUM ALLOWANCE USED IN THE ANALYSIS TO COVER LOSSES IN STORAGE AND HANDLING WAS ONE PERCENT.

4/ SOME STATES HAVE TAX RATES WHICH VARY ACCORDING TO THE PRICE OF THE FUEL BUT THEY ARE INDEXED AT SPECIFIC INTERVALS AND CONVERTED TO CENTS PER GALLON. THIS INFORMATION IS SHOWN ON TABLE MF-121 WHICH IS AVAILABLE FROM THE HIGHWAY STATISTICS DIVISION (HHP-42), FEDERAL HIGHWAY ADMINISTRATION.

5/ WHERE TWO TAX RATES ARE SHOWN FOR A STATE, THE FIRST APPLIES TO DIESEL FUEL AND THE SECOND TO LIQUEFIED PETROLEUM GASES. SOME STATES IMPOSE ADDITIONAL REGISTRATION FEES OR MILEAGE TAXES ON VEHICLES USING SPECIAL FUELS. SUCH ADDITIONAL FEES IN VERMONT AND WYOMING ARE IN LIEU OF GALLONAGE TAXES.

6/ IN SOME STATES, FUEL USED FOR SPECIFIC PURPOSES IS TAXED OR REFUNDED AT RATES OTHER THAN THE PREVAILING RATES SHOWN IN COLUMNS 6 AND 9. IN THE CASE OF AVIATION FUEL, ONLY AVIATION GASOLINE IS INCLUDED.

7/ TAX RATE CHANGES DURING 1980 WERE: APRIL 1- SOUTH DAKOTA, 9 TO 12 CENTS (GASOLINE AND DIESEL); 7 TO 10 CENTS (LPG); MAY 1- MICHIGAN, 6 TO 11 CENTS (DIESEL); MINNESOTA, 9 TO 11 CENTS; WISCONSIN, 7 TO 9 CENTS; JULY 1- KENTUCKY, 9 PERCENT OF AVERAGE WHOLESALE PRICE BUT EFFECTIVE RATE 9 CENTS; INDIANA, 8 TO 8.5 CENTS; NEW MEXICO, 7 TO 8 CENTS; AND VIRGINIA, 9 TO 11 CENTS; AUGUST 1 - ALABAMA, 7 TO 11 CENTS (GASOLINE), 8 TO 12 CENTS (SPECIAL FUELS); AND MASSACHUSETTS, 8.5 CENTS TO 11.6 CENTS, REDUCED TO 9.5 CENTS, OCTOBER 1; OCTOBER 1- NEBRASKA, 10.5 TO 13.9 CENTS AND TO 13.6 CENTS, NOVEMBER 1; NOVEMBER 1- SOUTH CAROLINA, 10 TO 11 CENTS; DECEMBER 1- DISTRICT OF COLUMBIA, 10 TO 11 CENTS.

8/ TRUCKS OR COMBINATIONS WITH MORE THAN 9 AXLES PAY AN 11-CENT TAX IN KENTUCKY AND 19 CENTS IN VIRGINIA.

9/ OREGON SPECIAL FUELS DATA ARE ESTIMATED BY THE STATE.

10/ WEIGHTED AVERAGE TAX RATE. THE WEIGHTED AVERAGE RATE FOR ALL MOTOR FUEL WAS 8.24 CENTS PER GALLON.

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 1980.

EXHIBIT 9 Average Maintenance Cost Multipliers for each Income Group

Income Group (1977$)	Average Maintenance Cost Multiplier. *
0 - $9,999	0.906
$10,000 - $19,999	0.987
$20,000 +	1.167

* Values estimated from previous study results and from Final Report on the Federal Highway Cost Allocation Study, USDOT, FHWA, May 1982.

The values for the other income groups follow the same methodology.

Once the above data items have been collected, the sector energy consumption model for households can be developed for each scenario. Notice that for each scenario, the fuel price obtained from Exhibit 4 has been broken down into fuel taxes and fuel price minus taxes. This is shown in Column E and F of Exhibit 10.

Model Estimation

The calculations to determine the impacts of the three scenarios are first performed to assess the household transportation expenditures for the base year before any transportation policy/action has taken place. The results for the first scenario can be found in Exhibit 10. The actual steps to be performed are as follows:

- First, vehicle miles traveled per household in Column A is multiplied by the fuel consumption rate in column B, to obtain an estimate of the annual number of gallons consumed per household, found in Column C.

- Second, this total gallons figure is then multiplied by the fuel price in Column F and the tax rate in Column E, to obtain the total fuel expenditures and the total tax expenditures found in Columns G and H, respectively. The total fuel price in Column D is obtained from Exhibit 4.

EXHIBIT 10 Average Household Transportation Expenditures by Income Class in 1982 (1977$)

Income Level	Average Annual VMT/HH	Fuel Rate (Gallons/Mile)*	Total Gallons	Total Fuel Price ($/Gallon)	Tax Rate ($/Gallon)	Fuel Price Minus Taxes ($/Gallon)	Fuel Expenditures ($)	Tax Expenditures ($)	Maintenance Cost ($/Vehicle-Mile)	Maintenance Expenditures ($)	Total Household Transportation Expenditures ($)
Less Than $10,000	8,631	0.0592	511	0.96	0.09	0.87	444.57	45.99	0.0564	486.79	977.35
$10,000 to $19,999	16,596	0.0592	982	0.96	0.09	0.87	854.34	88.38	0.0615	1,020.65	1,963.37
$20,000 and Over	20,696	0.0592	1,225	0.96	0.09	0.87	1,065.75	110.25	0.0727	1,504.60	2,680.60
	(A)	(B)	(C)=(A)x(B)	(D)	(E)	(F)=(D)-(E)	(G)=(F)x(C)	(H)=(E)x(C)	(I)	(J)=(I)x(A)	(K)=(G)+(H)+(J)

* Notice this is the inverse of fuel efficiency (miles/gallon). These values are found in Exhibit 3.

- Third, the vehicle miles traveled per household from Column A is then multiplied by the maintenance cost per vehicle mile in Column I to give the total maintenance expenditures found in Column J.

- Fourth, the total household transportation expenditure is shown in Column H of Exhibit 10 and is the sum of the fuel expenditures (G) plus the tax expenditures (H) plus the maintenance expenditures (J).

- Fifth, the elasticity for fuel price is considered in this step. The proposed 5 cent per gallon tax increase in Scenario 1 translates into a 5.2 percent increase in the total fuel price ((1.01 - 0.96)/0.96 = 5.2 percent). The effect of this 5.2 percent increase in fuel price is simulated by applying the short run price elasticity for gasoline of -0.11 (FEA, 1975). There are other elasticity figures which can be used; however, this estimate represents a median value from a large number of projections. If a more appropriate value is known for a local situation, then it should be selected.

- Sixth, the percentage reduction in gallons consumed, due to the tax increase, is then obtained by multiplying the 5.2 percent increase in fuel price by the price elasticity, -0.11, resulting in a 0.572 percent reduction in total gallons consumed. Then, given the same fuel efficiency rate, revised vehicle miles of travel values are calculated from the reduced gallons consumed. The following steps highlight the process:

Percent Change in
Fuel Consumed = percent change in price * elasticity value
= 5.2 * (-0.11)
= -0.572

Change In
Gallons Consumed$_i$ = original value * percent change in fuel consumed/100
= 511 * (-0.572/100)
= -2.9

Gallons Consumed
After Price Change$_i$ = original value + change in gallons consumed$_i$
= 511 + (-2.9)
= 508.1

Vehicle Miles of Travel
After Price Change$_i$ = gallons consumed after price change$_i$ ÷ original fuel rate
= 508.1/0.0592
= 8582

i = for lowest income group

The other income groups follow a similar methodology.

Exhibit 11 shows the results of the tax increase in the same format as Exhibit 10. Resulting changes in household transportation expenditures can be determined by comparing the two exhibits. It is important to point out that all three cost components, fuel, tax and maintenance, are projected to possess different values before and after the fuel tax increases because of expected changes in the household vehicle miles of travel.

The second scenario is a demonstration of the effects of changes in fuel price and efficiency over time, from 1980 to 2000. In order to determine the changes in household transportation expenditures, it is necessary to update the fuel (Column D) and maintenance prices (Column I) and the fuel consumption rate (Column B) to reflect the years 1980 and 2000. Notice the

EXHIBIT 11 Average Household Transportation Expenditures by Income Class Resulting from a 5¢ Fuel Tax Increase in 1982 (1977$)

Income Level	Average Annual VMT/HH	Fuel Rate (Gallons/Mile)*	Total Gallons	Total Fuel Price ($/Gallon)	Tax Rate ($/Gallon)	Fuel Price Minus Taxes ($/Gallon)	Fuel Expenditures ($)	Tax Expenditures ($)	Maintenance Cost ($/Vehicle-Mile)	Maintenance Expenditures ($)	Total Household Transportation Expenditures ($)
Less Than $10,000	8,582	0.0592	508	1.010	0.14	0.87	441.96	71.12	0.0564	484.03	997.11
$10,000 to $19,999	16,501	0.0592	976	1.010	0.14	0.87	849.12	136.64	0.0615	1,014.81	2,000.57
$20,000 and Over	20,578	0.0592	1,218	1.010	0.14	0.87	1,059.66	170.52	0.0727	1,496.02	2,726.20
	(A)	(B)	(C)=(A)x(B)	(D)	(E)	(F)=(D)-(E)	(G)=(F)x(C)	(H)=(E)x(C)	(I)	(J)=(I)x(A)	(K)=(G)+(H)+(J)

* Notice this is the inverse of fuel efficiency (miles/gallon). These values are found in Exhibit 3.

VMT per household (Column A) remains constant as previously discussed. According to information in Exhibits 3 and 4, recalculation of the expenditures for transportation is made. Exhibit 12 shows the household transportation expenditures for 1980 and Exhibit 13 shows the household transportation expenditures for 2000. By comparing Exhibits 12 and 13, it is possible to determine the changes in household transportation expenditures as a result of Scenario 2.

For the purpose of the third scenario, the assumption is made that transportation systems management (TSM) actions are implemented throughout the area resulting in an annual 10 percent reduction in fuel consumption by 1987. Appendix II documents the methodology used to determine this percent reduction. To quantify the effects of this scenario, a baseline projection for household transportation expenditures in 1987 must be prepared as if the TSM actions were not undertaken. Exhibit 14 contains this 1987 baseline projection, which was prepared by updating the fuel and maintenance prices and the fuel consumption rate from information in Exhibits 3 and 4.

Next, assuming transportation actions are in place, a 10 percent reduction in fuel consumption must be accounted for. In this type of scenario it is important to determine how the anticipated 10 percent improvement is achieved. In order to do this the local planner must isolate the source of the improvement (see Appendix II). For this scenario it is assumed that the VMT per household will decrease 0.51 percent due to increases in transit ridership and the fuel rate will decrease 9.67 percent due to speed improvements from signal and capacity improvements. It is also assumed that

EXHIBIT 12 Average Household Transportation Expenditures by Income Class in 1980 (1977$)

Income Level	Average Annual VMT/HH	Fuel Rate (Gallons/Mile)*	Total Gallons	Total Fuel Price ($/Gallon)	Tax Rate ($/Gallon)	Fuel Price Minus Taxes ($/Gallon)	Fuel Expenditures ($)	Tax Expenditures ($)	Maintenance Cost ($/Vehicle-Mile)	Maintenance Expenditures ($)	Total Household Transportation Expenditures
Less Than $10,000	8,631	0.0698	602	0.88	0.09	0.79	475.58	54.18	0.0562	485.06	1,014.82
$10,000 to $19,999	16,596	0.0698	1,158	0.88	0.09	0.79	914.82	104.22	0.0612	1,015.68	2,034.72
$20,000 and Over	20,696	0.0698	1,445	0.88	0.09	0.79	1,141.55	130.05	0.0724	1,498.39	2,769.99
	(A)	(B)	(C)=(A)x(B)	(D)	(E)	(F)=(D)-(E)	(G)=(F)x(C)	(H)=(E)x(C)	(I)	(J)=(I)x(A)	(K)=(G)+(H)+(J)

* Notice this is the inverse of fuel efficiency (miles/gallon). These values are found in Exhibit 3.

EXHIBIT 13 Average Household Transportation Expenditures by Income Class in 2000 (1977$)

Income Level	Average Annual VMT/HH	Fuel Rate (Gallons/Mile)*	Total Gallons	Total Fuel Price ($/Gallon)	Tax Rate ($/Gallon)	Fuel Price Minus Taxes ($/Gallon)	Fuel Expenditures ($)	Tax Expenditures ($)	Maintenance Cost ($/Vehicle-Mile)	Maintenance Expenditures ($)	Total Household Transportation Expenditures ($)
Less Than $10,000	8,631	0.038	328	1.58	0.09	1.49	488.72	29.52	0.0589	508.37	1,026.61
$10,000 to $19,999	16,596	0.038	631	1.58	0.09	1.49	940.19	56.79	0.0642	1,065.46	2,062.44
$20,000 and Over	20,696	0.038	787	1.58	0.09	1.49	1,172.63	70.83	0.0759	1,570.83	2,814.29
	(A)	(B)	(C)=(A)x(B)	(D)	(E)	(F)=(D)-(E)	(G)=(F)x(C)	(H)=(E)x(C)	(I)	(J)=(I)x(A)	(K)=(G)+(H)+(J)

* Notice this is the inverse of fuel efficiency (miles/gallon). These values are found in Exhibit 3.

EXHIBIT 14 Average Household Transportation Expenditures by Income Class in 1987 (1977$)

Income Level	Average Annual VMT/HH	Fuel Rate (Gallons/Mile)*	Total Gallons	Total Fuel Price ($/Gallon)	Tax Rate ($/Gallon)	Fuel Price Minus Taxes ($/Gallon)	Fuel Expenditures ($)	Tax Expenditures ($)	Maintenance Cost ($/Vehicle-Mile)	Maintenance Expenditures ($)	Total Household Transportation Expenditures ($)
Less Than $10,000	8,631	0.0455	392	1.15	0.09	1.06	415.52	35.28	0.0571	492.83	943.63
$10,000 to $19,999	16,596	0.0455	755	1.15	0.09	1.06	800.30	67.95	0.0622	1,032.27	1,900.52
$20,000 and Over	20,696	0.0455	942	1.15	0.09	1.06	998.52	84.78	0.0735	1,521.16	2,634.46
	(A)	(B)	(C)=(A)x(B)	(D)	(E)	(F)=(D)-(E)	(G)=(F)x(C)	(H)=(E)x(C)	(I)	(J)=(I)x(A)	(K)=(G)+(H)+(J)

* Notice this is the inverse of fuel efficiency (miles/gallon). These values are found in Exhibit 3.

fuel prices do not change as a result of the reduced demand in this one urban area. The net effect is a 10 percent reduction in fuel consumption. The result of this adjustment is shown in Exhibit 15.

To demonstrate this methodology, the following steps are necessary:

Vehicle Miles of Travel$_i$ = 8631 (from Column A of Exhibit 14) * (1-.0051)
= 8587 (see Column A of Exhibit 15)

Fuel Consumption Rate = 0.0455 (from Column B of Exhibit 14) * (1-.0967)
= 0.0411 (see Column B of Exhibit 15)

i = for the lowest income group

The other income groups in Exhibit 15 follow a similar methodology. The remaining information is calculated as previously described. The effect of the TSM actions on household transportation costs can now be determined by comparing the total household expenditures in Exhibits 14 and 15.

STEP 5 - CHANGES IN QUANTITIES OF AND EXPENDITURES FOR FUELS BY SECTOR

This step in the analysis involves the estimation of changes in household consumption patterns resulting from changes in the expenditures on transportation. Once again, there are a variety of easily obtainable data items needed in order to carry out this step. They are listed below.

Sectors Affected By Household Expenditures

As was mentioned previously, sector definitions tend to vary between economic regions of the country. Consequently, for whatever sector definitions are to be used in the study, those sectors that are affected by household expendi-

EXHIBIT 15 Average Household Transportation Expenditures by Income Class Resulting from a 10% Improvement in Fuel Efficiency in 1987 (1977$)

Income Level	Average Annual VMT/HH	Fuel Rate (Gallons/Mile)*	Total Gallons	Total Fuel Price ($/Gallon)	Tax Rate ($/Gallon)	Fuel Price Minus Taxes ($/Gallon)	Fuel Expenditures ($)	Tax Expenditures ($)	Maintenance Cost ($/Vehicle-Mile)	Maintenance Expenditures ($)	Total Household Transportation Expenditures ($)
Less Than $10,000	8,587	0.0411	353	1.15	0.09	1.06	374.18	31.77	0.0571	490.32	896.27
$10,000 to $19,999	16,513	0.0411	679	1.15	0.09	1.06	719.74	61.11	0.0622	1,027.11	1,807.96
$20,000 and Over	20,593	0.0411	846	1.15	0.09	1.06	896.76	76.14	0.0735	1,513.59	2,486.49
	(A)	(B)	(C)=(A)x(B)	(O)	(E)	(F)=(O)-(E)	(G)=(F)x(C)	(H)=(E)x(C)	(I)	(J)=(I)x(A)	(K)=(G)+(H)+(J)

* Notice this is the inverse of fuel efficiency (miles/gallon). These values are found in Exhibit 3.

tures need to be singled out. The sectors listed in Exhibit 16 are the economic sectors which are affected by household expenditures in the Dallas-Fort Worth area.

Income Elasticities by Sector

For those household related sectors in the Dallas-Fort Worth area, income elasticities have been developed and are shown in Exhibit 16. Appendix III contains a discussion of the methodology used to develop the elasticity. Income elasticities should be developed for each particular economic region of the country; however, if this is not feasible the elasticities found in Exhibit 16 may be transferred to regions other than the Dallas-Fort Worth SMSA.

Average Income Per Income Group

The average income within the income levels specified in this analysis are required and can be found in Exhibit 17. For simplicity, these average values by income group remain constant over time. The following section accounts for changes in income levels over time.

Distribution of Households by Income Group

Exhibit 18 contains the percentage of households per income group for the United States. These percentages vary with time and are presented for 1977 to 2000. It is assumed here that the percentage of households per income group for the Dallas-Fort Worth SMSA is not significantly different from those values shown in Exhibit 18 for the United States. This assumption is necessary for two reasons. First, income data at the local level is

EXHIBIT 16 Income Elasticities by Sector

Sector Number*	Sector Name	Income Levels: less than $10,000	$10,000 to $19,999	$20,000 and up
29	Transportation & Warehousing	0.137	0.415	1.121
30	Telephone & Telegraph	0.489	0.308	0.318
31	TV, Radio, & Other Communications	0.410	0.092	0.095
32	Gas Services	0.230	0.131	0.438
33	Electric Services	0.436	0.713	0.321
34	Water & Sanitation Services	0.364	0.543	0.356
40	Building Materials, Hardware and Equipment	0.315	1.002	0.438
41	Department and Variety Stores	0.820	0.841	0.752
42	Food Stores	0.396	0.513	0.230
43	Auto Dealers & Service Stations	0.809	0.575	0.144
44	Apparel and Accessories Stores	0.724	0.728	0.521
45	Furniture and Home Equipment	0.725	0.659	0.589
46	Eating and Drinking Places	0.812	0.983	0.479
47	Other Retail	0.527	0.994	0.421
48	Banking and Credit Agencies	1.492	1.388	0.515
49	Insurance Carriers	0.677	0.556	0.234
50	Finance, Insurance, & Real Estate	0.372	0.010	0.182
51	Legal Accounting, Engineering, and Professional Services	0.367	3.213	0.507
52	Lodging Services	1.312	1.666	1.058
53	Personal Services	0.463	0.407	0.690
56	Misc. Repair Services	0.629	1.300	0.680
57	Medical & Other Health Services	0.411	0.662	0.336
58	Education Services	1.008	1.402	0.604
59	Other Services	0.560	1.181	1.007

* The above sectors are those as defined by the 1972 Dallas-Fort Worth Input-Output Model.

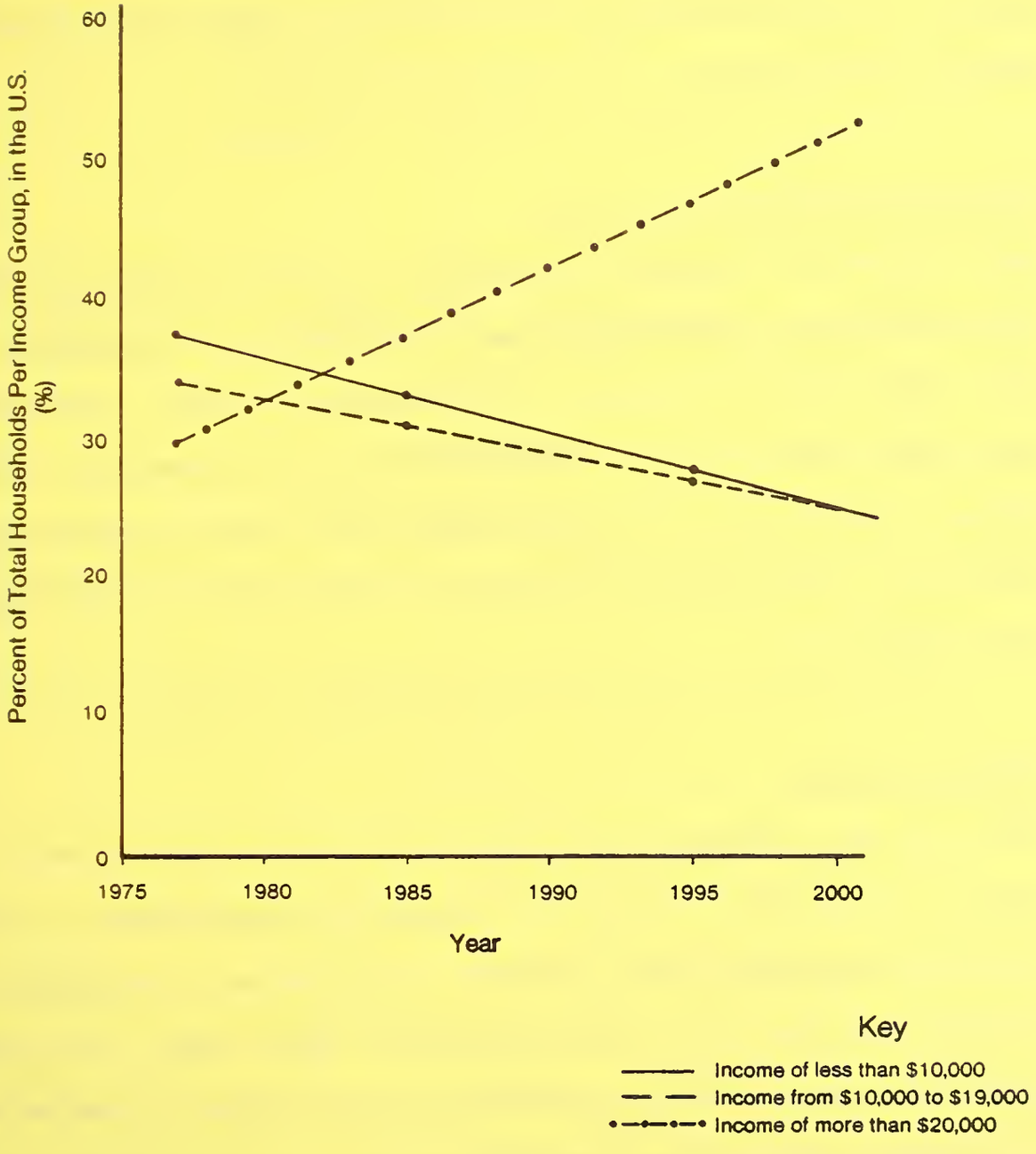
Source: William G. Barker and Associates, project memorandum, August 25, 1982 (see Appendix III)

EXHIBIT 17 Average National Income Per Household by Income Group

Income Group (1977$)	Average Income Per Income Group (1977$)
0 - $9,999	$ 5,362.30
$10,000 - $19,999	$14,670.28
$20,000 +	$31,023.13

Source: U.S. Department of Commerce, Bureau of the Census, Money Income in 1977 of Households in the United States, P-60 Series.

EXHIBIT 18 Percentage of Households by Income Group, for the United States, from 1977-2000



Source: U.S. Department of Commerce, Bureau of the Census, Illustrated Projections of Money Income Size Distributions for Households: 1980 to 1995. March, 1980.

difficult to collect and can often be extremely biased. Second, local jurisdictions often adopt national trends anyway, because of the sensitivity of national policy on income levels. The percentages should be determined for the appropriate year for each scenario of the analysis. For example, by using the information in Exhibit 18 it can be determined for 1982 that 34 percent of the households are in the lowest income group, 32 percent in the middle, and 34 percent in the highest income class.

Household Expenditures by Sector

These values are presented in Appendix IV and were obtained from the 1972 Dallas-Fort Worth Input-Output Model. This information should be obtained for each study region by adapting the "household" column information from the input-output table or from a detailed household expenditure survey for that region. In the case of the Dallas-Fort Worth area, an input-output model was available. Local household expenditure data by sector is contained in Column 62 of Appendix IV.

Population Ratios

There are two adjustments that need to be made to the household expenditure values to accurately convert 1972 household expenditures to 1977 values--increase in population and inflation. Since the total household expenditures are developed for 1972 in the Dallas-Fort Worth area, it is necessary to update these expenditures to account for the increase in population. Exhibit 19 contains ratios of the population for the years evaluated in the three chosen scenarios to the 1972 population. Other population ratios would need to be derived for locally developed scenarios. Adjustments to account for

EXHIBIT 19 Population Ratios

Corresponding Scenario	Scenario Year Population/ Input-Output Year Population	Ratio
1	1982/1972	1.239
2	2000/1972	1.778
3	1987/1972	1.370

Source: Population estimates from the North Central Texas Council of Governments.

inflation, represented by changes in the value of the dollar from 1972 to 1977, are addressed in Exhibit 21 and Appendix V.

Model Estimation

In order to begin execution of this step of the analysis, it is first necessary to determine the percent change in income as a result of each scenario. Exhibit 20 contains this information for each scenario. Shown here are the total household transportation expenditures both before and after the scenario action, obtained from Exhibits 10-15. The percent change between these two values is calculated in Column C. The average income per income group is shown in Column D and was obtained from Exhibit 17. The initial household transportation expenditures from Column A is then divided by the average income in Column D to obtain the transportation expenditures as a fraction of the income found in Column E. The values of these ratios are consistent with current thinking on the subject (Zahavi, 1977). The percent change in income is determined by multiplying columns C by E and by -1. This negative value converts expenditure values to income values. This "revised" income impacts the household purchasing power for other commodities.

It is now possible to calculate the percent change in total expenditures for each scenario by sector and income group. The entire set of calculations can be found in Appendix V. A partial table, shown in Exhibit 21, serves to better explain the method. The first column shown contains the numbers of the sectors that are household related. Notice that these sectors correspond to the local sectors from the Input-Output Model, in order to apply the

EXHIBIT 20 The Percent Change in Income for Scenarios 1, 2 and 3

Scenario 1: Five-Cent Increase in Fuel Tax in 1982

Income Level	Household Transportation Expenditures Before ($)	Household Transportation Expenditures After ($)	Percent Change (%)	Average Income per Income Level ($)	Transportation Expenditures as a Fraction of Income	Percent Change In Income (%)
Less than $10,000	977.35	997.11	+2.0	5362.30	0.1823	-0.3645
$10,000 to $19,999	1963.37	2000.57	+1.9	14670.28	0.1338	-0.2543
$20,000 and up	2680.60	2726.20	+1.7	31023.13	0.0864	-0.1469
	(A)	(B)	(C)= $\frac{(B)-(A)}{(A)}$ x100	(D)	(E)=(A)/(D)	(F)=-(C)x(E)

Scenario 2: Long Range Fuel Use and Price Trends by 2000

Less than $10,000	1014.82	1026.61	+1.2	5362.30	0.1893	-0.2272
$10,000 to $19,999	2034.72	2062.44	+1.4	14670.28	0.1387	-0.1942
$20,000 and up	2769.99	2814.29	+1.6	31023.13	0.0893	-0.1429
	(A)	(B)	(C)= $\frac{(B)-(A)}{(A)}$ x100	(D)	(E)=(A)/(D)	(F)=-(C)x(E)

Scenario 3: Ten Percent Reduction in Fuel Use by 1987

Less than $10,000	943.63	896.27	-5.0	5362.30	0.1760	+0.8799
$10,000 to $19,999	1900.52	1807.96	-4.9	14670.28	0.1296	+0.6348
$20,000 and up	2634.46	2486.49	-5.6	31023.13	0.0849	+0.4755
	(A)	(B)	(C)= $\frac{(B)-(A)}{(A)}$ x100	(D)	(E)=(A)/(D)	(F)=-(C)x(E)

EXHIBIT 21 Scenario 1: Change in Group Expenditures Due to a 5¢ Per Gallon Tax Increase in 1982 (1977$)

Income Level = Less Than $10,000

Sector Number	Percent Change In Income	Income Elasticity	Percent Change In Expenditures	Fraction of Households	Percent Change In Group Expenditures	1972 Household Expenditures (in 1000's)	Population Multipliers	Change In Expenditures (1977$)
29	-0.3645	0.137	-0.049937	.34	-0.0169786	304966.37	1.239	-64154.21
30	-0.3645	0.489	-0.178241	.34	-0.0606019	125975.61	1.239	-94589.74
.								
.								
.								
42	-0.3645	0.396	-0.144342	.34	-0.0490763	485285.95	1.239	-295080.72
.								
.								
.								
.								
47	-0.3645	0.527	-0.192092	.34	-0.0653113	356455.01	1.239	-288445.89
.								
.								
.								
.								
.								
59	-0.3645	0.560	-0.204120	.34	-0.0694008	164590.68	1.239	-141527.56
	(A)	(B)	(C)=(A)x(B)	(D)	(E)=(C)x(D)	(F)	(G)	(H)=$\frac{(E)*(F)*(G)*1000}{100}$

Column F expenditures have been converted to 1977$ using values from the Dallas-Fort Worth Consumer Price Index. The value used to convert 1972$ to 1977$ are contained in Appendix VI.

previously mentioned income elasticities. The percent change in income from Exhibit 20 is found in Column A. The income elasticities for each sector from Exhibit 16 are found in Column B. Column C contains the percent change in expenditures and is obtained by multiplying Column A by Column B. The fraction of households per income group from Exhibit 18 is found in Column D. By multiplying the values in Column C by Column D, the percent change in group expenditures is obtained and shown in Column E. The household expenditures for each sector are shown in column F. These values were converted from 1972$, shown in the 1972 Input-Output Model (Column 62 of Appendix IV), to 1977$ using Consumer Price Index (CPI) values for the Dallas-Fort Worth area.

The following steps highlight the use of the CPI:

$$\text{1972 Household Expenditures in 1977\$}_j = \text{1972 Household Expenditures in 1972\$} * CPI_{1977}/CPI_{1972}$$

$$= 211377.908 * 180.2/124.9$$

$$= 304966.37$$

$$j = \text{example Sector Number 29}$$

This methodology applies for all other sectors. Appendix VI contains the Dallas-Fort Worth and national CPI tables for various years.

Column G contains the population multiplier for 1982 necessary to convert the 1972 Household Expenditures to 1982 Household Expenditures. Finally, Column H contains the change in expenditures for each sector by income level and scenario. This value is calculated by dividing Column E by 100 and then multiplying this number by the values in Columns F and G and converting to dollars from thousands of dollars. The complete results for all three scenarios and all three income groups are contained in Appendix V.

SUMMARY

This chapter has summarized the process used to estimate changes in a wide range of household expenditures resulting from changes in transportation expenditures. The effect of these changes in transportation expenditures is to lower or raise household income and thus to reduce or increase the amount of that income which can be spent for other goods and services.

This household energy consumption modeling procedure is the central model in the planning manual. The basic function of this model is to replicate the decisions a household makes with regard to purchasing goods and services. As a result, the conversion of transportation policies into economic choices can take place. The household decision-making unit is gaining support as not only a major component of economic decision making, but the central decision-making component in several other transportation related decisions (e.g., residential choice, trip generation, mode split, and route choice).

The trucking sector energy consumption model adds completeness to the overall approach and is discussed in the following chapter. If truck analysis is not warranted continue to Chapter V.

IV. SECTOR ENERGY CONSUMPTION - TRUCKS

The purpose of this section is to determine the economic impacts of changes in fuel price and efficiency on truck travel within an economic region. This chapter presents a detailed methodology and example applications for the Dallas-Fort Worth area. Steps 4 and 5 in the planning manual are combined for the truck sectors because a more straightforward approach is used to address truck impacts. There are two reasons for merging these steps. First, commercial trucking expenditure patterns within a particular sector (e.g., agriculture) are not easily divided into income or revenue market segments. This assumes that larger businesses behave like smaller firms with regard to fuel efficiency and price impacts. This assumption is different from that for the household portion of the analysis, where segmentation on income levels was significant.

Second, it is difficult to obtain information on truck travel by economic sector and more difficult to apportion the information into small definitions or segmentations. This more simplified approach may lead to greater use of the trucking analysis since this aspect of the study is not the major component of investigation.

If the following analysis is too rigorous for a particular application, a default value to account for truck travel impacts is addressed in Chapter V.

STEP 4 AND 5 - SECTOR ENERGY CONSUMPTION MODEL AND THE CHANGE IN QUANTITIES OF AND EXPENDITURES FOR FUELS BY SECTOR

The overall process used to determine the impact of a change in fuel price and efficiency in the trucking sectors is similar to that used for the household sectors. The following information/data is used to determine the change in expenditures for the trucking sector.

Sector Number

The sector definitions used to evaluate the trucking sectors are obtained from the RIMS II process supported by the United States Department of Commerce. (U.S. Department of Commerce, 1981). A definition of the RIMS II sectors can be found in Appendix VII. The trucking sectors used in this analysis are represented later in Exhibit 23. Notice that the sectors evaluated in this chapter are not necessarily different than the sectors used in determining the economic impacts for the household sectors in Chapter V. Also notice that some economic sectors are not contained in either the household or trucking approaches since these sectors do not address either function.

1977 Total Trucks

Information on the total number of trucks is obtained from state vehicle registration data (U.S. Department of Commerce, 1977). The number of trucks within the Dallas-Fort Worth SMSA are estimated on the basis of the ratio of population in the SMSA to the state total. Exhibit 23, Column A, contains the estimated number of trucks in the Dallas-Fort Worth area. This level of truck activity represents 22 percent of the total state truck activity.

Travel Correction Factor

In order to determine the amount of truck travel for other than the base year, an adjustment of the 1977 values needs to be performed. Since population forecasts are often the most available demographic measure throughout the country, population changes are used to adjust truck travel for different years. Employment projections are not used because they are often not available as well as often tainted by both methodology errors and political intervention. Exhibit 22 contains the adjustment factors for the scenarios evaluated in this planning manual. Exhibit 23, Column B, demonstrates the use of the 1977 to 1982 truck travel correction factor of 1.121.

VMT per Truck per Year

In order to obtain estimates of annual vehicle miles of travel, the average annual VMT per truck must be determined. Average values were obtained from the Truck Inventory and Use Survey (U.S. Department of Commerce, 1977). The values for the sectors of interest are contained in Column C of Exhibit 23. The product of the number of trucks, the truck travel correction factor, and the average VMT per truck per year results in the total truck VMT for each sector for any given year (Column D). It is important to note that the truck travel correction factor results in adjustments to the truck VMT. It is therefore assumed that the truck VMT could result from either more trucks traveling the same, the same number of trucks traveling more, or combinations of the two. Therefore, this methodology does not pinpoint the component of the VMT change but simply the resultant VMT. It is also assumed in this

EXHIBIT 22 Adjustment Factors for Truck Travel in the Dallas-Fort Worth Area

Year	Ratio of Analysis Year Population to Baseyear Value	Fuel Consumption Adjustment Factors
1977/1977	1.00	1.00
1980/1977	1.104	0.97
1982/1977	1.121	0.95
1987/1977	1.250	0.90
2000/1977	1.609	0.77

Source: North Central Texas Council of Governments

EXHIBIT 23 Scenario 1: Total Trucking Expenditures by Sector in 1982 (1977$)

SECTOR NUMBER	1977 TOTAL TRUCKS	TRAVEL CORRECTION FACTOR	VMT/TRUCK/YEAR (IN 1000'S)	VMT (IN 1000'S)	1977 FUEL RATE (GALLONS/MI.)	CONSUMPTION CORRECTION FACTOR	TOTAL GALLONS (IN 1000'S)	FUEL PRICE MINUS TAXES ($/GALLON)	FUEL EXPENDITURES (IN 1000$)
1	48009	1.121	12	645907.62	.09	.95	55216.21	.37	48033.10
4	372	1.121	15	4570.68	.17	.95	733.65	.37	642.62
5	26543	1.121	19	565339.36	.09	.95	48336.52	.37	42052.77
8	10993	1.121	20	246463.06	.13	.95	30438.19	.87	26481.22
9	2717	1.121	19	57869.38	.13	.95	7146.87	.37	6217.78
11	2696	1.121	30	90666.48	.13	.95	11197.31	.37	9741.66
13	8841	1.121	19	188304.46	.13	.95	23255.60	.37	20232.37
17	2752	1.121	40	105912.08	.13	.95	13080.14	.37	11379.72
18	2997	1.121	21	52661.22	.13	.95	6503.66	.37	5658.19
19	3850	1.121	21	83641.17	.13	.95	10329.68	.37	8986.83
20	3604	1.121	11	81433.92	.13	.95	10057.09	.37	8749.67
21	11056	1.121	34	421398.28	.13	.95	52041.47	.37	45276.07
25	8319	1.121	21	195837.53	.13	.95	24185.94	.37	21041.77
27	10794	1.121	16	193421.32	.09	.95	16537.57	.37	14387.68
28	27172	1.121	19	578736.43	.09	.95	49481.96	.37	43049.31
29	9276	1.121	14	129883.54	.09	.95	11105.04	.37	9661.39
TOTALS	190430			3641936.19			369651.90		321597.15
	(A)	(B)	(C)	(D)=(A)*(B)*(C)	(E)	(F)	(G)=(D)*(E)*(F)	(H)	(I)=(G)*(H)

SECTOR NUMBER	TAX RATE ($/GALLON)	TAX EXPENDITURES (IN 1000$)	MAINTENANCE AND OVER-HEAD FACTOR	MAINTENANCE AND OVERHEAD EXPENDITURES (IN 1000$)	TOTAL EXPENDITURES (IN 1000$)
1	.09	4969.46	1.46	70173.63	123143.19
4	.09	66.48	1.46	939.23	1647.34
5	.09	4350.29	1.46	61397.04	107800.10
8	.09	2739.44	1.46	38662.59	67883.25
9	.09	643.22	1.46	9077.95	15938.95
11	.09	1007.75	1.46	14222.82	24972.24
13	.09	2093.80	1.46	29539.26	51864.64
17	.09	1177.21	1.46	16614.40	29171.33
18	.09	595.33	1.46	8260.95	14504.46
19	.09	929.87	1.46	13120.77	23037.26
20	.09	905.14	1.46	12774.52	22429.32
21	.09	4683.73	1.46	66103.07	116062.38
25	.09	2176.77	1.46	30720.98	53939.49
27	.09	1498.38	1.46	21006.02	36882.09
28	.09	4451.38	1.46	62951.39	110534.58
29	.09	999.45	1.46	14105.63	24766.47
TOTALS		32168.67		469531.34	824397.56
	(J)	(K)=(G)*(J)	(L)	(M)=(G)*(H)*(L)	(N)=(I)+(K)+(M)

methodology that truck VMT from Dallas-Fort Worth SMSA trucks is replaced by non-Dallas-Fort Worth SMSA trucks if truck VMT leaves the study region.

1977 Fuel Rate

Average fuel economy for various truck classes in the urban driving mode is summarized in the Truck Inventory and Use Survey. 1977 fuel consumption rates can be found in Column E of Exhibit 23.

Consumption Correction Factor

Since the fuel consumption rate of truck vehicles varies over time, an adjustment for improvements in efficiency must be accounted for. It is assumed that the efficiency of truck vehicles increases 1 percent per year between 1977 and 2000. These factors can be found in Exhibit 22. The 1977 to 1982 fuel consumption adjustment factor of 0.95 can be found in Column F of Exhibit 23.

Fuel Price and Fuel Tax

As discussed previously in Chapter III, it is assumed in this analysis that the pump price per gallon of fuel is the same for both cars and trucks. Exhibit 4 contains the estimated fuel price for different years. Fuel taxes per gallon are the same for both personal-use vehicles and trucks. Fuel price and tax values documented in the preceding chapter are used in this analysis. Column H and Column J of Exhibit 23 demonstrate these values for 1982.

Maintenance and Overhead Factor

In order to be consistent with the methodology established for the household sectors, estimates of maintenance costs need to be determined. Maintenance and overhead expenses are estimated at 1.46 times the fuel expenses. This is based on linehaul trucking cost estimates by Case (1979). Overhead expenses were assumed zero for the household sectors. This value is found in Column L of Exhibit 23.

This information highlights the input variables and parameters necessary to determine the economic impact of changes in fuel price and efficiency on truck travel within an economic region. Truck travel estimates for any region can be obtained from this approach and from the data sources cited.

MODEL ESTIMATION

The necessary steps to calculate the changes in expenditures which result from the three scenarios are similar to those found in Chapter III. The following information outlines the important components and distinctions to estimate the changes in expenditures.

There are two important assumptions in this analysis which distinguish it from the previous chapter. First, it is assumed that a fuel tax increase does not affect the existing expenditure arrangements among commercial sectors. This assumption is necessary because there is very little knowledge on elasticity values for each commercial sector. Second, it is assumed that a change in fuel price or efficiency does not alter the amount of truck travel for a given year. This assumption infers that present increases in

trucking costs will be passed on to the consumer. Therefore, truck fuel efficiency improvements will not lead to increased travel, and fuel price increases do not decrease travel.

Scenario 1 - 5 Cents Per Gallon Increase in Fuel Tax in 1982

Exhibit 23 contains the expenditures for fuel, tax, and maintenance for each trucking sector for 1982. The methodology is straightforward and uses the information defined previously in this chapter. Exhibit 24 contains the result of a 5 cent increase in fuel tax in 1982. Notice Column J increased 5 cents to account for the tax increase. Also notice that all other input data remained constant.

Scenario 2 - Economic Impact of Fuel Price and Efficiency Changes Between 1980 and 2000

Exhibit 25 contains the expenditures for each commercial trucking sector for 1980. Notice that the input values for the travel correction factor (Column B), consumption correction factor (Column F), fuel price (Column H), and fuel taxes (Column J) have been updated for 1980. Exhibit 26 contains the change in expenditures for 2000 due to changes in VMT (Columns B and D), fuel consumption (Columns F and G), fuel expenditures (Columns H and I), tax expenditures (Column K), and maintenance and overhead expenditures (Column M).

Scenario 3 - 10 Percent Efficiency Improvement in 1987

Exhibit 27 contains the expenditures for each commercial sector for 1987. Again columns B, F, J, and N have been updated. Exhibit 28 contains the changes in expenditures due to a 10 percent improvement in fuel economy. As

EXHIBIT 24 Scenario 1: Total Trucking Expenditures by Sector Resulting from a 5 Cent Fuel Tax Increase in 1982 (1977$)

SECTOR NUMBER	1977 TOTAL TRUCKS	TRAVEL CORRECTION FACTOR	VMT/TRUCK/YEAR (IN 1000'S)	VMT (IN 1000'S)	1977 FUEL RATE (GALLONS/MI.)	CONSUMPTION CORRECTION FACTOR	TOTAL GALLONS (IN 1000'S)	FUEL PRICE MINUS TAXES ($/GALLON)	FUEL EXPENDITURES (IN 1000$)
1	48008	1.121	12	645803.62	.09	.95	55216.21	.87	48038.10
4	272	1.121	15	4573.68	.17	.95	738.65	.87	642.62
6	26543	1.121	19	565339.36	.09	.95	48336.52	.87	42052.77
8	10993	1.121	20	246463.06	.13	.95	30438.19	.87	26481.22
9	2717	1.121	19	57869.38	.13	.95	7146.37	.87	6217.78
11	2696	1.121	30	90666.48	.13	.95	11197.31	.87	9741.66
13	8841	1.121	19	188304.46	.13	.95	23255.60	.87	20232.37
17	2362	1.121	40	105912.08	.13	.95	13080.14	.87	11379.72
18	2237	1.121	21	52661.22	.13	.95	6503.66	.87	5658.18
19	3553	1.121	21	83641.17	.13	.95	10329.68	.87	8986.83
20	6604	1.121	11	81433.92	.13	.95	10057.09	.87	8749.67
21	11056	1.121	34	421388.38	.13	.95	52041.47	.87	45276.07
25	9319	1.121	21	195837.58	.13	.95	24185.94	.87	21041.77
27	10784	1.121	16	193421.82	.09	.95	16537.57	.87	14387.68
28	27172	1.121	19	578736.43	.09	.95	49481.76	.87	43049.31
29	9275	1.121	14	129883.54	.09	.95	11105.04	.87	9661.39
TOTALS	180433			3641936.19			369651.90		321597.15
	(A)	(B)	(C)	(D)=(A)*(B)*(C)	(E)	(F)	(G)=(D)*(E)*(F)	(H)	(I)=(G)*(H)

SECTOR NUMBER	TAX RATE ($/GALLON)	TAX EXPENDITURES (IN 1000$)	MAINTENANCE AND OVERHEAD FACTOR	MAINTENANCE AND OVERHEAD EXPENDITURES (IN 1000$)	TOTAL EXPENDITURES (IN 1000$)
1	.14	7730.27	1.46	70135.63	125904.00
4	.14	103.41	1.46	938.23	1684.27
6	.14	6767.11	1.46	61397.04	110216.92
8	.14	4261.35	1.46	38662.59	69405.16
9	.14	1000.56	1.46	9077.95	16296.29
11	.14	1567.62	1.46	14222.82	25532.11
13	.14	3255.78	1.46	29539.26	53027.42
17	.14	1831.22	1.46	16614.40	29825.34
18	.14	910.51	1.46	8260.95	14829.65
19	.14	1446.16	1.46	13120.77	23555.75
20	.14	1407.99	1.46	12774.52	22932.18
21	.14	7295.81	1.46	66103.07	118664.95
25	.14	3386.83	1.46	30720.98	55148.79
27	.14	2315.26	1.46	21006.02	37708.96
28	.14	6927.48	1.46	62851.99	112928.78
29	.14	1554.71	1.46	14105.63	25321.72
TOTALS		51751.27		469531.84	842980.26
	(J)	(K)=(G)*(J)	(L)	(M)=(G)*(H)*(L)	(N)=(I)+(K)+(M)

EXHIBIT 25 Scenario 2: Total Trucking Expenditures by Sector in 1980 (1977$)

SECTOR NUMBER	1977 TOTAL TRUCKS	TRAVEL CORRECTION FACTOR	VMT/TRUCK/YEAR (IN 1000'S)	VMT (IN 1000'S)	1977 FUEL RATE (GALLONS/MI.)	CONSUMPTION CORRECTION FACTOR	TOTAL GALLONS (IN 1000'S)	FUEL PRICE MINUS TAXES ($/GALLON)	FUEL EXPENDITURES (IN 1000$)
1	48008	1.104	12	636009.98	.09	.97	55523.67	.79	43863.70
4	272	1.104	15	4504.32	.17	.97	742.76	.79	586.79
6	26543	1.104	19	556765.97	.09	.97	48605.67	.79	38398.48
8	10993	1.104	20	242725.44	.13	.97	30607.68	.79	24180.07
9	2717	1.104	19	56991.79	.13	.97	7186.66	.79	5677.47
11	2696	1.104	30	89291.52	.13	.97	11259.66	.79	8895.13
13	8841	1.104	19	185448.82	.13	.97	23385.10	.79	18474.23
17	2362	1.104	40	104305.92	.13	.97	13152.98	.79	10390.85
18	2237	1.104	21	51862.61	.13	.97	6539.87	.79	5166.50
19	3553	1.104	21	82372.75	.13	.97	10387.20	.79	8205.89
20	6604	1.104	11	80198.98	.13	.97	10113.09	.79	7989.34
21	11056	1.104	34	414998.02	.13	.97	52331.25	.79	41341.69
25	8319	1.104	21	192867.70	.13	.97	24320.62	.79	19213.29
27	10784	1.104	16	190488.58	.09	.97	16629.65	.79	13137.43
28	27172	1.104	19	569959.87	.09	.97	49757.50	.79	39308.42
29	8276	1.104	14	127913.86	.09	.97	11166.88	.79	8821.83
TOTALS	180433			3586706.11			371710.24		293651.09
	(A)	(B)	(C)	(D)=(A)*(B)*(C)	(E)	(F)	(G)=(D)*(E)*(F)	(H)	(I)=(G)*(H)

SECTOR NUMBER	TAX RATE ($/GALLON)	TAX EXPENDITURES (IN 1000$)	MAINTENANCE AND OVERHEAD FACTOR	MAINTENANCE AND OVERHEAD EXPENDITURES (IN 1000$)	TOTAL EXPENDITURES (IN 1000$)
1	.09	4997.13	1.46	64041.00	112901.33
4	.09	66.85	1.46	856.70	1510.33
6	.09	4374.51	1.46	56061.78	98834.77
8	.09	2754.69	1.46	35302.90	62237.65
9	.09	646.80	1.46	8289.10	14613.36
11	.09	1013.37	1.46	12986.89	22895.39
13	.09	2104.66	1.46	26972.37	47551.25
17	.09	1183.77	1.46	15170.64	26745.26
18	.09	588.59	1.46	7543.09	13298.18
19	.09	934.95	1.46	11980.60	21121.34
20	.09	910.18	1.46	11664.44	20563.96
21	.09	4709.31	1.46	60358.86	106410.36
25	.09	2188.36	1.46	28051.40	49453.54
27	.09	1496.67	1.46	19180.64	33814.74
28	.09	4478.17	1.46	57390.30	101176.89
29	.09	1005.02	1.46	12879.98	22706.73
TOTALS		33453.92		428730.60	755935.61
	(J)	(K)=(G)*(J)	(L)	(M)=(G)*(H)*(L)	(N)=(I)+(K)+(M)

EXHIBIT 26 Scenario 2: Total Trucking Expenditures by Sector in 2000 (1977$)

SECTOR NUMBER	1977 TOTAL TRUCKS	TRAVEL CORRECTION FACTOR	VMT/TRUCK/YEAR (IN 1000'S)	VMT (IN 1000'S)	1977 FUEL RATE (GALLONS/MI.)	CONSUMPTION CORRECTION FACTOR	TOTAL GALLONS (IN 1000'S)	FUEL PRICE MINUS TAXES ($/GALLON)	FUEL EXPENDITURES (IN 1000$)
1	48008	1.609	12	926938.46	.09	.77	64236.84	1.49	95712.38
4	272	1.609	15	6564.72	.17	.77	859.32	1.49	1280.39
6	26543	1.609	19	811446.05	.09	.77	56233.21	1.49	83787.49
8	10992	1.609	20	353754.74	.13	.77	35410.85	1.49	52762.17
9	2717	1.609	19	83061.41	.13	.77	8314.45	1.49	12388.53
11	2696	1.609	30	130135.92	.13	.77	13026.61	1.49	19409.64
13	9841	1.609	19	270278.21	.13	.77	27054.85	1.49	40311.72
17	2282	1.609	40	152018.32	.13	.77	15217.03	1.49	22673.38
18	2257	1.609	21	75585.99	.13	.77	7566.16	1.49	11273.58
19	3583	1.609	21	120052.32	.13	.77	12017.24	1.49	17905.68
20	6604	1.609	11	116884.20	.13	.77	11700.11	1.49	17433.16
21	11056	1.609	34	604829.54	.13	.77	60543.44	1.49	90209.72
25	9319	1.609	21	281090.69	.13	.77	28137.18	1.49	41924.40
27	10784	1.609	16	277623.30	.09	.77	19239.29	1.49	28666.55
28	27132	1.609	19	830675.21	.09	.77	57565.79	1.49	85773.03
29	9276	1.609	14	186425.18	.09	.77	12919.26	1.49	19249.70
TOTALS	180433			5227364.25			430041.82		640762.02
	(A)	(B)	(C)	(D)=(A)*(B)*(C)	(E)	(F)	(G)=(D)*(E)*(F)	(H)	(I)=(G)*(H)

SECTOR NUMBER	TAX RATE ($/GALLON)	TAX EXPENDITURES (IN 1000$)	MAINTENANCE AND OVERHEAD FACTOR	MAINTENANCE AND OVERHEAD EXPENDITURES (IN 1000$)	TOTAL EXPENDITURES (IN 1000$)
1	.09	5781.32	1.46	139740.81	241235.01
4	.09	77.34	1.46	1869.37	3227.10
6	.09	5060.99	1.46	122329.73	211179.20
8	.09	3186.98	1.46	77032.76	132981.90
9	.09	748.30	1.46	18087.25	31224.07
11	.09	1172.39	1.46	28339.08	48920.11
13	.09	2434.94	1.46	58855.12	101601.78
17	.09	1369.53	1.46	33103.14	57146.05
18	.09	680.95	1.46	16459.42	28413.95
19	.09	1081.55	1.46	26142.30	45129.53
20	.09	1053.01	1.46	25452.41	43938.59
21	.09	5448.91	1.46	131706.19	227364.92
25	.09	2532.35	1.46	61209.62	105666.36
27	.09	1731.54	1.46	41853.16	72251.25
28	.09	5180.92	1.46	125228.62	216182.58
29	.09	1162.73	1.46	28104.57	48517.01
TOTALS		39793.75		935512.55	1614979.31
	(J)	(K)=(G)*(J)	(L)	(M)=(G)*(H)*(L)	(N)=(I)+(K)+(M)

EXHIBIT 27 Scenario 3: Total Trucking Expenditures by Sector in 1987 (1977$)

SECTOR NUMBER	1977 TOTAL TRUCKS	TRAVEL CORRECTION FACTOR	VMT/TRUCK/YEAR (IN 1000'S)	VMT (IN 1000'S)	1977 FUEL RATE (GALLONS/MI.)	CONSUMPTION CORRECTION FACTOR	TOTAL GALLONS (IN 1000'S)	FUEL PRICE MINUS TAXES ($/GALLON)	FUEL EXPENDITURES (IN 1000$)
1	48008	1.25	12	720120.00	.09	.9	58329.72	1.06	61829.50
4	272	1.25	15	5100.00	.17	.9	780.30	1.06	827.12
6	26543	1.25	19	630396.25	.09	.9	51062.10	1.06	54125.82
8	10993	1.25	20	274825.00	.13	.9	32154.53	1.06	34083.80
9	2717	1.25	19	64529.75	.13	.9	7549.86	1.06	8002.86
11	2696	1.25	30	101100.00	.13	.9	11829.70	1.06	12538.42
13	8841	1.25	19	209973.75	.13	.9	24566.93	1.06	26040.94
17	2362	1.25	40	118100.00	.13	.9	13817.70	1.06	14646.76
18	2237	1.25	21	58721.25	.13	.9	6870.39	1.06	7282.61
19	3553	1.25	21	93256.25	.13	.9	10912.15	1.06	11566.88
20	3604	1.25	11	90805.00	.13	.9	10624.19	1.06	11261.64
21	11056	1.25	34	469880.00	.13	.9	54975.96	1.06	58274.52
25	8319	1.25	21	218373.75	.13	.9	25549.73	1.06	27082.71
27	10784	1.25	16	215680.00	.09	.9	17470.08	1.06	18518.28
28	27172	1.25	19	645335.00	.09	.9	52272.14	1.06	55408.46
29	9276	1.25	14	144830.00	.09	.9	11731.23	1.06	12435.10
TOTALS	180433			4061035			390495.69		413925.43
	(A)	(B)	(C)	(D)=(A)*(B)*(C)	(E)	(F)	(G)=(D)*(E)*(F)	(H)	(I)=(G)*(H)

SECTOR NUMBER	TAX RATE ($/GALLON)	TAX EXPENDITURES (IN 1000$)	MAINTENANCE AND OVERHEAD FACTOR	MAINTENANCE AND OVERHEAD EXPENDITURES (IN 1000$)	TOTAL EXPENDITURES (IN 1000$)
1	.09	5249.67	1.46	90271.07	157350.25
4	.09	70.23	1.46	1207.59	2104.94
6	.09	4595.59	1.46	79023.70	137745.11
8	.09	2893.91	1.46	49762.34	86740.05
9	.09	679.49	1.46	11684.17	20366.51
11	.09	1064.58	1.46	18306.10	31909.10
13	.09	2211.02	1.46	38019.78	66271.75
17	.09	1243.59	1.46	21384.27	37274.63
18	.09	618.33	1.46	10632.61	18533.55
19	.09	982.09	1.46	16887.65	29436.62
20	.09	956.18	1.46	16441.99	28659.80
21	.09	4947.34	1.46	85080.80	148303.15
25	.09	2299.48	1.46	39540.76	68922.95
27	.09	1572.31	1.46	27036.79	47127.29
28	.09	4704.49	1.46	80896.36	141009.31
29	.09	1055.91	1.46	18155.25	31646.17
TOTALS		35144.61		604331.13	1053401.17
	(J)	(K)=(G)*(J)	(L)	(M)=(G)*(H)*(L)	(N)=(I)+(K)+(M)

EXHIBIT 28 Scenario 3: Total Trucking Expenditures by Sector Resulting from a 10 Percent Improvement in Fuel Efficiency in 1987 (1977$)

SECTOR NUMBER	1977 TOTAL TRUCKS	TRAVEL CORRECTION FACTOR	VMT/TRUCK/ YEAR (IN 1000'S)	VMT (IN 1000'S)	1977 FUEL RATE (GALLONS/MI.)	CONSUMPTION CORRECTION FACTOR	TOTAL GALLONS (IN 1000'S)	FUEL PRICE MINUS TAXES ($/GALLON)	FUEL EXPENDITURES (IN 1000$)
1	48008	1.25	12	720120.00	.09	.81	52496.75	1.06	55646.55
4	272	1.25	15	5100.00	.17	.81	702.27	1.06	744.41
6	26543	1.25	19	630396.25	.09	.81	45955.89	1.06	48713.24
8	10993	1.25	20	274825.00	.13	.81	28939.07	1.06	30675.42
9	2717	1.25	19	64528.75	.13	.81	6794.88	1.06	7202.57
11	2696	1.25	30	101100.00	.13	.81	10645.83	1.06	11284.58
13	8841	1.25	19	209973.75	.13	.81	22110.24	1.06	23436.85
17	2362	1.25	40	118100.00	.13	.81	12435.93	1.06	13182.09
18	2237	1.25	21	58721.25	.13	.81	6183.35	1.06	6554.35
19	3553	1.25	21	93266.25	.13	.81	9820.94	1.06	10410.19
20	6604	1.25	11	90805.00	.13	.81	9561.77	1.06	10135.47
21	11056	1.25	34	469880.00	.13	.81	49478.36	1.06	52447.07
25	8319	1.25	21	218373.75	.13	.81	22994.76	1.06	24374.44
27	10784	1.25	16	215680.00	.09	.81	15723.07	1.06	16666.46
28	27172	1.25	19	645335.00	.09	.81	47044.92	1.06	49867.62
29	8276	1.25	14	144830.00	.09	.81	10558.11	1.06	11191.59
TOTALS	180430			4061035			351446.12		372532.89
	(A)	(B)	(C)	(D)=(A)*(B)*(C)	(E)	(F)	(G)=(D)*(E)*(F)	(H)	(I)=(G)*(H)

SECTOR NUMBER	TAX RATE ($/GALLON)	TAX EXPENDITURES (IN 1000$)	MAINTENANCE AND OVER-HEAD FACTOR	MAINTENANCE AND OVERHEAD EXPENDITURES (IN 1000$)	TOTAL EXPENDITURES (IN 1000$)
1	.09	4724.71	1.46	81243.97	141615.23
4	.09	63.20	1.46	1086.83	1894.44
6	.09	4136.03	1.46	71121.33	123970.60
8	.09	2604.52	1.46	44796.11	78066.04
9	.09	611.54	1.46	10515.75	18329.86
11	.09	958.12	1.46	16475.49	28718.19
13	.09	1989.92	1.46	34217.80	59644.57
17	.09	1119.23	1.46	19245.85	33547.16
18	.09	556.50	1.46	9569.35	16680.20
19	.09	883.88	1.46	15198.88	26492.96
20	.09	860.56	1.46	14797.79	25793.82
21	.09	4453.05	1.46	76572.72	133472.83
25	.09	2069.53	1.46	35586.68	62030.65
27	.09	1415.08	1.46	24333.03	42414.56
28	.09	4234.04	1.46	72806.72	126908.38
29	.09	950.23	1.46	16339.73	28481.55
TOTALS		31630.15		543898.02	948061.06
	(J)	(K)=(G)*(J)	(L)	(M)=(G)*(H)*(L)	(N)=(I)+(K)+(M)

discussed in Chapter III, the breakdown of this efficiency improvement indicated that 9.67 percent improvement would be realized by vehicular traffic, through signal and capacity modifications. This improvement is recorded in Column F and affects all three expenditure categories (i.e., fuel, tax and maintenance). This value is calculated by multiplying the baseline consumption correction factor (0.9) by the anticipated efficiency improvement (9.67 percent). The resulting consumption correction factor is then obtained (0.81 = 0.9 * [1.00 - 0.0967]).

SUMMARY

From this analysis it is then possible to obtain the changes in total expenditures which result from the three scenarios. The impacts of these changes in expenditures can be reflected in changes in income, employment and the CPI as shown in the following chapter.

V. RESULTING CHANGES AND IMPACTS

This chapter outlines the various changes and impacts that result from the proposed scenarios. Changes in the Consumer Price Index (CPI) as well as the economic impacts of changes in consumption patterns are discussed. It is at this stage in the analysis that the household sectors (Chapter III) and the trucking sectors (Chapter IV) are combined, in order that the effects to the total economy can be evaluated.

STEP 6 - CONSUMER PRICE IMPACT MODEL

The performance measure adopted to most accurately represent Consumer Price Index changes is the percent change in the CPI. The following equations contain the recommended approach to estimate this performance measure.

Short run (5 years or less):

$$\%\Delta CPI = \%\Delta P \times W_1$$

where

$\%\Delta CPI$ = Percent Change in CPI

$\%\Delta P$ = Percent Change in Fuel Price (see Chapter III)

W_1 = Weight of Private Transportation Gasoline Cost in the Total CPI. This value is 0.04786 and can be found in Appendix VIII.

Long run (greater than 5 years):

$$\%\Delta CPI = \%\Delta E \times W_2$$

where

%ΔCPI = Percent Change in CPI

%ΔE = Percent Change in Expenditures (Average of Column C in Exhibit 20 weighted by the distribution of households in Exhibit 18.)

W_2 = Weight of Local Transportation Cost in the Total CPI. This value is 0.07265 and includes the cost of gasoline (0.04786), maintenance (0.01664), and parts (0.0815). These values can be found in Appendix VIII.

It is important to note that the short-run equation accounts only for price impacts, since a new market basket of goods would not have been developed by the U. S. Department of Labor. The long-run equation accounts for both price and quantity impacts since revised quantities would most likely have been developed.

The weights in Appendix VIII are for the United States. It is assumed in this analysis that these values accurately reflect the conditions in a local area. It should also be pointed out that this step considers the changes in prices and quantities of only household transportation related goods and services. No account is made of expenditure changes for other commodities due to the effect of changes in truck transportation costs on household purchasing behavior. These effects could only be accurately accounted for

in the long-run CPI model because both prices and quantities are changed (i.e., transport prices increase and they are passed on to the consumer and consumption decreases because of fixed household incomes). Forecasting CPI weights for non-transportation sectors is an extremely difficult task given proposed changes in the CPI methodology.

STEP 7 - ESTIMATED CHANGES IN THE CPI

By adopting the equations in the previous section, projections in the percent change in the CPI resulting from the three scenarios can now be estimated. The actual calculations are presented below.

Scenario 1: 1982

The appropriate equation and values are:

$$\%\Delta CPI = \%\Delta P \times W$$
$$= 5.2 \times 0.04786$$
$$= 0.25$$

Therefore, a 5.2 percent increase in the fuel tax will increase the CPI 0.25 percent.

Scenario 2: 1980-2000

The appropriate equation and values are:

$$\%\Delta CPI = \%\Delta E \times W$$
$$= 1.5 \times 0.07265$$
$$= 0.11$$

Therefore, it is expected that between 1980 and 2000, changes in transportation expenditures will increase the CPI 0.11 percent.

Scenario 3: 1987

The appropriate equation and values are:

$$\%\Delta CPI = \%\Delta E \times W$$
$$= -5.3 \times 0.07265$$
$$= -0.39$$

Therefore, a 10 percent improvement in energy efficiency will decrease the CPI 0.39 percent.

None of these three scenarios greatly affect the CPI.

STEP 8 - DIRECT ECONOMIC IMPACTS

The purpose of this step in the analysis is to draw together the information in Chapter III and IV, in order to demonstrate the direct economic impacts created as a result of each scenario. Exhibit 29 contains the changes in household expenditures, summed across income groups, for each scenario. The values shown here are taken from the tables in Appendix V. Note that the household sectors have been redefined using national economic sector numbers. This step is necessary because the economic multipliers used in this analysis were derived from the national RIMS-II model. The sector equivalency table used to convert these sectors is shown in Appendix VII.

EXHIBIT 29 Changes in Household Expenditures for Each Scenario by National Sector (1977$)

National Sector Number	Scenario 1 (In 1000$)	Scenario 2 (In 1000$)	Scenario 3 (In 1000$)
25	- 403.32	- 455.69	+ 1,758.38
26	- 661.82	- 413.40	+ 2,245.91
27	- 408.37	- 296.65	+ 1,456.24
28	---	---	---
29	- 4,314.22	- 3,252.01	+16,478.24
30	- 1,387.91	- 951.93	+ 4,844.37
31	- 2,189.95	- 1,396.60	+ 7,447.39
32	- 565.18	- 360.29	+ 1,923.16
33	- 233.74	- 158.95	+ 821.20
34	- 479.66	- 346.63	+ 1,708.68
35	- 380.40	- 321.31	+ 1,449.48
36	- 477.91	- 341.21	+ 1,681.16
37	- 1,119.99	- 803.24	+ 3,972.05
38	- 2,093.41	- 1,495.50	+ 7,415.69
39	---	---	---

Exhibit 30 contains the change in expenditures by trucking sector, for each scenario. In Chapter IV, the expenditures for each trucking sector, both before and after the implementation of each scenario, were calculated in Exhibits 23 through 28. The expenditures shown in Exhibit 30 were determined by taking the difference between the before and after calculations of each scenario. As discussed previously, it is assumed that the increase in truck expenses will be passed on to consumers.

It is important to note, in comparing Exhibits 29 and 30, that not all of the thirty-nine sectors shown in Exhibit 31 are included. This demonstrates that not all sectors of the economy are affected by changes in transportation cost or efficiency.

From examining Exhibits 29 and 30 it can be observed that Scenarios 1 and 2 resulted in a reduction in expenditures due to higher transportation costs. Scenario 3, on the other hand, created an increase in expenditures for both the household and trucking segments of the economy due to higher net income from reduced transportation costs.

If Chapter IV was omitted, the following factor can be developed to account for the effect of changes in fuel price and efficiency on commercial truck sectors. It is essential to note that this factor derives total expenditures (i.e., fuel, fuel tax, maintenance and overhead) and not fuel consumption alone.

EXHIBIT 30 Change in Trucking Expenditures for Each Scenario by National Sector (1977$)

National Sector Number	Scenario 1 (In 1000$)	Scenario 2 (In 1000$)	Scenario 3 (In 1000$)
1	- 2,760.81	-128,333.18	+15,735.03
4	- 36.93	- 1,716.76	+ 210.49
6	- 2,416.83	-112,343.44	+13,774.51
8	- 1,521.91	- 70,744.25	+ 8,674.00
9	- 357.34	- 16,610.71	+ 2,036.65
11	- 559.87	- 26,024.72	+ 3,190.91
13	- 1,162.78	- 54,050.53	+ 6,627.17
17	- 654.01	- 30,400.79	+ 3,727.46
18	- 325.18	- 15,115.77	+ 1,853.36
19	- 516.48	- 24,008.19	+ 2,943.66
20	- 502.85	- 23,374.63	+ 2,865.98
21	- 2,602.07	-120,954.46	+14,830.31
25	- 1,209.30	- 56,212.82	+ 6,892.29
27	- 826.88	- 38,436.51	+ 4,712.73
28	- 2,474.10	-115,005.68	+14,100.93
29	- 555.25	- 25,810.27	+ 3,164.62

The following equations can be used to estimate the total change in expenditures when trucking information is not available. Methodology 1 should be used when a scenario contains an evaluation for the same year (e.g., Scenario 1 - 1982 and Scenario 3 - 1987). Methodology 2 should be used when a scenario evaluates impacts between years (e.g., Scenario 2 - 1980 and 2000). The details of each equation are:

Methodology 1 (same year):

$$\Delta TE = \Delta HE * (A + [B * Y])$$

where

ΔTE = Change in Total Expenditures (1000$)

ΔHE = Change in Household Expenditures (1000$)

A = a constant 2.26

B = a constant 0.144

Y = number of years between scenario year and 1982

This equation reduces to:

$$\Delta TE = HE * (2.26 + [0.144 * Y])$$

An example using Scenario 3 would result in:

$$\Delta TE = 36875.38 * (2.26 + [0.144 * 5])$$

$$= 109887$$

Methodology 2 (different years):

$$\Delta TE = \Delta HE * C * Y$$

where

ΔTE = Change in Total Expenditures (1000$)

ΔHE = Change in Household Expenditures (1000$)

C = a constant 4.105

Y = number of years between scenario baseline year and 1980

This equation reduces to:

$$\Delta TE = \Delta HE * 4.105 * Y$$

An example using Scenario 2 would result in

$$\Delta TE = -7342.55 * 4.105 * 20$$

$$= -602823$$

The following step of the planning manual uses the data on changes in household and trucking expenditures and converts these values into total (i.e., direct and indirect) changes in expenditures, income and employment.

STEP 9 - INPUT-OUTPUT MODEL

It is at this stage in the analysis that some preliminary conclusions can be drawn about the effects of the various scenario actions that were taken. However, in order to begin to formulate these conclusions, the following pieces of information are required:

Change in Household and Trucking Expenses

The expenditure values in Exhibits 29 and 30 need to be converted from 1977 dollars to 1972 dollars in order to be consistent with the RIMS-II multipliers (1972$). Columns A and B of Exhibits 32, 33, and 34 are converted to 1972$ using the CPI values discussed earlier.

Final Demand Multipliers

A final demand multiplier represents the magnitude of rippling effects a particular sector has in the economy. These values are shown in Exhibit 31 for all thirty-nine sectors of the economy and are specific to the Dallas-Fort Worth area. The multipliers shown were obtained from the RIMS-II analysis done for the Dallas-Fort Worth area. It is essential that these types of multipliers be available for each specific planning region.

Income Multipliers

Exhibit 31 also contains the income multipliers supplied by RIMS-II, for the 39 sectors. These values should also be planning area specific. An income multiplier is used to determine the total income of a particular sector. This is necessary in accounting for total direct and indirect effects.

Employment Multipliers

The employment multipliers for the 39 sectors are shown in Exhibit 31. These values are calculated by taking the ratio of employment by industry to the earnings within that industry and multiplying that ratio by the income multiplier shown for each industry or sector. This type of industry specific data can be found for each State in the 1980 OBERS BEA Regional Projections (U.S. Department of Commerce, 1981).

The employment adjustment factor accounts for anticipated increases in real income over time. These increases in real income are demonstrated in Exhibit 18.

EXHIBIT 31 Final Demand, Income and Employment Multipliers for the Dallas-Fort Worth Area

SECTOR NUMBER	FINAL DEMAND MULTIPLIER	INCOME MULTIPLIER	EMPLOYMENT MULTIPLIER
1	2.2111	.4552	.00011
2	2.1987	.5021	.00011
3	2.2537	.5438	.00003
4	1.9019	.2671	.00002
5	2.3798	.5638	.00005
6	2.9223	.7271	.00008
7	2.8962	.8058	.00009
8	2.2181	.3918	.00004
9	2.1099	.4518	.00006
10	2.3171	.5329	.00011
11	2.3719	.5551	.00005
12	2.7221	.7108	.00009
13	2.4813	.4918	.00003
14	2.3809	.5481	.00006
15	2.4207	.5649	.00008
16	2.7761	.6398	.00006
17	2.2994	.5235	.00004
18	2.2934	.5127	.00005
19	2.4721	.5914	.00005
20	2.9584	.8005	.00008
21	2.0184	.3479	.00003
22	3.0598	.7926	.00006
23	2.7451	.7379	.00008
24	2.6427	.6363	.00011
25	2.7697	.7486	.00006
26	2.2641	.5381	.00004
27	2.2138	.3617	.00003
28	2.6366	.7256	.00007
29	2.5959	.7326	.00011
30	2.7219	.6587	.00011
31	2.8677	.7041	.00007
32	3.6246	1.0111	.00011
33	1.6184	.1747	.00002
34	2.7315	.6644	.00021
35	2.9928	.8601	.00011
36	2.7933	.7809	.00006
37	2.4738	.6332	.00007
38	2.7901	.7419	.00051
39	2.4766	.3676	.00021

Model Estimation

Once these multipliers have been obtained, the changes in income and employment created by each scenario action can be calculated. Exhibit 32 shows the documented methodology and the results for Scenario 1. Column A contains the changes in household expenditures due to the 5 cent tax increase in 1972 dollars. Column B contains the resulting expenditure changes in the trucking sectors. The final demand multipliers from Exhibit 31 can be found in Column C. By multiplying the sum of Column A plus Column B by the value in Column C, the total change in expenditures can be found in Column D. Then, by multiplying the income multiplier in Column E by the total change in Column D, the change in income per sector is found in Column F. Finally, by multiplying the employment multiplier and factor of Column G and Column H by the change in income of Column F, the change in the number of jobs resulting from the change in income is determined. By summing Columns F and I the loss in income and loss in jobs is found as a result of Scenario 1. Exhibit 33 contains these results for Scenario 2 and Exhibit 34 contains them for Scenario 3.

STEP 10 - TOTAL ECONOMIC IMPACTS

The purpose of this step is to determine the additional economic effects that are produced as a result of that portion of the fuel tax that is returned to the local economy. It has been determined for the Dallas-Fort Worth area and the State of Texas that 45 cents of every transportation tax dollar collected locally by the State is returned to the Dallas-Fort Worth area. This relatively low value is due to the state allocation process. These return rates are specific to Dallas-Fort Worth and the State of Texas and need to be

EXHIBIT 32 Resulting Impacts of Scenario 1 (1972$)

SECTOR NUMBER	CHANGE IN HOUSEHOLD EXPENDITURES (IN 1000$)	CHANGE IN TRUCKING EXPENDITURES (IN 1000$)	FINAL DEMAND MULTIPLIER	TOTAL CHANGE IN EXPENDITURES (IN 1000$)	INCOME MULTIPLIER	CHANGE IN INCOME (REVENUE) ($)	EMPLOYMENT MULTIPLIER	EMPLOYMENT ADJUSTMENT	CHANGE IN EMPLOYMENT (JOBS)
1	--	-1913.57	2.2111	-4231.09	.4552	-1925994.27	.00011	.84	-178
2	--	--	2.1987	0.00	.5021	0.00	.00011	.84	0
3	--	--	2.2537	0.00	.5438	0.00	.00003	.84	0
4	--	-25.61	1.9019	-48.71	.2671	-13009.82	.00002	.84	0
5	--	--	2.3798	0.00	.5638	0.00	.00005	.84	0
6	--	-1575.16	2.9223	-4895.32	.7271	-3559387.22	.00008	.84	-239
7	--	--	2.8962	0.00	.8058	0.00	.00007	.84	0
8	--	-1054.87	2.2181	-2339.81	.3918	-916736.44	.00004	.84	-31
9	--	-247.68	2.1099	-522.58	.4518	-236101.66	.00006	.84	-12
10	--	--	2.3171	0.00	.5329	0.00	.00011	.84	0
11	--	-388.06	2.3719	-920.44	.5551	-510935.97	.00005	.84	-21
12	--	--	2.7221	0.00	.7108	0.00	.00009	.84	0
13	--	-805.95	2.4813	-1999.80	.4918	-983503.48	.00003	.84	-25
14	--	--	2.3809	0.00	.5481	0.00	.00006	.84	0
15	--	--	2.4207	0.00	.5649	0.00	.00008	.84	0
16	--	--	2.7761	0.00	.6398	0.00	.00006	.84	0
17	--	-453.31	2.2994	-1042.34	.5235	-545665.52	.00004	.84	-18
18	--	-225.39	2.2934	-516.91	.5127	-265019.46	.00005	.84	-11
19	--	-357.98	2.4721	-884.96	.5914	-523366.74	.00005	.84	-22
20	--	-349.54	2.9534	-1031.12	.8005	-825412.15	.00008	.84	-55
21	--	-1803.55	2.0184	-3640.29	.3479	-1266455.26	.00003	.84	-32
22	--	--	3.0598	0.00	.7926	0.00	.00006	.84	0
23	--	--	2.7451	0.00	.7379	0.00	.00008	.84	0
24	--	--	2.6427	0.00	.6363	0.00	.00011	.84	0
25	-279.55	-838.19	2.7697	-3095.80	.7486	-2317519.23	.00006	.84	-117
26	-458.72	--	2.2641	-1038.59	.5581	-579635.94	.00004	.84	-19
27	-283.05	-573.13	2.2138	-1895.41	.3617	-685570.26	.00003	.84	-17
28	--	-1714.95	2.6366	-4521.37	.7256	-3280708.62	.00007	.84	-193
29	-2990.28	-384.86	2.5959	-8761.53	.7326	-6418693.89	.00011	.84	-593
30	-961.59	--	2.7219	-2616.44	.6587	-1724766.81	.00011	.84	-159
31	-1517.91	--	2.8677	-4352.91	.7041	-3064884.29	.00007	.84	-180
32	-391.74	--	3.6246	-1419.90	1.0111	-1435661.70	.00011	.84	-133
33	-162.01	--	1.6184	-262.20	.1747	-45805.81	.00002	.84	-1
34	-332.46	--	2.7315	-908.11	.6644	-603351.27	.00021	.84	-106
35	-263.67	--	2.9928	-789.11	.8601	-678714.87	.00011	.84	-63
36	-331.25	--	2.7933	-925.28	.7809	-722551.64	.00008	.84	-36
37	-776.29	--	2.4738	-1920.39	.6732	-1215988.54	.00007	.84	-72
38	-1450.99	--	2.7901	-4048.41	.7419	-3003513.30	.00051	.84	-129
39	--	--	2.4756	0.00	.3676	0.00	.00021	.84	0
TOTALS	-14135.9	-12810.70		-59679.82		-37348954.17			-3821
	(A)	(B)	(C)	(D)=((A)+(B))*(C)	(E)	(F)=(D)*(E)*1000	(G)	(H)	(I)=(F)*(G)*(H)

EXHIBIT 33 Resulting Impacts of Scenario 2 (1972$)

SECTOR NUMBER	CHANGE IN HOUSEHOLD EXPENDITURES (IN 1000$)	CHANGE IN TRUCKING EXPENDITURES (IN 1000$)	FINAL DEMAND MULTIPLIER	TOTAL CHANGE IN EXPENDITURES (IN 1000$)	INCOME MULTIPLIER	CHANGE IN INCOME (REVENUE) ($)	EMPLOYMENT MULTIPLIER	EMPLOYMENT ADJUSTMENT	CHANGE IN EMPLOYMENT (JOBS)
1	--	-88950.39	2.2111	-196678.21	.4552	-89527919.98	.00011	.59	-5810
2	--	--	2.1987	0.00	.5021	0.00	.00011	.59	0
3	--	--	2.2537	0.00	.5438	0.00	.00003	.59	0
4	--	-1189.92	1.9019	-2263.11	.2671	-604476.37	.00002	.59	-7
5	--	--	2.3798	0.00	.5638	0.00	.00005	.59	0
6	--	-77867.58	2.9223	-227552.43	.7271	-165453371.15	.00008	.59	-7809
7	--	--	2.8962	0.00	.8058	0.00	.00009	.59	0
8	--	-49034.31	2.2181	-108763.00	.3918	-42613344.58	.00004	.59	-1006
9	--	-11513.24	2.1099	-24291.79	.4518	-10975028.50	.00006	.59	-389
10	--	--	2.3171	0.00	.5329	0.00	.00011	.59	0
11	--	-18038.27	2.3719	-42784.97	.5551	-23749938.30	.00005	.59	-701
12	--	--	2.7221	0.00	.7108	0.00	.00009	.59	0
13	--	-37463.55	2.4813	-92958.31	.4918	-45716895.19	.00003	.59	-809
14	--	--	2.3809	0.00	.5481	0.00	.00006	.59	0
15	--	--	2.4207	0.00	.5649	0.00	.00008	.59	0
16	--	--	2.7761	0.00	.6398	0.00	.00006	.59	0
17	--	-21071.42	2.2994	-48451.62	.5235	-25364424.72	.00004	.59	-599
18	--	-10477.05	2.2934	-24028.07	.5127	-12319189.68	.00005	.59	-363
19	--	-16640.58	2.4721	-41137.18	.5914	-24328526.96	.00005	.59	-718
20	--	-16201.44	2.9584	-47930.34	.8005	-38368237.25	.00008	.59	-1811
21	--	-93836.05	2.0184	-169214.68	.3479	-58869788.33	.00003	.59	-1042
22	--	--	3.0598	0.00	.7926	0.00	.00006	.59	0
23	--	--	2.7451	0.00	.7379	0.00	.00008	.59	0
24	--	--	2.6427	0.00	.6363	0.00	.00011	.59	0
25	-315.85	-38962.27	2.7697	-108788.61	.7486	-81439152.67	.00006	.59	-2883
26	-286.54	--	2.2641	-648.76	.5581	-362070.28	.00004	.59	-9
27	-205.61	-26641.14	2.2138	-59433.34	.3617	-21497037.32	.00003	.59	-380
28	--	-79712.83	2.6366	-210170.85	.7256	-152499967.00	.00007	.59	-6298
29	-2254.04	-17889.63	2.5959	-52290.95	.7326	-38308352.13	.00011	.59	-2486
30	-659.81	--	2.7219	-1795.94	.6587	-1182983.60	.00011	.59	-77
31	-968.02	--	2.8677	-2775.99	.7041	-1954575.23	.00007	.59	-81
32	-249.72	--	3.6246	-905.14	1.0111	-915182.11	.00011	.59	-59
33	-110.17	--	1.6184	-178.30	.1747	-31148.86	.00002	.59	0
34	-240.26	--	2.7315	-656.27	.6644	-436025.91	.00021	.59	-54
35	-222.71	--	2.9928	-666.53	.8601	-573279.43	.00011	.59	-37
36	-236.51	--	2.7933	-660.64	.7809	-515896.42	.00006	.59	-18
37	-556.74	--	2.4738	-1377.26	.6332	-872083.19	.00007	.59	-36
38	-1036.57	--	2.7901	-2892.13	.7419	-2145674.18	.00051	.59	-646
39	--	--	2.4766	0.00	.3676	0.00	.00021	.59	0
TOTALS	-7342.55	-595489.67		-1469294.40		-840624569.23			-74128
	(A)	(B)	(C)	(D)=((A)+(E))* (C)	(E)	(F)=(D)*(E)* 1000	(G)	(H)	(I)=(F)*(G)* (H)

EXHIBIT 34 Resulting Impacts of Scenario 3 (1972$)

SECTOR NUMBER	CHANGE IN HOUSEHOLD EXPENDITURES (IN 1000$)	CHANGE IN TRUCKING EXPENDITURES (IN 1000$)	FINAL DEMAND MULTIPLIER	TOTAL CHANGE IN EXPENDITURES (IN 1000$)	INCOME MULTIPLIER	CHANGE IN INCOME (REVENUE) ($)	EMPLOYMENT MULTIPLIER	EMPLOYMENT ADJUSTMENT	CHANGE IN EMPLOYMENT (JOBS)
1	--	10906.28	2.2111	24114.88	.4552	10977091.42	.00011	.75	906
2	--	--	2.1987	0.00	.5021	0.00	.00011	.75	0
3	--	--	2.2537	0.00	.5438	0.00	.00003	.75	0
4	--	145.89	1.9019	277.47	.2671	74111.75	.00002	.75	1
5	--	--	2.3798	0.00	.5638	0.00	.00005	.75	0
6	--	9547.41	2.9223	27900.40	.7271	20286378.11	.00008	.75	1217
7	--	--	2.8962	0.00	.8058	0.00	.00009	.75	0
8	--	6012.13	2.2181	13335.51	.3918	5224851.08	.00004	.75	157
9	--	1411.64	2.1099	2978.42	.4518	1345649.81	.00006	.75	61
10	--	--	2.3171	0.00	.5329	0.00	.00011	.75	0
11	--	2211.69	2.3719	5245.91	.5551	2912003.26	.00005	.75	109
12	--	--	2.7221	0.00	.7108	0.00	.00009	.75	0
13	--	4593.43	2.4813	11397.68	.4918	5605377.97	.00003	.75	126
14	--	--	2.3809	0.00	.5481	0.00	.00006	.75	0
15	--	--	2.4207	0.00	.5649	0.00	.00008	.75	0
16	--	--	2.7761	0.00	.6398	0.00	.00006	.75	0
17	--	2583.58	2.2994	5940.68	.5235	3109948.00	.00004	.75	93
18	--	1284.61	2.2934	2946.12	.5127	1510478.07	.00005	.75	57
19	--	2040.31	2.4721	5043.85	.5914	2982933.10	.00005	.75	112
20	--	1986.47	2.9584	5876.77	.8005	4704356.66	.00008	.75	282
21	--	10279.21	2.0184	20747.56	.3479	7218075.24	.00003	.75	162
22	--	--	3.0598	0.00	.7926	0.00	.00006	.75	0
23	--	--	2.7451	0.00	.7379	0.00	.00008	.75	0
24	--	--	2.6427	0.00	.6363	0.00	.00011	.75	0
25	1218.77	4777.19	2.7697	16607.01	.7486	12432007.99	.00006	.75	559
26	1556.69	--	2.2641	3524.50	.5581	1967024.47	.00004	.75	59
27	1009.35	3266.49	2.2138	9465.85	.3617	3423799.61	.00003	.75	77
28	--	9773.65	2.6366	25769.21	.7256	18698135.58	.00007	.75	982
29	11421.41	2193.46	2.5959	35342.84	.7326	25892165.34	.00011	.75	2136
30	3357.73	--	2.7219	9139.41	.6587	6020126.26	.00011	.75	497
31	5161.94	--	2.8677	14802.90	.7041	10422718.61	.00007	.75	547
32	1332.98	--	3.6246	4831.52	1.0111	4885149.17	.00011	.75	403
33	569.19	--	1.6184	921.18	.1747	160929.64	.00002	.75	2
34	1184.32	--	2.7315	3234.97	.6644	2149314.12	.00021	.75	339
35	1004.67	--	2.9928	3006.78	.8601	2586128.36	.00011	.75	213
36	1165.25	--	2.7933	3254.89	.7809	2541745.81	.00008	.75	114
37	2753.11	--	2.4738	6810.64	.6332	4312499.48	.00007	.75	226
38	5139.97	--	2.7901	14341.03	.7419	10639610.38	.00051	.75	4070
39	--	--	2.4766	0.00	.3676	0.00	.00021	.75	0
TOTALS	36375.38 (A)	73013.44 (B)	(C)	276857.56 (D)=((A)+(B))*(C)	(E)	172082609.23 (F)=(D)*(E)*1000	(G)	(H)	13509 (I)=(F)*(G)*(H)

adjusted to fit a particular study area. It has also been determined that the tax dollars returning to the local economy are spent in the construction sector, number six. To determine the impact of a state tax, Scenario 1 represents a 5 cent tax increase resulting in a 10 cent per gallon state tax. It is important to note that only those scenarios with a change in the tax rate need to be recalculated.

The procedure outlined below demonstrates the method used to determine the effects of returned transportation tax dollars (i.e., construction dollars) to the local economy. In order to determine these effects it is first necessary to determine the tax dollars leaving the region. For the trucking sector of the economy, the tax dollars leaving the region as a result of Scenario 1 are calculated as follows:

Tax Expenditures in the Trucking Sector (Exhibit 24, Column K)	$51,751,270
Tax Expenditures in the Trucking Sector (Exhibit 23, Column K)	-$33,268,670
Tax dollars from trucks leaving the area as a result of Scenario 1	$18,482,600

To calculate the tax dollars leaving the household sector of the economy, the change in tax expenditures per income group for Scenario 1 (Exhibits 10 and 11, Column H) are determined. Since these values are for the average household, it

is then necessary to determine the number of households in the Dallas-Fort Worth SMSA in each income group. The total number of households per income group is determined by taking the values from Exhibit 18 and multiplying these percentages by the total number of households in the Dallas-Fort Worth SMSA.:

INCOME GROUP	FRACTION OF HOUSEHOLDS	TOTAL HOUSEHOLDS	HOUSEHOLDS PER INCOME GROUP
Less than $10,000	0.34	1,179,228	400,938
$10,000 to $19,999	0.32	1,179,228	377,352
$20,000 and Up	0.34	1,179,228	400,938
	(A)	(B)	(C)=(A)x(B)

To calculate the tax dollars per income group leaving the region, the following values are used:

INCOME GROUP	TAX EXPENDITURE (EXHIBIT 11, COLUMN H) (1977$)	TAX EXPENDITURES (EXHIBIT 10, COLUMN H) (1977$)	TAX DOLLARS LEAVING THE REGION (1977$)
Less than $10,000	71.12	45.99	25.13
$10,000 to $19,999	136.64	88.38	48.26
$20,000 and Up	170.52	110.25	60.27
	(A)	(B)	(C)=(A)-(B)

Using the number of households per income group that were calculated previously, the total tax dollars leaving the region as a result of household expenditures is found as follows:

INCOME GROUP	TAX DOLLARS PER HOUSEHOLD LEAVING (1977$)	HOUSEHOLDS PER INCOME GROUP	TOTAL TAX DOLLARS PER INCOME GROUP (1977$)
Less than $10,000	25.13	400,938	10,075,572
$10,000 to $19,999	48.26	377,352	18,211,008
$20,000 and Up	60.27	400,938	24,164,533
TOTAL			52,451,113
	(A)	(B)	(C)=(A)x(B)

By adding the total tax dollars leaving the trucking sector to the total tax dollars leaving the household sector, and converting these values to 1972 dollars, the total tax dollars leaving the region are obtained.

Total Tax Dollars Leaving the Trucking Sector (1977$)	$18,482,600
Total Tax Dollars Leaving the Household Sector (1977$)	+ $52,451,113
Total Tax Dollars Leaving Dallas-Fort Worth SMSA (1977$)	$70,933,713
CPI Adjustment Factor	x 0.6931
Total Tax Dollars Leaving Dallas-Fort Worth SMSA (1972$)	$49,165,487

By using this total tax figure, the effects of the tax dollars returning to the area can now be determined. Information pertaining to lines D, F, and H are obtained from Exhibit 32. The overall methodology and final results for Scenario 1 are as follows:

	Scenario 1 State Tax
(A) Tax Dollars Leaving Region (Millions)	49.166
(B) Returning Tax Dollars to Region Adjustment Factor	0.45
(C) Tax Dollars Entering Local Economy for Construction (Millions) (C)=(A)x(B)	22.125
(D) Final Demand Multiplier (Sector 6)	2.9223
(E) Total Change In Expenditures (Millions) (E)=(C)x(D)	64.655
(F) Income Multiplier (Sector 6)	0.7271
(G) Change In Income Revenue (Millions) (G)=(E)x(F)	47.011
(H) Employment Multiplier (Sector 6)*	0.000067
(I) Change In Employment (Jobs) (I)=(G)x(H)	3150
(J) Final Change In Expenditures ($)	6,024,000
(K) Final Change In Income/Revenue ($)	9,662,000
(L) Final Change In Employment (Jobs)	-500

* Includes adjustment factor
x .84 (Column H, Exhibit 32)

Rows J, K, and L reflect the final values for Scenario 1. These values were obtained by adding the changes in Exhibit 32 to the corresponding values developed above. These final values represent the total impact of the scenario, including the additional roadway construction and maintenance funding resulting from the returning tax dollars into the local economy.

Exhibit 35 contains final economic impacts for each scenario. It is important to remember that the scenarios are not all evaluated for the same year.

In the analysis presented here, the updated multipliers obtained from RIMS-II were used. Should the local planner be unable to afford the $2000 to obtain the updated RIMS-II multipliers, the following local differences between the RIMS-II multipliers and those determined by the Input-Output Analysis should be noted. Concerning the final demand multipliers, thirteen of the RIMS-II multipliers were found to be lower than the I-O multipliers, with the extreme RIMS-II value being low by 1.5. There were fifteen of the RIMS-II multipliers that were higher, with the extreme being 0.72 higher than the corresponding I-O multiplier. There were seven RIMS-II multipliers that were within $\pm$0.05 of the Input-Output multipliers. There were four economic sectors presented in RIMS-II that did not exist in the 1972 Input-Output Analysis for Dallas-Fort Worth.

In relation to the income multipliers, there were seventeen RIMS-II multipliers that were lower than the Input-Output multipliers with the extreme being low by 0.73. There were seven of the RIMS-II multipliers that

EXHIBIT 35 Final Impact of Three Scenarios in the Dallas-Fort Worth SMSA

	Change in Income/ Revenue (1000$)	Change in Employment	Percent Change in CPI
Scenario 1: 5 Cent Increase in State Fuel Tax	$ 9 ,700	-500	0.25
Scenario 2: Energy and Efficiency Changes Between 1980 and 2000	$-840,600	-34,100	0.11
Scenario 3: 10 Percent Improvement in Efficiency in 1987	$ 172,100	13,500	-0.39

were higher than the others, with the extreme being high by 0.22 and finally, there were eleven RIMS-II multipliers that were within ±0.05 of the Input-Output multipliers. There is considerable difference between the 1972 Input-Output values and RIMS-II coefficients. Both sets of data use 1972$ values, however, the RIMS-II coefficients are based on more recent expenditure data. Therefore, in areas like the Dallas-Fort Worth area which has changed drastically over the last ten years, serious consideration should be given to adopting the more up-to-date values.

VI. SUMMARY

The methodology established in this manual is designed to be straightforward. This manual has demonstrated the flexibility of the procedure for a wide-range of planning issues as well as for a large number of planning areas across the nation.

Recalling that Scenario 1 represents a 5 cent per gallon fuel tax increase, the results of this investigation show that approximately 500 jobs would be lost to the economy of the Dallas-Fort Worth SMSA if a state tax increase was adopted. This information indicates that there is no significant improvement in employment in the Dallas-Fort Worth area if a gasoline tax is implemented. Scenario 2 shows a loss of 34,000 jobs as a result of the long term changes in fuel price and efficiency. Finally, Scenario 3, representing a 10 percent improvement in efficiency for the year 1987, produces a gain of approximately 13,500 jobs. From the information presented for each scenario, it can be seen that the procedures, input data, and results used in this planning manual are certainly sensitive to policy concerns and significant in magnitude.

By evaluating the changes in household and trucking expenditures resulting from the proposed scenarios a great deal can be learned about the effects of policy/engineering decisions in energy economics. The process outlined and demonstrated in this manual can be very useful to planners and engineers at

any level - local, regional or statewide. For example, the information presented in Exhibit 33 (Columns A and B) indicates that future energy prices and inadequate fuel efficiency improvements for the truck fleet will lead to a significant increase in household expenditures due to higher trucking costs.

It is hoped that this procedure can be easily applied to any geographic area in the nation, for any time frame, and across any combination of economic sectors. Also, the flexibility of the method allows various steps within the procedure to be used independently.

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APPENDIX I

IMPORTANT ASSUMPTIONS

APPENDIX I

IMPORTANT ASSUMPTIONS

- Essential services and business/rental car travel represent 6.6 percent of the regional travel and is not included in this methodology because of the inelasticity of this type of travel to fuel price and efficiency.

- Variable costs (i.e., gasoline, maintenance and fuel taxes) are included in the analysis and fixed costs (e.g., insurance) are not addressed.

- Households possess fixed budgets while trucking sectors adjust their prices to meet changes in the cost of business. It is assumed that these costs are passed on to the consumer.

- Diesel and gasoline prices are equal.

- Vehicle miles of travel per household remains constant over time.

- Automobile fuel efficiency does not vary significantly between income groups.

- Fuel prices do not vary significantly between income groups.

- Fuel prices do not change as a result of energy efficiency improvements in the local transportation system.

- The percentage of households per income group for the Dallas-Fort Worth SMSA is not significantly different than the national average.

- Growth in truck VMT could result from either more trucks traveling the same, the same number of trucks traveling more, or combinations of the two.

- Changes in fuel prices or efficiency do not affect the amount of truck travel.

APPENDIX II

DEVELOPMENT OF LOCAL EFFICIENCY IMPROVEMENTS

APPENDIX II

TABLE 1

AREAWIDE ACTIONS CONTAINED
IN THE REGIONAL ASSESSMENT

ACTION	PACKAGE #1 *	PACKAGE #2
Employer Based Carpool/Vanpool Program for Firms of 250 or More Employees	X	
Employer Based Carpool/Vanpool Program Including Parking Subsidies and Priority Parking for Firms of 100 or More Employees		X
10 Percent Improvement in Peak-Period Transit Frequency	X	
25 Percent Improvement in Peak-Period Transit Frequency		X
15 Percent Reduction in Peak-Period Transit Fare		X
Employer Based Variable Work Hours for Firms of 250 or More Persons	X	X

* This package is identical to the actions contained in the Areawide Transportation System Management/Air Quality Study approved by the Regional Transportation Council on December 4, 1979.

TABLE 2

LOCALIZED ACTIONS CONTAINED IN THE REGIONAL ASSESSMENT

AREA	UNIT OF MEASURE	PACKAGE #1 *	PACKAGE #2
DALLAS COUNTY			
Signal Progression	Miles	340	465
Signal Removal	Intersections	50	65
Intersection Improvements (Low Cost)	Intersections	270	340
Parking Restrictions (Peak Period)	Lane Miles	95	120
Park-and-Ride	Locations	8	8
Headway Improvements (5%)	Route Miles	545	545
Non-Radial Bus Routes	Route Miles	25	25
Bus Stop Removal	Locations	315	315
Widen Roadways	Lane Miles	---	200
Grade Separations	Locations	---	10
TARRANT COUNTY			
Signal Progression	Miles	145	180
Signal Removal	Intersections	30	40
Spot Signal Improvements	Intersections	20	25
Intersection Improvements (Major)	Intersections	15	20
Parking Restrictions (Peak Period)	Lane Miles	45	55
Park-and-Ride	Locations	5	5
Bus Route Modifications (5%)	Route Miles	25	25
Widen Roadways	Lane Miles	---	100
Grade Separations	Locations	---	5
REMAINDER OF INTENSIVE STUDY AREA			
Signal Progression	Miles	25	30
Spot Signal Improvements	Intersections	2	3
Intersection Improvements (Low Cost)	Intersections	10	15
Parking Restrictions (Peak Period)	Lane Miles	10	15
Park-and-Ride	Locations	2	2
Widen Roadways	Lane Miles	---	20
Grade Separations	Locations	---	1

* This package was extrapolated from the results of the Dallas North Central Subarea Transportation System Management and Air Quality Study Volume Two: Analysis of TSM/TCM Actions approved by the Regional Transportation Council on September 1, 1981 and the Southwest Fort Worth Subarea Study: Analysis of TSM/TCM Actions approved by the Regional Transportation Council on November 3, 1981.

TABLE 3

IMPACT OF AREAWIDE AND LOCALIZED ACTIONS
AS COMPARED TO THE 1987 BASELINE

	DALLAS COUNTY		TARRANT COUNTY		REMAINDER OF INTENSIVE STUDY AREA		TOTAL	
	PACKAGE 1	PACKAGE 2	PACKAGE 1	PACKAGE 2	PACKAGE 1	PACKAGE 2	PACKAGE 1	PACKAGE 2
SAVINGS								
Hydrocarbon (HC) Emissions [1]	5.0%	8.6%	5.0%	8.9%	4.2%	8.1%	5.0%	8.7%
Fuel Consumption	5.9%	9.1%	6.1%	9.5%	4.8%	7.8%	5.9%	9.2%
Travel Time	8.5%	10.0%	9.6%	11.0%	7.2%	8.1%	8.9%	10.4%
ANNUAL COST ($1981, Millions)								
To User	-39.85 [2]	-57.35	-20.04	-28.55	-3.70	-4.52	-62.98	-90.42
To Public	18.80	52.07	7.35	24.50	1.52	4.90	27.55	81.47
To Private	5.68	6.50	2.82	3.22	0.64	0.73	9.14	10.46
Total	-15.37	1.22	- 9.99	- 0.83	-0.94	1.11	-26.29	1.51
EFFECTIVENESS								
Public Cost/Ton of HC Saved	$9,100	$14,500	$7,300	$13,700	$8,100	$13,600	$8,400	$14,300
Public Cost/Gallon of Fuel Saved	$ 0.37	$ 0.66	$ 0.29	$ 0.62	$ 0.34	$ 0.67	$ 0.34	$ 0.64
Public Cost/Hour of Time Saved	$ 0.32	$ 0.77	$ 0.23	$ 0.67	$ 0.29	$ 0.84	$ 0.29	$ 0.73

[1] Mobile Source percentages.

[2] A negative value indicates a reduction in the cost to travel.

Source: North Central Texas Council of Governments

APPENDIX III

DERIVATION OF INCOME ELASTICITIES

APPENDIX III

DERIVATION OF INCOME ELASTICITIES

Household income elasticities were estimated for 24 economic sectors of the 1972 Dallas-Fort Worth Input-Output model. The data used for the estimates was obtained from the Bureau of Labor Statistics' Consumer Expenditure Survey: Interview Survey, 1972-1973, Volume 2: Regional Tables (Bulletin 1997). From this volume, family expenditures for over 5,000 items was aggregated into the sector definitions used in the input-output model. Household income data was also reported in the survey for 12 family income classes.

Once the aggregation was completed, the elasticities were estimated using a simple regression technique, assuming the following formula:

$$\ln C_{k,j} = \ln a + b \ln Y_j$$

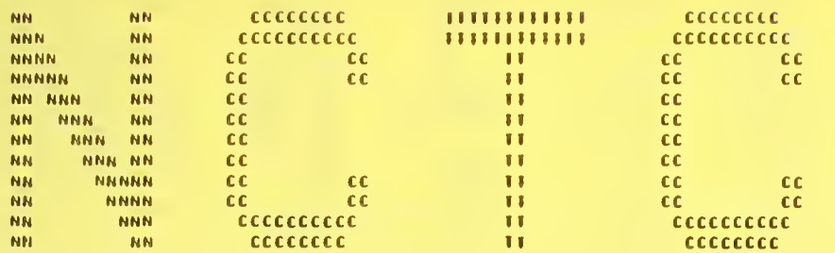
where C_{kj} is the average expenditure by the jth income group for the goods and services of the kth industrial sector and Y_j is the average income of the jth income group and ln is the base of the natural logrithms.

There are several points to be made about this approach. Since the elasticities were estimated over the income distribution by using each income group's average expenditure and average income as observations, the elasticity estimates are purged of any changes in income and expenditures due to changes in prices and wages over time. Thus, the elasticity estimates can be considered intertemporal. Additionally, since the form of regression equation is logrithmic, the income group distribution is also assumed to be logrithmic.

Elasticities were estimated for 3 income classes for each economic sector: less than $10,000, $10,000-$19,999, and $20,000 and over. Thus, there are three income elasticities for each of the 24 economic sectors, making a total of 72 elasticity coefficients. Overall, the statistical results seem satisfactory and the elasticity estimates themselves exhibit the typical declining pattern from lower income groups to higher income groups, indicating that most of these products are normal goods.

APPENDIX IV

1972 TRANSACTIONS TABLE



"NCTCOG 1972 I-O MODEL"

Draft Version
8-30-77

• • • • • • UNIVAC 1100 TIME/SHARING EXEC --- MULTI-PROCESSOR SYSTEM --- VER. 33-R1-UPD-A SITE • TWDB • • • • • •

RUNID • NCTCOG USER ID • PART NUMBER • 00 INPUT DEVICE • CRI OUTPUT DEVICE • PRI

FILE NAME • PR@DDONCTCOG CREATED AT: 14:38:38 AUG 31,1977 PRINTED AT: 15:28:24 AUG 31,1977

Appendix IV contains a listing of the transaction table from the input-output model developed by Mullendore etal. (1972) for the Dallas-Fort Worth Metropolitan Area. The household expenditures by sector, needed in Step 5 of the methodology, are found in column 62 of this table. The sectors used here are defined in Appendix VII.

TRANSACTIONS (NCTCOG, 1972)
(THOUSAND DOLLARS)

		1	2	3	4	5	6	7	8
1	AGRICULTURE PROD	5995.193	762.105	0.	0.	.734	.088	.166	0.
2	AGRICULTURE SERV	7404.583	0.	0.	2490.322	12969.554	820.404	0.	0.
3	CRUDE PETRENA GAS	.093	.839	64.268	0.	.015	.039	.012	.015
4	RESTDENTIAL CONST	0.	0.	0.	4.088	0.	0.	0.	0.
5	COMM,ED,&INST CON	0.	0.	0.	242.298	858.599	332.627	924.044	38.280
6	INDUSTRIAL CONSTR	0.	0.	0.	19.129	0.	0.	0.	0.
7	FACILITY CONSTR	0.	0.	0.	1205.418	18.632	790.334	33.694	180.183
8	MAINTEREPAIR	1016.495	1400.115	53.776	517.929	986.420	736.940	113.558	181.575
9	FOOD&KINDRED PROD	10570.040	63.517	2.250	18.975	0.	0.	0.	0.
10	TEXTILE MILL PROD	5.256	2.278	.019	438.520	59.468	70.498	12.732	13.666
11	APPAREL,OTHER TEX	.155	0.	3.046	.660	0.	64.115	.689	0.
12	LUMBER&WOOD PROD	636.173	0.	1.627	11413.063	6003.200	397.768	198.226	9402.790
13	FURNITURE&FIXTURE	1.279	0.	0.	4304.854	1783.454	105.148	7.990	2070.858
14	PAPER&ALLIED PROD	211.864	3.174	6.944	1830.426	307.880	26.159	47.938	212.960
15	PRINTING&PUBLISH	5.696	1.656	28.448	1248.867	83.884	35.391	206.491	64.460
16	CHEM&ALLIED PROD	2254.936	2233.744	26.449	1528.797	878.376	560.068	115.724	1167.469
17	PETR REF&REL IND	268.366	105.613	19.178	287.759	633.574	102.750	319.200	132.246
18	RUBBER,PLAS,LEATH	197.334	16.422	3.015	146.874	5244.594	1709.298	1860.185	531.299
19	GL,STO,CLAY,CONCR	102.832	0.	72.403	34440.371	45320.635	14682.011	53202.794	14861.424
20	PRIMARY METAL IND	17.505	0.	1.523	2089.512	10605.990	1261.251	7080.799	2398.677
21	FAB METAL PROD	675.927	17.388	27.603	30904.626	75426.902	29971.573	11377.122	2181.518
22	PLUMB,HTG,REFRIG	0.	8.418	1.008	5674.211	10519.885	3113.410	397.967	2286.457
23	MACH EX ELEC&REFR	807.238	1099.427	134.979	3124.367	3090.043	1653.390	3454.972	2939.197
24	ELECT MACH,EQ,SUP	101.902	9.936	230.072	2471.790	2685.210	1546.960	3332.097	1095.599
25	AIRCRAFT,PTS,ORDN	0.	76.313	.234	0.	34.344	0.	0.	0.
26	TRAN EQUIP EX AIR	1024.604	41.123	3.714	931.593	1415.700	204.398	385.983	333.520
27	PROF,SCI,CON INST	.997	0.	1.194	409.141	264.058	383.148	103.091	104.975
28	MISC MFG IND	57.654	9.384	.547	1061.097	777.450	93.095	82.376	76.340
29	TRANE&WAREHOUSING	2966.226	676.028	181.956	6804.173	8041.621	4665.279	11709.152	1753.370
30	TELEPHONE&TELEGRA	282.343	200.787	36.743	1457.525	1355.218	280.309	590.821	337.920
31	TV,RADIO,OTH COMM	0.	36.293	2.978	1435.758	557.405	65.141	11.296	13.860
32	GAS SERVICES	280.539	38.882	4.586	63.742	64.808	9.585	15.512	28.463
33	ELECTRIC SERVICES	677.778	1029.923	138.116	953.197	576.082	170.990	291.718	241.885
34	WATER&SAN SVC SYS	2.690	37.223	5.805	1187.696	258.655	59.130	102.027	69.329
35	WHL AUTO,PTS&SUPP	226.549	13.386	6.367	10.334	74.159	18.465	138.166	46.860
36	WHL GROCERY PROD	11.081	0.	0.	7.036	0.	0.	0.	0.
37	WHL MACH,EQ&SUPP	1547.367	1725.108	186.294	588.375	378.999	0.	110.064	.440
38	WHL PETR&REL PROD	1131.470	2669.101	26.820	370.261	298.951	56.223	1596.826	226.213
39	GENERAL WHOLESALE	14649.305	753.191	7.582	341.899	791.430	143.617	173.706	132.440
40	BLD MAT,HDW,FM EQ	806.508	0.	1.221	20174.129	6879.077	12.821	4.186	3436.819
41	DEPT&VAR STORES	0.	0.	0.	29.054	0.	0.	0.	0.
42	FOOD STORES	17.700	17.158	6.298	0.	0.	0.	0.	0.
43	AUTO DL,SV STE&REP	2818.648	158.723	82.808	1956.475	1727.978	454.681	876.396	1643.809
44	APPAR&ACCES STORE	0.	19.219	0.	0.	0.	0.	0.	0.
45	FURN,HOME EQUIP	0.	0.	0.	0.	0.	0.	0.	0.
46	EAT&DRINK PLACES	0.	47.057	5.318	328.267	307.880	460.087	90.090	111.540
47	OTHER RETAIL	0.	11.868	7.959	639.385	687.183	66.166	380.748	415.800
48	BANK&CREDIT AGENC	4462.744	629.269	99.225	23794.878	1273.765	979.160	2144.119	597.959
49	INSURANCE CARRIER	1530.435	1146.484	132.711	10507.414	29348.573	8703.443	3718.217	2670.137
50	FIRE,NEC	0.	30.773	289.504	30622.312	3563.260	2548.688	10832.999	1316.039

	1	2	3	4	5	6	7	8
51 LEG,ACCT,ENGNEPRO	33.167	239.702	102.391	8009.240	1926.300	4843.994	905.585	1103.299
52 LODGING SERVICES	0.	135.126	16.955	268.136	362.195	99.837	199.866	214.110
53 PERSONAL SERVICES	0.	.690	2.532	7.915	0.	0.	5.510	31.240
54 PHOTO,AMUSE&REC	0.	0.	0.	0.	0.	0.	0.	0.
55 MISC BUSINESS SVC	110.543	3245.980	200.831	2955.726	3117.701	14877.945	4686.342	4046.016
56 MISC REPAIR SVC	394.130	335.645	13.289	117.476	141.736	4.774	2.436	54.882
57 MED&OTH HEALTH SV	0.	0.	4.322	17.632	1.269	0.	.460	0.
58 EDUCATION SERVICE	3339.672	201.894	1355.323	3320.982	5247.284	1290.990	1315.113	1210.263
59 OTHER SERVICES	0.	0.	27.704	350.881	1002.782	180.782	216.461	379.303
60 OUTDOOR REC	1.627	4.416	32.747	56.947	186.308	45.393	16.806	34.980
61 SCRAP	0.	0.	0.	65.011	525.499	47.958	6.878	0.
62 HOUSEHOLDS	50722.604	15254.949	8962.519	172313.109	246461.271	87015.451	178789.051	88503.703
63 PROPERTY PAYMENTS	1076.716	2494.997	5802.639	14241.920	17880.735	3073.401	4182.855	989.999
64 FEDERAL GOVT	1276.569	1196.439	2530.443	15339.516	12114.295	7487.313	13171.208	6367.671
65 STATE GOVT	47.735	59.753	1353.421	1039.550	3331.059	709.621	318.759	610.499
66 LOCAL GOVT	2726.914	111.088	148.781	1735.221	787.175	212.861	795.383	115.940
67 DEPRECIATION	10905.099	3248.878	3197.468	3617.536	4323.994	2002.943	3673.998	2342.777
68 IMPORTS	65392.728	18191.523	7837.047	200723.650	175668.795	29692.102	99719.410	47091.942
TOTAL VALUE ADDED	66755.635	22366.102	21995.271	209286.848	284898.520	100501.589	200931.250	98930.586
TOTAL PURCHASES	198795.000	59813.000	33493.000	632257.000	709231.000	228940.000	424070.000	206413.000

	17	18	19	20	21	22	23	24
1 AGRICULTURE PROD	0.	0.	0.	0.	0.	0.	0.	0.
2 AGRICULTURE SERV	0.	0.	0.	0.	0.	0.	0.	0.
3 CRUDE PETRENA GAS	631.224	12.813	.309	0.	0.	1.549	.365	32.969
4 RESIDENTIAL CONST	0.	0.	0.	0.	0.	0.	0.	0.
5 COMM,ED,&INST CON	0.	0.	0.	0.	0.	0.	0.	0.
6 INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
7 FACILITY CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
8 MAINT&REPAIR	1242.670	216.651	1978.628	225.381	1834.717	1126.020	1665.680	544.125
9 FOOD&KINDRED PROD	.587	768.203	74.193	14.397	456.156	9.088	24.584	56.901
10 TEXTILE MILL PROD	1.917	30.590	6.347	3.216	8.967	12.831	16.408	20.465
11 APPAREL,OTHER TEX	0.	29.091	0.	11.834	14.941	1207.524	11.242	17.846
12 LUMBER&WOOD PROD	26.132	403.220	943.809	22.700	1231.790	563.756	1123.139	397.067
13 FURNITURE&FIXTURE	.039	38.789	72.648	1.414	52.570	483.132	63.362	124.283
14 PAPER&ALLIED PROD	351.674	2414.586	6217.677	113.204	2850.658	161.858	1077.662	1135.114
15 PRINTING&PUBLISH	36.845	352.254	288.752	33.864	1374.834	939.389	809.907	2924.145
16 CHEM&ALLIED PROD	1412.483	12562.096	724.878	528.201	1574.455	403.384	437.801	1655.936
17 PETR REF&REL IND	378.876	7.440	146.552	53.364	57.490	24.189	67.031	34.822
18 RUBBER,PLAS,LEATH	22.872	1518.165	1058.145	10.271	5403.329	32187.213	2149.703	15090.448
19 GL,STO,CLAY,CONCR	112.059	7.442	45452.430	1872.440	2642.593	173.463	559.781	151.051
20 PRIMARY METAL IND	95.030	171.027	751.112	4235.565	16625.528	530.644	6700.250	5641.901
21 FAB METAL PROD	958.344	577.092	465.008	498.960	49167.831	18902.612	25276.764	12443.548
22 PLUMB,HTG,REFRIG	1.012	19.169	50.578	5.359	404.510	302.950	1789.460	469.724
23 MACH EX ELEC&REFR	113.189	1122.161	2497.309	274.339	4427.747	2777.245	18812.582	4033.764
24 ELECT MACH,EQ,SUP	116.699	83.440	582.409	301.951	429.134	2498.116	3926.899	33314.089
25 AIRCRAFT,PTS,ORDN	0.	0.	0.	0.	129.211	0.	0.	0.
26 TRAN EQUIP EX AIR	4.311	9.472	387.762	13.174	329.252	17.113	384.770	56.724
27 PROF,SCI,CON INST	9.596	0.	0.	0.	30.271	9.546	940.218	1681.129
28 MISC MFG IND	3.036	170.940	100.236	8.931	516.843	35.426	436.123	1036.962
29 TRANS&WAREHOUSING	5191.322	2888.493	13330.876	5161.272	13054.934	3128.342	6893.316	5732.004
30 TELEPHONE&TELEGRA	88.017	678.348	1448.359	325.396	1734.521	926.563	2001.773	2601.010
31 TV,RADIO,OTH COMM	12.356	7.216	49.965	0.	69.724	0.	1.022	11.472
32 GAS SERVICES	336.414	92.177	2206.344	608.002	193.171	56.779	220.368	111.473
33 ELECTRIC SERVICES	607.295	1422.337	5396.291	3722.332	2410.354	667.958	2231.998	3681.582
34 WATER&SAN SVC SYS	179.561	208.384	445.335	69.569	319.458	185.411	147.609	329.643
35 WHL AUTO,PTS&SUPP	5.534	20.296	91.346	464.798	69.447	13.437	381.448	13.384
36 WHL GROC&REL PROD	0.	0.	0.	.521	0.	0.	0.	1.912
37 WHL MACH,EQ&SUPP	674.312	582.054	1561.776	1295.480	4590.160	443.431	5877.063	2701.711
38 WHL PET&REL PROD	97.583	27.782	267.910	99.921	319.656	64.581	252.794	232.463
39 GENERAL WHOLESALE	1418.804	1029.249	7811.638	367.522	10462.188	4893.619	6703.833	10964.905
40 RET MAIL,MDW,FM EQ	2.242	24.758	208.226	115.129	79.194	93.399	65.615	33.112
41 DEPT&VAR STORES	0.	0.	0.	0.	22.658	0.	.476	5.338
42 FOOD STORES	0.	0.	0.	0.	0.	0.	0.	0.
43 AUTO DL,SV ST&REP	46.306	83.784	1164.504	71.708	692.395	155.200	592.888	78.521
44 APPAR&ACCES STORE	0.	0.	0.	0.	46.498	0.	23.247	18.345
45 FURN,HOME EQUIP	0.	0.	12.999	0.	0.	0.	0.	35.842
46 EAT&DRINK PLACES	8.492	40.142	170.738	33.046	833.090	658.428	663.766	114.085
47 OTHER RETAIL	5.560	28.189	127.517	5.805	134.191	14.659	156.361	378.584
48 BANK&CREDIT AGENC	767.364	3068.579	9023.662	1059.695	3099.672	2422.378	1022.476	2917.682
49 INSURANCE CARRIER	452.652	1957.017	4371.440	521.139	5392.262	1139.116	3408.763	1109.620
50 FIRE,NEC	584.152	125.306	2686.132	276.646	671.785	5.497	1842.347	2051.618

	17	18	19	20	21	22	23	24
51 LEG,ACCT,ENGNRPRO	363.689	672.710	2196.908	202.368	2803.622	2435.816	3317.297	10149.102
52 LODGING SERVICES	16.004	101.900	333.028	8.204	389.900	1464.251	572.913	95.574
53 PERSONAL SERVICES	46.769	2.030	159.703	6.061	110.120	4.276	164.536	198.215
54 PHOTO,AMUSE&REC	96.088	51.868	0.	0.	0.	0.	520.180	683.873
55 MISC BUSINESS SVC	1167.069	1173.128	4040.386	438.897	5925.982	5002.339	3183.420	6267.663
56 MISC REPAIR SVC	48.624	586.504	1525.077	35.540	954.457	1109.216	806.205	140.009
57 MEDICIN HEALTH SV	1.087	0.	19.461	10.196	17.103	8.164	22.837	71.343
58 EDUCATION SERVICE	608.239	553.918	6733.351	388.060	2760.793	1458.805	2120.566	4938.743
59 OTHER SERVICES	15.366	18.767	504.183	15.448	139.777	20.930	200.111	692.009
60 OUTDOOR REC	20.558	0.	209.667	8.261	63.123	17.102	32.703	45.889
61 SCRAP	6.152	.442	0.	4640.283	1145.589	0.	4.753	4.368
62 HOUSEHOLDS	5234.237	34210.358	93032.186	29470.718	123912.729	54640.937	148324.889	317863.703
63 PROPERTY PAYMENTS	10066.960	21881.013	63063.863	14020.763	36169.845	23723.547	59300.524	52250.922
64 FEDERAL GOVT	2245.673	4386.712	17073.167	5127.811	20591.249	15168.875	18518.511	22440.325
65 STATE GOVT	265.694	252.576	7025.385	159.944	1455.349	532.606	996.927	1087.950
66 LOCAL GOVT	158.604	207.982	886.488	174.606	970.048	641.326	1246.541	1784.570
67 DEPRECIATION	2373.163	5902.396	16202.926	4118.876	11435.002	1972.839	12517.790	22787.679
68 IMPORTS	58569.461	60752.866	83120.393	51458.422	210107.160	141762.541	161088.363	431250.777
TOTAL VALUE ADDED	20344.332	66921.036	197284.010	53872.717	194534.217	96680.128	240905.178	418215.141
TOTAL PURCHASES	97300.000	163700.000	408300.000	133500.000	552700.000	327200.000	511700.000	986800.000

	25	26	27	28	29	30	31	32
1 AGRICULTURE PROD	0.	0.	0.	0.	0.	0.	0.	0.
2 AGRICULTURE SERV	0.	0.	0.	0.	0.	0.	0.	0.
3 CRUDE PETRLNA GAS	5.032	.762	0.	.559	23.950	0.	0.	1557.123
4 RESIDENTIAL CONSI	0.	0.	0.	0.	0.	0.	0.	0.
5 COMM,FO,CINSI CON	0.	0.	0.	0.	0.	0.	0.	0.
6 INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
7 FACILITY CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
8 MAINTNCEPAIR	4879.871	707.260	160.597	189.688	7812.600	33.156	71.580	236.878
9 FOODSKINDRED PROD	152.649	92.723	2.869	5.318	334.499	0.	0.	0.
10 TEXTILE MILL PROD	12.670	35.834	1.302	270.949	7.780	0.	0.	0.
11 APPAREL,OTHER TEX	516.093	277.178	1.653	377.154	150.514	14.202	0.	16.582
12 LUMBERWOOD PROD	258.324	9407.300	7.024	1844.419	362.936	2070.723	29.909	0.
13 FURNITUREFIXTURE	264.435	5744.013	.413	263.434	28.246	0.	9.495	0.
14 PAPERALLIED PROD	12248.467	1832.184	729.885	1081.686	1865.945	61.450	19.227	22.827
15 PRINTINGPUBLISH	8557.483	1560.409	391.076	1293.429	962.282	4192.245	539.315	86.355
16 CHEMALLIED PROD	486.838	729.825	178.876	362.212	390.566	9.813	2.340	35.950
17 PETR REFINRL IND	185.820	61.159	5.559	7.280	1497.245	94.803	3.180	27.003
18 RUBBLR,PLAS,LEATH	12257.356	5111.852	74.992	3004.216	4764.206	46.429	4.985	.538
19 GL,STO,CLAY,CONCR	112.218	4425.662	676.998	252.713	1847.179	69.097	15.667	0.
20 PRIMARY METAL IND	8375.520	9509.786	828.513	268.739	376.974	9.227	18.083	.321
21 FAB METAL PROD	6564.774	21338.918	1694.250	2509.895	1905.992	35.504	39.404	1538.786
22 PLUMB,HTG,REFRIG	1158.849	510.591	3.925	29.100	167.152	0.	43.440	0.
23 MACH EX ELECTREFR	14544.499	5451.166	435.286	90.364	1994.211	44.517	0.	3.661
24 ELECT MACH,EQ,SUP	40674.711	1500.435	792.688	277.218	3405.906	309.980	827.250	33.056
25 AIRCRAFT,PTS,ORDN	54555.900	9.185	0.	0.	826.472	0.	0.	.323
26 TRAN EQUIP EX AIR	4797.613	13830.260	2.892	29.866	11732.336	7.101	109.192	16.151
27 PROF,SCI,CON INST	10621.537	55.636	580.252	0.	868.873	0.	22.042	1.188
28 MISC MFG IND	1569.946	182.624	387.977	452.585	69.260	3.824	19.465	0.
29 TRANSWAREHOUSING	7095.947	13018.565	961.541	1014.688	17929.305	756.668	157.773	335.402
30 TELEPHONETELEGRA	5946.462	1820.297	326.620	341.545	10943.783	0.	779.538	236.885
31 TV,RADIO,OTH COMM	37.776	10.266	0.	78.877	161.735	116.891	286.274	59.114
32 GAS SERVICES	142.951	210.231	51.279	62.382	1029.566	79.569	6.370	454.973
33 ELECTRIC SERVICES	3141.026	3362.267	326.453	854.347	6495.449	1699.531	452.255	127.347
34 WATERSAN SVC SYS	435.693	243.860	130.759	56.583	593.305	344.265	60.435	35.274
35 WHL AUTO,PTSESUPP	31.666	436.028	4.132	9.190	3463.171	0.	0.	1.184
36 WHL GROCEREL PROD	0.	0.	0.	0.	0.	0.	0.	0.
37 WHL MACH,EQUESUPP	4863.166	8858.347	434.254	49.394	1085.131	266.556	.949	80.649
38 WHL PETREREL PROD	804.567	1305.061	1.804	30.086	5605.598	0.	11.283	47.420
39 GENERAL WHOLESALE	25505.789	18079.241	167.958	2130.444	3067.734	170.694	107.056	596.951
40 BLD MAT,HDW,FM EQ	56.089	1508.904	12.960	155.010	253.166	0.	2.559	1.372
41 DEPTSVAR STORES	16.611	0.	0.	0.	0.	0.	0.	0.
42 FOOD STORES	0.	0.	0.	0.	0.	0.	0.	0.
43 AUTO DL,SV STOREP	1237.836	2219.031	58.261	105.770	3302.382	0.	20.106	342.624
44 APPARLACCES STORE	0.	0.	0.	0.	1.617	0.	0.	0.
45 FURN,HOME EQUIP	1.536	0.	.190	0.	0.	0.	0.	0.
46 TAILORING PLACES	68.331	272.855	267.741	83.089	596.058	52.983	103.495	0.
47 OTHER RETAIL	2981.008	405.771	10.123	41.736	.193	0.	0.	0.
48 BANKCHEDIT AGENC	3940.975	1336.181	233.034	384.429	10047.665	1496.372	344.905	971.984
49 INSURANCE CARRIER	6624.772	2956.565	362.773	544.481	22395.986	120.715	64.091	116.074
50 FIRE,NEC	13805.636	634.862	65.489	687.302	33463.972	6546.730	770.280	3059.267

	25	26	27	28	29	30	31	32
51 LEG,ACCT,ENGREPRO	3538.212	1836.668	672.246	521.124	10326.638	880.781	697.643	979.629
52 LODGING SERVICES	64.410	248.434	214.191	81.754	668.214	58.856	19.330	18.499
53 PERSONAL SERVICES	1332.732	341.475	100.610	3.829	104.663	24.580	0.	0.
54 PHOTO,AMUSEREC	817.194	195.591	2.479	6.509	258.659	84.937	251.142	0.
55 MISC BUSINESS SVC	4991.495	9024.222	830.701	1049.906	11158.720	900.445	6306.326	397.537
56 MISC REPAIR SVC	408.516	570.327	63.075	151.832	507.206	0.	59.216	408.025
57 MEDEOTH HEALTH SV	0.	25.727	6.903	.960	.646	7.985	0.	0.
58 EDUCATION SERVICE	3612.073	3162.837	322.143	951.391	8502.707	13721.821	206.144	8936.543
59 OTHER SERVICES	709.243	222.704	141.382	720.887	1369.619	3.743	93.193	44.909
60 OUTDOOR REC	213.326	106.981	.826	9.190	280.327	237.333	2.611	166.573
61 SCRAP	7463.030	1.587	0.	47.235	0.	0.	0.	0.
62 HOUSEHOLDS	481624.531	167538.658	13157.345	24122.947	298825.758	70059.375	17229.110	8306.278
63 PROPERTY PAYMENTS	48175.002	31654.482	7750.248	8733.132	42631.186	17909.489	2617.765	5570.356
64 FEDERAL GOVT	61429.545	20344.555	1934.102	1959.671	38908.583	52533.608	5587.556	6895.729
65 STATE GOVT	1554.391	2038.582	111.146	423.102	3860.349	5605.864	72.637	2976.571
66 LOCAL GOVT	1635.499	655.934	149.778	325.080	2044.511	7148.392	140.051	1512.405
67 DEPRECIATION	31142.813	10846.682	1117.242	3665.480	39608.723	36236.290	2190.491	7832.395
68 IMPORTS	428909.602	461329.492	20153.186	25785.800	91833.501	30411.458	7287.842	99720.292
TOTAL VALUE ADDED	625561.766	241078.889	24219.861	39229.411	425879.102	189493.014	27837.610	33093.732
TOTAL PURCHASES	1337200.000	857200.000	57100.000	87600.000	712721.000	254478.000	47703.000	153809.000

	33	34	35	36	37	38	39	40
1 AGRICULTURE PROD	0.	0.	0.	0.	0.	0.	3.451	0.
2 AGRICULTURE SERV	0.	0.	0.	0.	0.	0.	347.250	0.
3 CRUDE PETR&NA GAS	0.	.208	0.	0.	.613	1.069	11.805	0.
4 RESIDENTIAL CONST	0.	0.	0.	0.	0.	0.	0.	0.
5 COMM,ED,CINST CON	0.	0.	0.	0.	0.	0.	0.	0.
6 INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
7 FACILITY CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
8 MAINT&REPAIR	412.260	1592.473	631.406	35.482	1355.599	64.663	3508.252	70.086
9 FOOD&KINDRED PROD	0.	0.	0.	0.	0.	0.	47.286	0.
10 TEXTILE MILL PROD	5.282	8.685	0.	0.	0.	0.	182.648	.066
11 APPAREL,OTHER TEX	107.360	7.130	17.603	55.773	15.638	5.449	263.626	0.
12 LUMBER&WOOD PROD	6054.400	52.429	24.804	552.552	81.447	1.962	737.941	45.815
13 FURNITURE&FIXTURE	31.240	0.	9.335	18.356	31.927	.872	51.619	1.542
14 PAPER&ALLIED PROD	102.080	59.559	17.070	678.453	151.492	3.706	3520.892	16.740
15 PRINTING&PUBLISH	775.500	277.871	1808.855	664.334	3399.604	2402.733	9235.593	1129.734
16 CHEM&ALLIED PROD	211.822	350.157	16.707	108.876	40.919	106.669	98.649	69.058
17 PETR REF&REL IND	132.710	43.575	99.635	85.033	407.913	79.846	378.664	29.713
18 RUBBER,PLAS,LEATH	98.120	155.608	69.879	140.021	574.040	9.809	361.860	12.335
19 GL,STO,CLAY,CONCR	153.120	3484.611	5.868	6.354	46.914	3.924	76.112	0.
20 PRIMARY METAL IND	65.363	91.828	.530	3.585	38.955	2.455	2.181	0.
21 FAB METAL PROD	469.040	226.491	41.607	139.315	93.827	45.557	527.515	0.
22 PLUMB,HTG,REFRIG	141.240	6.921	360.064	60.244	67.764	5.667	253.618	0.
23 MACH EX ELEC&REFR	85.360	154.979	210.971	335.344	426.783	257.210	1952.306	0.
24 ELECT MACH,EQ,SUP	410.740	145.122	56.277	148.728	61.900	15.694	572.813	21.366
25 AIRCRAFT,PTS,ORDN	0.	0.	0.	0.	0.	0.	0.	0.
26 TRAN EQUIP EX AIR	16.280	.419	520.359	2037.243	150.840	57.327	1130.878	78.855
27 PROF,SCI,CON INST	0.	112.406	8.582	2.380	0.	0.	0.	0.
28 MISC MFG IND	4.620	31.457	169.630	227.092	899.177	18.092	1192.768	96.255
29 TRANS&WAREHOUSING	2066.846	131.985	1435.641	2861.431	1911.257	2031.324	4947.769	760.447
30 TELEPHONE&TELEGRA	1074.260	166.932	2932.254	1931.815	8924.002	642.589	10974.838	497.356
31 TV,RADIO,OTH COMM	438.240	0.	656.117	45.654	522.891	175.905	806.942	713.876
32 GAS SERVICES	25420.637	426.283	79.878	55.593	125.514	41.153	569.912	54.251
33 ELECTRIC SERVICES	0.	3992.069	816.867	1740.902	1893.057	789.613	16334.302	375.232
34 WATER&SAN SVC SYS	1327.443	8184.274	217.487	422.545	228.536	66.169	3791.719	83.727
35 WHL AUTO,PTS&SUPP	78.540	.839	224.040	200.500	275.617	6.975	264.679	1277.090
36 WHL GROC&REL PROD	0.	0.	0.	37.182	0.	0.	248.877	0.
37 WHL MACH,EQ&SUPP	464.420	1807.107	272.582	125.195	568.008	1.526	1032.117	5.507
38 WHL PETR&REL PROD	261.426	124.907	211.377	91.311	700.319	256.270	2316.112	670.267
39 GENERAL WHOLESALE	965.360	272.628	492.354	626.681	1603.857	50.570	4496.123	130.396
40 BLD MAT,HDW,FM EQ	121.627	0.	64.314	.461	29.699	0.	136.048	154.807
41 DEPT&VAR STORES	0.	0.	0.	0.	0.	3.854	0.	0.
42 FOOD STORES	0.	0.	0.	3.901	0.	0.	19.404	0.
43 AUTO DL,SV ST&REP	5019.307	90.025	794.522	1461.627	3873.851	624.994	4927.253	527.041
44 APPAR&ACCES STORE	0.	0.	0.	7.210	0.	0.	21.029	0.
45 FURN,HOME EQUIP	0.	0.	0.	0.	0.	0.	0.	1.015
46 EAT&DRINK PLACES	0.	0.	2758.090	312.987	3427.948	100.050	4161.916	35.462
47 OTHER RETAIL	0.	0.	596.906	99.073	209.156	109.859	880.421	191.409
48 BANK&CREDIT AGENC	2446.180	713.448	6107.752	3408.509	16572.541	581.774	27518.738	1128.853
49 INSURANCE CARRIER	1250.260	826.903	2519.914	2943.730	6478.958	593.109	22990.748	986.783
50 FIRE,NEC	7553.040	0.	1203.680	2152.554	[illegible]	[illegible]	[illegible]	

	33	34	35	36	37	38	39	40
51 LEG,ACCT,ENGR&PRO	5683.040	254.593	1531.739	577.262	4463.956	578.286	10080.723	321.585
52 LODGING SERVICES	74.065	20.410	3668.468	179.718	3519.120	214.304	3665.785	64.966
53 PERSONAL SERVICES	0.	0.	5.334	60.715	31.601	0.	124.044	3.965
54 PHOTO,AMUSE&REC	0.	0.	0.	0.	0.	0.	153.540	25.991
55 MISC BUSINESS SVC	513.040	5671.720	1849.129	1920.284	3286.230	2649.480	14139.401	344.713
56 MISC REPAIR SVC	515.642	58.953	450.353	1165.132	1900.185	2777.050	2543.627	58.638
57 MED,OTH HEALTH SV	0.	0.	58.597	0.	5.443	0.	34.980	0.
58 EDUCATION SERVICE	10392.358	0.	3318.898	1280.600	3724.967	1154.217	10575.939	1051.237
59 OTHER SERVICES	192.344	0.	230.836	195.609	338.739	342.093	1579.042	52.187
60 OUTDOOR REC	20.020	0.	72.280	16.002	63.855	14.386	406.105	21.806
61 SCRAP	0.	0.	0.	0.	.638	0.	.516	0.
62 HOUSEHOLDS	74232.178	37155.060	116915.439	95305.157	249426.371	37507.310	479132.070	26682.997
63 PROPERTY PAYMENTS	80230.917	0.	60435.536	20235.698	83654.045	33306.722	277818.629	10618.926
64 FEDERAL GOVT	24651.219	629.352	12871.620	10702.759	47959.341	12181.941	60169.617	2199.997
65 STATE GOVT	1902.560	0.	518.492	283.336	1557.270	306.036	6104.740	343.612
66 LOCAL GOVT	6499.900	0.	1279.961	229.446	1030.469	739.587	9503.169	1471.143
67 DEPRECIATION	40186.958	11154.906	2574.591	6524.729	8428.477	7532.327	22151.675	1488.324
68 IMPORTS	50459.646	6388.678	22405.777	16485.536	66795.757	4791.022	73742.687	10766.006
TOTAL VALUE ADDED	227703.727	48939.318	194595.633	133281.121	392055.969	91573.921	854879.883	42804.996
TOTAL PURCHASES	353318.000	84873.000	259700.000	178990.000	539949.000	117815.000	1124736.000	65688.000

	41	42	43	44	45	46	47	48
1 AGRICULTURE PROD	0.	0.	0.	0.	0.	1626.630	0.	0.
2 AGRICULTURE SERV	0.	0.	0.	0.	0.	0.	0.	0.
3 CRUDE PETRLNA GAS	0.	0.	.665	0.	0.	0.	11.229	6.648
4 RESIDENTIAL CONST	0.	0.	0.	0.	0.	0.	0.	0.
5 COMM,ED,CINST CON	0.	0.	0.	0.	0.	0.	0.	0.
6 INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
7 FACILITY CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
8 MAINTLREPAIR	857.804	169.729	887.630	110.711	278.501	68.407	245.044	6451.707
9 FOODLKINDRED PROD	72.427	204.704	62.852	12.876	48.884	67365.479	38.962	238.782
10 TEXTILE MILL PROD	29.259	14.921	0.	.396	1.452	3.074	1.807	0.
11 APPAREL,OTHER TEX	3655.102	0.	28.600	4.400	4.400	38.875	159.117	213.896
12 LUMBERLWOOD PROD	103.069	32.780	0.	4.840	2.420	0.	6.021	0.
13 FURNITURELFIXTURE	92.602	31.460	3.080	7.260	2.420	39.663	8.314	2043.319
14 PAPERLALLIED PROD	2363.796	20.240	4.840	476.518	38.720	175.990	481.937	31.018
15 PRINTINGLPUBLISH	5676.315	22496.137	6009.520	2721.171	4090.891	2072.211	4897.930	6073.414
16 CHEMLALLIED PROD	28.029	24.624	67.226	2.658	2.868	57.798	41.935	12.431
17 PETR REFLREL IND	22.605	24.143	85.981	8.816	16.910	21.573	62.422	1.229
18 RUBBER,PLAS,LEATH	17.140	19.800	375.980	6.160	12.760	47.806	21.216	68.498
19 GL,STO,CLAY,CONCR	5.788	14.520	16.500	0.	1.100	0.	.573	14.217
20 PRIMARY METAL IND	0.	0.	18.873	0.	0.	0.	0.	3.960
21 FAB METAL PROD	0.	9.460	372.460	0.	.660	213.289	0.	156.060
22 PLUMB,HTG,REFRIG	2445.935	19.360	0.	0.	0.	279.219	0.	0.
23 MACH EX ELECLREFR	.890	0.	160.380	1.100	0.	2305.200	0.	0.
24 ELECT MACH,EQ,SUP	2077.309	11.220	473.440	20.460	12.320	639.604	38.991	325.690
25 AIRCRAFT,PTS,ORDN	0.	0.	0.	0.	0.	0.	0.	0.
26 TRAN EQUIP EX AIR	15.805	843.701	7623.880	10.560	94.820	14.972	81.709	26.172
27 PROF,SCI,CON INST	0.	0.	0.	0.	0.	0.	0.	0.
28 MISC MFG IND	105.290	70.180	1773.200	11.880	1.980	1603.606	49.599	121.488
29 TRANLWAREHOUSING	2872.440	1152.564	1503.729	660.850	329.384	1339.249	827.879	1382.831
30 TELEPHONE&TELEGRA	856.122	457.381	3699.520	808.057	1538.677	1231.664	3539.273	5185.520
31 TV,RADIO,OTH COMM	1009.494	1537.583	2866.820	1528.335	1789.696	1293.917	1428.324	3639.460
32 GAS SERVICES	86.293	214.846	278.098	31.310	54.607	349.029	227.638	466.801
33 ELECTRIC SERVICES	4003.525	5702.514	5872.450	1624.481	1395.737	6314.534	3262.483	2964.720
34 WATERLSAN SVC SYS	417.723	596.743	1151.966	138.854	256.166	2098.641	361.647	800.190
35 WHL AUTO,PTSLSUPP	30.051	11.440	2597.540	12.540	9.240	9.981	93.463	367.048
36 WHL GROCLREL PROD	3.339	664.401	36.960	0.	0.	13617.912	0.	0.
37 WHL MACH,EQLSUPP	284.484	20.240	41.580	49.500	5.500	0.	0.	3747.378
38 WHL PETRLREL PROD	110.557	72.986	275.084	29.877	76.187	57.840	385.457	7.522
39 GENERAL WHOLESALE	3634.845	934.562	1224.740	242.879	321.199	4342.739	698.394	5489.563
40 BLD MAT,HDW,FM EQ	0.	0.	18.977	0.	14.233	0.	0.	0.
41 DEPTLVAR STORES	0.	0.	0.	0.	17.197	0.	8.537	0.
42 FOOD STORES	0.	0.	0.	2.837	0.	2044.935	0.	0.
43 AUTO DL,SV STLREP	201.612	390.678	29527.393	290.731	466.695	339.790	1324.536	547.028
44 APPARLACCES STORE	0.	0.	0.	1.021	0.	6.829	0.	0.
45 FURN,HOME EQUIP	0.	0.	0.	0.	0.	0.	0.	0.
46 EATLDRINK PLACES	404.910	148.060	287.100	167.419	157.080	112.686	362.672	0.
47 OTHER RETAIL	12.020	5.500	355.300	16.720	845.200	1810.853	302.752	0.
48 BANKLCREDIT AGENC	1160.862	1968.343	6639.380	929.057	3046.553	2937.974	4078.263	35847.263
49 INSURANCE CARRIER	1493.650	1649.783	5865.200	496.978	2108.695	4777.984	7797.869	6263.400
50 FIRE,NEC	22707.264	36151.779	20258.921	9914.926	8179.802	20646.198	15658.525	44771.115

	41	42	43	44	45	46	47	48
51 LEG,ACCT,ENGREPRO	4533.929	2372.924	6670.400	2427.912	4044.691	6839.951	2549.882	28788.377
52 LODGING SERVICES	762.224	45.444	256.714	243.167	131.962	249.379	363.867	0.
53 PERSONAL SERVICES	41.404	249.700	1142.020	59.620	15.840	891.505	62.500	21.971
54 PHOTO,AMUSEREC	317.206	0.	194.040	872.077	590.039	16710.074	604.357	1604.219
55 MISC BUSINESS SVC	7261.899	13165.921	4688.420	2349.372	2364.555	3101.881	7336.574	30243.968
56 MISC REPAIR SVC	2618.217	1935.400	772.848	113.244	6084.067	2720.325	2419.938	19.549
57 MEDEOTH HEALTH SV	695.825	0.	0.	0.	0.	0.	0.	0.
58 EDUCATION SERVICE	4686.702	4859.122	2106.034	1064.344	1154.806	1929.608	9044.103	13240.507
59 OTHER SERVICES	43.369	115.234	236.499	306.931	252.222	32.917	287.146	3603.388
60 OUTDOOR REC	26.267	0.	68.200	14.300	21.340	76.437	76.261	114.702
61 SCRAP	0.	0.	0.	0.	0.	0.	0.	0.
62 HOUSEHOLDS	136932.980	169252.437	252290.512	65271.796	43314.162	137863.631	151739.496	618468.531
63 PROPERTY PAYMENTS	28231.319	20530.431	48701.395	23280.978	9083.999	22952.973	60491.895	150158.760
64 FEDERAL GOVT	20672.916	21211.332	27323.778	14686.488	4706.449	20535.875	17578.246	94282.827
65 STATE GOVT	1393.034	856.021	2010.580	309.759	459.139	1394.520	1651.661	1443.635
66 LOCAL GOVT	4867.384	7.260	892.540	426.578	734.358	714.990	1838.300	10820.480
67 DEPRECIATION	6692.041	8554.713	6838.699	1631.954	3076.693	8757.186	4694.088	19651.922
68 IMPORTS	92958.937	21628.687	56467.466	4685.303	3368.729	103374.620	14041.178	39106.813
TOTAL VALUE ADDED	198789.672	220412.191	338057.500	105607.554	61314.798	192219.172	237993.682	895426.141
TOTAL PURCHASES	369594.000	340471.000	511126.000	138090.000	103926.000	468052.000	321284.000	1139438.000

	49	50	51	52	53	54	55	56
1 AGRICULTURE PROD	0.	0.	0.	0.	0.	0.	0.	0.
2 AGRICULTURE SERV	0.	0.	0.	0.	0.	0.	0.	0.
3 CRUDE PETRLNA GAS	0.	0.	0.	0.	0.	0.	0.	0.
4 RESIDENTIAL CONST	0.	0.	0.	0.	0.	0.	0.	0.
5 COMM,ED,&INST CON	0.	0.	0.	0.	0.	0.	0.	0.
6 INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
7 FACILITY CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
8 MAINT&REPAIR	0.	48715.333	13025.791	1282.558	989.962	2647.782	263.556	174.854
9 FOOD&KINDRED PROD	170.573	52.020	311.946	2969.247	0.	59.081	0.	64.075
10 TEXTILE MILL PROD	0.	0.	5.906	3.309	29.959	3.529	11.968	2.696
11 APPAREL,OTHER TEX	0.	0.	0.	162.678	7481.332	172.986	131.828	250.247
12 LUMBER&WOOD PROD	119.809	5789.106	15.990	81.829	6.199	0.	52.805	4.064
13 FURNITURE&FIXTURE	0.	18.200	12.300	282.971	2.841	0.	143.275	26.094
14 PAPER&ALLIED PROD	205.332	8.329	57.810	345.200	85.499	268.584	754.777	26.522
15 PRINTING&PUBLISH	21198.263	4702.974	4995.838	696.036	1778.576	4547.341	12760.688	340.507
16 CHEM&ALLIED PROD	2.091	334.966	229.711	112.414	361.451	64.052	638.983	33.461
17 PETR REFINEL IND	221.471	51.211	41.324	4.557	58.850	25.853	645.158	13.062
18 RUBBER,PLAS,LEATH	130.482	20.359	976.208	28.665	209.823	127.469	152.137	24.811
19 GL,STO,CLAY,CONCR	0.	2969.666	5.330	17.885	445.031	23.141	40.619	13.047
20 PRIMARY METAL IND	0.	112.594	3.395	21.504	25.152	0.	35.592	23.449
21 FAB METAL PROD	0.	1901.117	1578.906	96.284	1698.765	795.510	317.937	624.549
22 PLUMB,HTG,REFRIG	0.	202.975	1.230	169.393	64.056	0.	44.681	82.346
23 MACH EX ELEC&REFR	0.	0.	249.359	31.360	871.208	0.	382.189	6.844
24 ELEC MACH,EQ,SUP	0.	153.311	382.529	69.824	49.591	262.135	1289.104	510.975
25 AIRCRAFT,PTS,ORDN	0.	0.	0.	0.	0.	0.	0.	0.
26 TRAN EQUIP EX AIR	2.023	0.	28.700	29.400	52.691	7.966	11529.928	34.436
27 PROF,SCI,CON INST	0.	0.	1079.193	0.	.237	2849.819	150.057	0.
28 MISC MFG IND	220.504	812.825	231.649	286.696	5309.124	551.963	916.516	84.699
29 TRANS&WAREHOUSING	3773.380	817.460	5009.651	569.515	2523.736	2047.185	5294.018	789.254
30 TELEPHONE&TELEGRA	3145.222	22863.685	7141.363	2253.235	1297.901	1403.997	3522.787	516.750
31 TV,RADIO,OTH COMM	247.815	1198.725	33.620	893.993	675.425	1267.429	5985.415	8.342
32 GAS SERVICES	743.509	1727.654	55.010	220.004	193.324	170.510	297.621	12.299
33 ELECTRIC SERVICES	6933.602	38716.082	1179.932	2807.863	4830.522	2780.749	4786.304	279.971
34 WATER&SAN SVC SYS	3.602	5994.902	316.807	498.354	1817.373	612.599	1147.571	105.864
35 WHL AUTO,PTS&SUPP	115.815	0.	13.120	0.	56.307	4.552	605.964	2.353
36 WHL GROCERY PROD	0.	0.	26.650	1803.421	8.007	2042.453	32.126	0.
37 WHL MACH,EQ&SUPP	1457.049	0.	673.628	0.	2663.473	547.411	210.050	0.
38 WHL PETR&REL PROD	639.242	116.700	178.972	33.272	156.594	157.132	2372.372	43.363
39 GENERAL WHOLESALE	7824.367	1752.433	3754.361	1885.495	1858.904	4813.269	6011.263	2672.727
40 BLD MAT,HDW,FM EQ	0.	0.	0.	9.366	0.	11.899	36.558	1.881
41 DEPT&VAR STORES	0.	0.	0.	25.079	0.	0.	0.	0.
42 FOOD STORES	0.	0.	0.	568.614	1.665	16.421	0.	0.
43 AUTO DL,SV STS&REP	1895.511	283.543	594.697	83.240	660.784	112.825	2804.946	344.001
44 APPAR&ACCES STORE	0.	0.	2.284	2.047	10.552	25.008	0.	0.
45 FURN,HOME EQUIP	0.	0.	0.	0.	0.	2.798	0.	0.
46 EAT&DRINK PLACES	17285.321	1683.335	1926.176	255.042	276.885	1289.431	3420.132	267.358
47 OTHER RETAIL	0.	0.	1984.805	308.941	189.842	423.741	556.113	80.421
48 BANK&CREDIT AGENC	431.905	159800.250	3428.412	1569.939	1329.670	1045.126	4513.156	230.998
49 INSURANCE CARRIER	5059.970	19387.815	3444.402	504.938	1791.749	4307.588	4488.415	517.606
50 FIRE,NEC	169473.326	42913.114	13751.778	4484.911	8136.868	7282.119	15863.990	4439.217

	49	50	51	52	53	54	55	56
51 LEG,ACCT,ENGR&PRO	26421.588	39623.313	13478.309	7320.013	2185.897	1829.255	16088.503	236.559
52 LODGING SERVICES	11523.121	1331.360	2511.402	315.079	173.140	756.861	4564.119	52.253
53 PERSONAL SERVICES	0.	0.	2.870	1461.896	2765.239	545.514	2194.541	51.974
54 PHOTO,AMUSE&REC	0.	0.	163.590	41.159	0.	5577.672	12237.808	12.192
55 MISC BUSINESS SVC	23786.662	29505.719	6518.165	1163.980	2809.923	3980.204	17215.130	416.865
56 MISC REPAIR SVC	0.	0.	829.683	415.051	1067.716	730.243	1590.747	349.008
57 MED,OTH HEALTH SV	10234.032	0.	22.262	0.	0.	288.692	0.	0.
58 EDUCATION SERVICE	55049.294	31460.738	5376.913	3421.659	2689.087	3871.069	8137.975	377.046
59 OTHER SERVICES	9697.486	5964.095	3860.756	546.410	432.926	685.249	2332.945	272.227
60 OUTDOOR REC	2253.596	610.467	39.360	95.304	139.476	77.389	206.788	53.258
61 SCRAP	0.	0.	0.	0.	1.517	0.	.723	0.
62 HOUSEHOLDS	669827.195	342065.945	425211.242	34147.647	90128.803	105621.067	229618.521	43887.180
63 PROPERTY PAYMENTS	301576.699	46837.250	103118.043	2765.278	6487.952	16676.110	52091.459	11670.422
64 FEDERAL GOVT	20330.405	13486.732	20345.383	9280.828	11784.160	6978.633	31905.225	2947.143
65 STATE GOVT	40240.538	10907.592	1816.296	642.381	2525.030	1495.421	3416.808	441.034
66 LOCAL GOVT	2417.457	31662.865	2202.515	1572.389	454.330	1848.981	3622.858	173.034
67 DEPRECIATION	4968.935	116443.402	6487.415	21412.471	5118.247	7463.450	26227.408	729.781
68 IMPORTS	53662.858	50478.730	38769.034	17223.431	26089.643	33656.753	77218.064	13825.870
TOTAL VALUE ADDED	1039361.203	561403.859	559180.875	64820.996	116498.520	140083.660	346882.270	59856.593
TOTAL PURCHASES	1473280.000	1083479.000	697492.000	122284.000	202138.000	234854.000	580881.000	88157.000

	57	58	59	60	61
1 AGRICULTURE PROD	28.912	0.	0.	0.	0.
2 AGRICULTURE SERV	0.	0.	0.	0.	0.
3 CRUDE PETRLNA GAS	0.	0.	0.	0.	0.
4 RESIDENTIAL CONSI	0.	0.	0.	0.	0.
5 COMM,ED,CINSI CON	0.	0.	0.	0.	0.
6 INDUSIRIAL CONSTR	0.	0.	0.	0.	0.
7 FACILIIY CONSTR	0.	0.	0.	0.	0.
8 MAINIENAIR	763.816	4308.972	905.933	141.506	212.378
9 FOODSKINDRED PROD	4824.870	48939.708	1473.076	18.688	0.
10 IEXTILE MILL PROD	137.781	21.685	3.499	.707	0.
11 APPAREL,OTHER TEX	126.868	249.527	441.318	42.603	0.
12 LUMBERSWOOD PROD	142.146	827.052	61.600	23.549	0.
13 FURNITURE&FIXTURE	29.203	4584.636	848.756	52.103	0.
14 PAPER&ALLIED PROD	1648.891	3107.985	245.739	25.315	0.
15 PRINTING&PUBLISH	1394.962	2644.121	14081.906	113.331	11.880
16 CHEM&ALLIED PROD	1748.977	662.810	96.047	18.065	10.493
17 PEIR REF&REL IND	20.692	18.593	170.982	12.501	6.615
18 RUBBER,PLAS,LEAIH	1046.850	595.026	64.020	24.138	1.760
19 GL,SIO,CLAY,CONCR	263.598	260.065	33.000	38.562	0.
20 PRIMARY MEIAL IND	3.843	213.601	10.566	2.827	1.093
21 FAB MEIAL PROD	2864.382	1537.245	81.400	42.389	2.200
22 PLUMB,HIG,REFRIG	892.134	1913.229	123.419	9.714	1.540
23 MACH EX ELEC&REFR	75.618	519.566	1.980	65.938	279.402
24 ELECT MACH,EQ,SUP	1525.698	2088.236	143.879	193.104	0.
25 AIRCRAFI,PIS,ORDN	11.024	289.986	0.	1.766	0.
26 IRAN EQUIP EX AIR	12.958	13.737	1884.730	1069.430	5.060
27 PROF,SCI,CON INST	3705.258	2073.855	20.833	5.142	0.
28 MISC MFG IND	697.771	512.603	476.518	12.069	0.
29 IRAN&WAREHOUSING	2351.885	3006.997	1543.686	100.107	2436.211
30 IELEPHONE&TELEGRA	2929.556	3150.702	1445.392	8.242	116.361
31 IV,RADIO,OIH COMM	88.769	472.521	540.537	0.	26.180
32 GAS SERVICES	314.898	935.269	77.272	2.962	7.485
33 ELECIRIC SERVICES	5588.325	12793.542	2392.347	40.924	328.044
34 WAIER&SAN SVC SYS	1490.066	1738.519	319.815	29.349	9.792
35 WHL AUIO,PIS&SUPP	4.255	16.936	34.100	307.318	10.780
36 WHL GROCERSL PROD	2792.439	382.947	0.	0.	0.
37 WHL MACH,EQ&SUPP	10679.498	1077.520	57.420	4.710	17.160
38 WHL PEIR&REL PROD	51.778	53.302	140.209	21.130	97.955
39 GENERAL WHOLESALE	7015.038	6571.443	910.575	75.946	43.340
40 BLD MAT,HDW,FM EQ	5.687	0.	0.	0.	0.
41 DEPI&VAR SIORES	0.	0.	43.606	0.	0.
42 FOOD SIORES	704.093	0.	522.753	0.	0.
43 AUIO DL,SV SI&REP	231.375	108.312	591.625	377.957	348.965
44 APPAR&ACCES SIORE	5.207	0.	0.	0.	0.
45 FURN,HOME EQUIP	23.357	0.	18.254	0.	0.
46 EAI&DRINK PLACES	922.304	9.974	2291.068	.883	0.
47 OIHER REIAIL	477.494	160.706	1583.992	0.	0.
48 BANK&CREDII AGENC	3434.899	2105.925	3019.264	99.496	434.063
49 INSURANCE CARRIER	3784.558	5801.598	5186.473	364.424	289.302
50 FIRE,NEC	15436.836	1290.917	2974.384	0.	592.904

	57	58	59	60	61
51 LEG,ACCT,ENGRGPRO	4225.500	5047.559	4194.498	0.	76.560
52 LODGING SERVICES	467.089	9.157	995.608	.585	51.999
53 PERSONAL SERVICES	2495.964	420.863	221.979	0.	2.860
54 PHOTO,AMUSE&REC	832.761	446.740	637.337	0.	0.
55 MISC BUSINESS SVC	5479.284	4733.863	4090.659	371.784	69.740
56 MISC-REPAIR SVC	638.344	8.233	472.840	0.	164.032
57 MED&OTH HEALTH SV	6787.029	0.	0.	0.	0.
58 EDUCATION SERVICE	2880.440	0.	0.	0.	0.
59 OTHER SERVICES	2599.124	295.333	5107.970	0.	39.417
60 OUTDOOR REC	70.976	33.120	0.	0.	12.320
61 SCRAP	0.	0.	0.	0.	0.
62 HOUSEHOLDS	329744.520	479859.109	97565.091	11897.370	9383.057
63 PROPERTY PAYMENTS	12561.236	7957.578	3407.781	3306.902	1343.108
64 FEDERAL GOVT	18556.885	7393.790	3992.538	633.180	636.904
65 STATE GOVT	1252.236	1137.738	837.975	0.	245.741
66 LOCAL GOVT	1010.685	557.390	846.335	0.	130.901
67 DEPRECIATION	14404.489	5062.425	2341.227	3.532	929.725
68 IMPORTS	50298.888	75421.761	31444.196	1399.671	1654.874
TOTAL VALUE ADDED	377530.043	501960.020	108990.946	15840.984	-12669.436
TOTAL PURCHASES	534604.000	704252.000	201018.000	20960.000	20032.000

		62 HOUSEHOLDS	63 FED GOVT OFF	64 FED GOVT NDEF	65 STATE GOVT	66 LOCAL GOVT	67 EXPORTS
1	AGRICULTURL PROD	9584.071	0.	12422.095	51.059	1.744	80935.936
2	AGRICULTURE SERV	0.	0.	0.	0.	0.	35517.014
3	CRUDE PETRLNA GAS	416.504	.592	.014	.037	.003	30232.664
4	RESIDENTIAL CONST	0.	0.	0.	0.	0.	49984.805
5	COMM,ED,INST CON	0.	0.	0.	0.	0.	226433.219
6	INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	44201.678
7	FACILITY CONSTR	0.	6450.791	0.	0.	0.	30828.934
8	MAINTEREPAIR	35744.034	1554.108	1179.076	1454.421	892.509	26293.000
9	FOODSKINDRED PROD	628295.156	9685.789	5628.687	4342.481	539.524	389068.953
10	TEXTILE MILL PROD	306.599	1.914	0.	79.715	3.035	2470.853
11	APPAREL,OTHER TEX	77754.720	2144.224	303.662	390.358	1020.827	320681.410
12	LUMBERWOOD PROD	6226.498	1490.014	1013.586	634.215	70.995	57900.807
13	FURNITUREFIXTURE	13905.645	1792.112	376.258	2144.947	3549.734	84009.199
14	PAPERALLIED PROD	6840.408	1482.965	675.264	574.806	74.433	73154.670
15	PRINTINGPUBLISH	39896.274	2131.804	1961.991	2690.204	426.979	156913.223
16	CHEMALLIED PROD	12180.557	1477.502	689.770	1156.777	288.388	357407.426
17	PETR REFINEL IND	11560.773	2341.473	111.029	193.014	133.429	75167.548
18	RUBBER,PLAS,LEATH	26114.656	5197.763	247.792	3169.520	77.872	15071.061
19	GL,STO,CLAY,CONCR	9235.951	436.364	472.133	3467.810	869.735	149014.043
20	PRIMARY METAL IND	2360.527	4825.597	1117.447	81.697	610.783	34149.262
21	FAB METAL PROD	15962.149	3186.797	626.120	1113.220	565.935	139691.562
22	PLUMB,HTG,REFRIG	1748.112	100.028	12.071	505.133	179.206	252622.187
23	MACH EX ELECTREFR	1458.157	13658.854	1307.764	5918.201	366.502	259979.289
24	ELECT MACH,EQ,SUP	4917.987	3269.707	228.997	3082.118	1081.910	884160.273
25	AIRCRAFT,PTS,ORDN	1405.242	575720.437	10059.126	29.238	10.113	637659.922
26	TRAN EQUIP EX AIR	114858.468	6460.868	533.866	23.328	317.757	601589.492
27	PROF,SCI,CON INST	2036.656	1201.392	612.739	1276.838	10.228	20199.277
28	MISC MFG IND	5280.970	1661.203	192.268	325.661	48.341	45693.230
29	TRANSWAREHOUSING	211377.906	14781.666	1441.258	1475.008	477.319	229785.008
30	TELEPHONETELEGRA	87316.062	1993.175	977.547	1062.209	917.065	19307.881
31	TV,RADIO,OTH COMM	1788.577	0.	0.	0.	0.	8671.659
32	GAS SERVICES	26839.055	2599.241	57.014	183.177	44.874	78690.252
33	ELECTRIC SERVICES	136507.242	3525.255	773.052	2484.335	480.019	7687.508
34	WATERSAN SVC SYS	34728.001	5408.484	0.	381.004	120.638	.003
35	WHL AUTO,PTSESUPP	151737.627	0.	0.	0.	123.583	84429.275
36	WHL GROCEREL PROD	152381.227	0.	0.	0.	95.266	1999.719
37	WHL MACH,EQESUPP	42227.649	0.	0.	132.504	131.674	259957.062
38	WHL PETRPREL PROD	43739.001	11154.033	543.297	660.171	527.397	34385.873
39	GENERAL WHOLESALE	445749.703	344.392	75.700	243.235	812.697	426175.844
40	BLD MAT,HDW,FM EQ	28156.834	0.	0.	0.	0.	614.062
41	DEPTSVAR STORES	369358.129	0.	0.	0.	0.	.004
42	FOOD STORES	336360.789	0.	0.	0.	0.	.004
43	AUTO DL,SV STEREP	419937.449	0.	998.644	1213.077	1333.743	.004
44	APPARACCES STORE	137879.162	0.	0.	0.	0.	.002
45	FURN,HOME EQUIP	102210.702	0.	0.	0.	700.757	0.
46	EATDRINK PLACES	379579.789	0.	0.	0.	11.125	39426.684
47	OTHER RETAIL	247065.650	0.	0.	11.198	19.822	56501.527
48	BANKCCREDIT AGENC	378611.754	0.	0.	4178.541	622.366	370845.203
49	INSURANCE CARRIER	224501.572	1604.476	35.177	113.219	8260.666	993776.656
50	FIRE,NEC	233132.711	0.	0.	13435.158	26120.581	160054.875

	9	10	11	12	13	14	15	16
1 AGRICULTURE PROD	77166.338	332.445	0.	2572.879	0.	294.793	0.	6.850
2 AGRICULTURE SERV	0.	0.	0.	8.706	0.	0.	0.	.834
3 CRUDE PETRLNA GAS	6.948	0.	.217	2.450	.318	0.	.256	612.430
4 RESIDENTIAL CONST	0.	0.	0.	0.	0.	0.	0.	0.
5 COMM,ED,INST CON	0.	0.	0.	0.	0.	0.	0.	0.
6 INDUSTRIAL CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
7 FACILITY CONSTR	0.	0.	0.	0.	0.	0.	0.	0.
8 MAINTENANCE REPAIR	1336.031	8.451	112.242	270.771	382.150	2896.263	2770.219	13360.239
9 FOOD,KINDRED PROD	53801.854	.134	0.	0.	0.	0.	0.	93.700
10 TEXTILE MILL PROD	30.503	73.682	2884.220	0.	360.092	89.035	109.675	4.031
11 APPAREL,OTHER TEX	624.798	0.	1312.466	6.701	145.445	78.818	0.	11.647
12 LUMBER,WOOD PROD	2260.909	0.	2121.796	21210.853	7106.013	16469.052	71.200	400.769
13 FURNITURE,FIXTURE	3.789	0.	10.422	25.002	101.292	84.264	34.160	11.647
14 PAPER,ALLIED PROD	20983.678	16.386	964.583	396.932	3254.325	37929.251	37769.010	2859.684
15 PRINTING,PUBLISH	3979.940	15.847	1598.175	194.600	349.513	713.204	20957.129	672.854
16 CHEM,ALLIED PROD	405.349	11.386	122.617	416.671	594.732	1935.686	789.909	15432.851
17 PETR REF,REL IND	111.199	.205	22.389	87.721	3.972	64.867	50.293	2450.549
18 RUBBER,PLAS,LEATH	1114.517	.337	150.941	97.944	4069.854	919.219	158.040	1716.825
19 GL,STO,CLAY,CONCR	11695.294	0.	11.500	314.968	136.540	368.777	22.636	1992.769
20 PRIMARY METAL IND	28.572	.112	850.740	172.023	2671.453	22.073	34.352	550.589
21 FAB METAL PROD	18246.648	0.	1479.938	225.272	4685.026	172.053	607.053	3006.444
22 PLUMB,HTG,REFRIG	98.969	0.	6.110	29.899	18.923	3.845	115.649	41.513
23 MACH EX ELEC,REFR	1212.817	.809	423.353	145.370	143.219	919.219	507.044	2856.540
24 ELEC MACH,EQ,SUP	98.077	2.158	74.392	4.124	62.333	0.	46.506	28.366
25 AIRCRAFT,PTS,ORDN	0.	0.	0.	0.	0.	0.	0.	0.
26 TRAN EQUIP EX AIR	150.906	.202	14.375	61.602	13.728	3.204	46.918	125.182
27 PROF,SCI,CON INST	80.129	0.	1.982	37.204	26.607	0.	230.434	87.566
28 MISC MFG IND	1865.033	.607	2352.160	60.055	25.230	106.051	2001.424	195.561
29 TRANS,WAREHOUSING	20030.992	23.978	2350.918	7106.214	2385.917	6887.645	5610.210	9423.296
30 TELEPHONE,TELEGRA	1533.798	15.914	770.157	507.248	529.092	891.024	3039.794	747.806
31 TV,RADIO,OTH COMM	3779.995	0.	20.125	1.289	30.425	81.060	358.059	54.374
32 GAS SERVICES	543.028	6.430	137.251	126.966	31.647	132.034	102.353	4707.861
33 ELECTRIC SERVICES	4070.076	236.158	1338.458	1000.565	576.132	3490.074	1724.589	8850.359
34 WATER,SAN SVC SYS	1392.784	12.966	226.827	91.550	47.563	1904.130	296.764	526.151
35 WHL AUTO,PTS,SUPP	215.770	.067	13.657	102.326	2.226	2.243	14.816	92.458
36 WHL GROC,REL PROD	2736.139	.270	4.672	0.	0.	0.	20.578	34.868
37 WHL MACH,EQ,SUPP	923.935	5.395	18.329	673.238	254.157	529.616	1202.583	590.686
38 WHL PETR,REL PROD	754.194	1.374	53.338	395.041	17.996	29.215	206.403	93.777
39 GENERAL WHOLESALE	9620.510	21.983	2054.951	658.804	1649.610	239.337	9252.728	3381.777
40 BLD MAT,HDW,FM EQ	75.381	0.	19.023	276.654	66.920	0.	4.034	11.136
41 DEPT,VAR STORES	48.745	0.	10.033	0.	0.	0.	2.681	0.
42 FOOD STORES	161.155	0.	1.986	0.	0.	0.	19.710	1.579
43 AUTO DL,SV STS,REP	1487.004	6.815	262.888	721.422	54.996	81.413	425.044	363.869
44 APPAR,ACCES STORE	12.004	0.	0.	0.	0.	0.	7.260	1.459
45 FURN,HOME EQUIP	.822	0.	1.988	0.	0.	0.	3.415	0.
46 EAT,DRINK PLACES	421.956	2.495	369.445	112.894	71.238	267.532	255.580	152.405
47 OTHER RETAIL	69.323	.405	15.813	17.269	11.131	34.923	243.644	174.698
48 BANK,CREDIT AGENC	1022.904	13.419	2891.234	1113.729	708.301	1697.144	3441.067	1585.641
49 INSURANCE CARRIER	2966.459	53.610	1139.962	1682.321	1077.107	140.975	2354.956	2225.199
50 FIRE,REC	2504.765	0.	10691.277	2077.96	174.756	327.125	926.837	453.428

	9	10	11	12	13	14	15	16
51 LEG,ACCT,ENGR&PRO	1798.384	106.208	1119.037	901.602	1208.453	631.503	2507.645	1233.387
52 LODGING SERVICES	607.421	9.978	215.211	149.997	208.553	263.456	641.279	173.704
53 PERSONAL SERVICES	229.145	0.	1.797	7.990	.792	16.981	979.105	87.885
54 PHOTO,AMUSE&REC	20.061	0.	68.642	46.910	137.653	0.	565.486	6.645
55 MISC BUSINESS SVC	9515.299	31.964	3420.964	1021.713	1060.782	900.316	10342.890	4360.798
56 MISC REPAIR SVC	2726.143	22.346	225.134	596.439	169.575	93.646	1219.023	168.067
57 MED&OTH HEALTH SV	288.615	0.	2.101	3.660	8.678	1.874	8.595	5.193
58 EDUCATION SERVICE	8378.507	62.854	2603.345	1592.115	267.841	1553.551	1838.082	2986.923
59 OTHER SERVICES	422.500	1.651	367.335	68.386	30.877	83.754	161.176	153.060
60 OUTDOOR REC	250.989	1.214	75.470	22.940	14.470	13.777	36.629	50.302
61 SCRAP	.218	0.	0.	.757	0.	1651.255	0.	.490
62 HOUSEHOLDS	121861.277	1733.045	113133.687	38250.312	36250.607	49373.195	131243.295	48901.076
63 PROPERTY PAYMENTS	91067.552	256.248	24454.196	9999.332	10433.801	26786.479	34638.255	76435.136
64 FEDERAL GOVT	63260.600	683.372	22233.929	4541.519	5158.834	3919.097	18272.098	12239.556
65 STATE GOVT	4576.426	9.845	1435.015	399.767	159.915	276.503	867.983	894.281
66 LOCAL GOVT	2319.531	30.952	1101.867	947.997	91.274	1149.905	848.640	1618.294
67 DEPRECIATION	20736.017	145.454	3532.732	4530.951	3153.404	9730.139	11774.364	29110.066
68 IMPORTS	665847.344	4240.830	214001.793	76810.383	52204.568	61549.418	84625.464	172182.889
TOTAL VALUE ADDED	303821.395	2858.917	165891.422	58669.877	55247.835	91235.315	197644.631	169198.404
TOTAL PURCHASES	1243600.000	8200.000	424900.000	182900.000	142400.000	237800.000	404400.000	430600.000

	62 HOUSEHOLDS	63 FED GOVT DEF	64 FED GOVT NDEF	65 STATE GOVT	66 LOCAL GOVT	67 EXPORTS
51 LEG,ACCT,ENGR&PRO	54446.956	51548.647	20450.883	1861.588	4996.731	291504.648
52 LODGING SERVICES	76444.497	1589.390	106.047	784.280	83.761	.002
53 PERSONAL SERVICES	170224.854	482.014	105.704	.311	0.	14450.863
54 PHOTO,AMUSE&REC	102115.517	8.056	1.891	5.910	0.	84258.631
55 MISC BUSINESS SVC	22998.175	4873.511	550.524	1794.092	1645.620	211783.648
56 MISC REPAIR SVC	39696.725	403.993	88.601	284.026	49.139	0.
57 MED&OTH HEALTH SV	515301.715	143.284	32.554	100.814	0.	.016
58 EDUCATION SERVICE	343551.008	0.	39757.813	0.	0.	42557.680
59 OTHER SERVICES	114080.895	0.	0.	0.	2447.806	36423.650
60 OUTDOOR REC	9250.796	0.	0.	0.	0.	4855.704
61 SCRAP	0.	0.	0.	0.	0.	4397.103
62 HOUSEHOLDS	837292.359	583005.359	733843.172	447666.297	139192.654	212232.000
63 PROPERTY PAYMENTS	107686.466	0.	0.	0.	0.	0.
64 FEDERAL GOVT	1509139.672	20349.641	10096.027	8316.344	5201.826	0.
65 STATE GOVT	129135.211	0.	175462.459	0.	0.	0.
66 LOCAL GOVT	60694.033	0.	31753.624	0.	0.	0.
67 DEPRECIATION	0.	0.	0.	0.	0.	0.
68 IMPORTS	2478666.125	463252.180	232566.279	48617.716	25487.890	0.
TOTAL VALUE ADDED	2643946.687	603355.000	951155.266	455982.641	144394.480	212232.000
TOTAL PURCHASES	11790000.000	1813339.000	1290096.984	567709.000	231045.000	8755802.875

	68 CAPITAL FORM	69 INVENTORY CHA	FINAL DEMAND	TOTAL SALES
1 AGRICULTURE PROD	0.	7009.517	110004.420	198795.000
2 AGRICULTURE SERV	0.	254.334	35771.348	59813.000
3 CRUDE PETRENA GAS	0.	-141.607	30508.208	33493.000
4 RESIDENTIAL CONST	582268.109	0.	632252.914	632257.000
5 COMM,FO,&INST CON	480401.937	0.	706835.156	709231.000
6 INDUSTRIAL CONSTR	184719.195	0.	228920.873	228940.000
7 FACILITY CONSTR	384562.023	0.	421841.746	424070.000
8 MAINTEREPAIR	0.	0.	67117.147	206413.000
9 FOODEKINDRED PROD	0.	12526.278	1050086.844	1243600.000
10 TEXTILE MILL PROD	0.	291.306	3153.422	8200.000
11 APPAREL,OTHER TEX	0.	4073.980	406369.172	424900.000
12 LUMBEREWOOD PROD	487.968	3870.640	71694.720	182900.000
13 FURNITUREEFIXTURE	10296.173	2262.120	118336.187	142400.000
14 PAPEREALLIED PROD	0.	1069.171	83871.717	237800.000
15 PRINTINGEPUBLISH	0.	2882.578	206903.051	404400.000
16 CHEMEALLIED PROD	0.	1875.234	375075.648	430600.000
17 PETR REFEREL IND	0.	-2310.595	87196.671	97300.000
18 RUBBER,PLAS,LEATH	68.084	7704.087	57650.834	163700.000
19 GL,STO,CLAY,CONCR	0.	1268.724	164764.758	408300.000
20 PRIMARY METAL IND	6050.233	1693.738	50889.283	133500.000
21 FAB METAL PROD	46731.350	8064.220	215941.350	552700.000
22 PLUMB,HTG,REFRIG	21606.568	16014.875	292788.172	327200.000
23 MACH EX ELECEREFR	130834.287	10673.958	424197.008	511700.000
24 ELECT MACH,EQ,SUP	8379.894	-30884.426	874236.453	986800.000
25 AIRCRAFT,PTS,ORDN	39326.771	17054.426	1281265.250	1337200.000
26 TRAN EQUIP EX AIR	44358.143	25197.876	793339.789	857200.000
27 PROF,SCI,CON INST	4354.244	49.994	29741.366	57100.000
28 MISC MFG IND	0.	4350.887	57552.560	87800.000
29 TRANEWAREHOUSING	8836.759	0.	468174.918	712721.000
30 TELEPHONEETELEGRA	5873.210	0.	117447.147	254478.000
31 TV,RADIO,OTH COMM	0.	0.	10460.236	47703.000
32 GAS SERVICES	0.	0.	108413.612	153809.000
33 ELECTRIC SERVICES	0.	0.	151457.406	353318.000
34 WATERESAN SVC SYS	0.	0.	40638.110	84873.000
35 WHL AUTO,PTSESUPP	10795.523	0.	247086.008	259700.000
36 WHL GROCEREL PROD	0.	0.	154476.211	178990.000
37 WHL MACH,EQESUPP	169594.246	0.	472043.131	519949.000
38 WHL PETREREL PROD	0.	0.	91009.771	117815.000
39 GENERAL WHOLESALE	42117.586	1150.362	916669.508	1124736.000
40 BLD MAT,HDW,FM EQ	1942.900	0.	30713.797	65688.000
41 DEPTEVAR STORES	0.	0.	369358.133	369594.000
42 FOOD STORES	0.	0.	336[illegible]0.793	340471.000
43 AUTO DL,SV STEREP	5503.961	0.	428986.867	5[illegible]1126.000
44 APPAREACCES STORE	0.	0.	137879.164	138090.000
45 FURN,HOME EQUIP	912.324	0.	103823.782	103926.000
46 EATERDRNK PLACES	0.	0.	419017.594	468052.000
47 OTHER RETAIL	118.578	0.	303716.770	321284.000
48 BANKECREDIT AGENC	0.	0.	754257.859	1139438.000
49 INSURANCE CARRIER	60.013	0.	1228351.750	1473280.000
50 FIRE,NEC	0.	0.	432743.324	1083479.000

	68 CAPITAL FORM	69 INVENTORY CHA	FINAL DEMAND	TOTAL SALES
51 LEG,ACCT,ENGRGPRO	1968.636	0.	426778.082	697492.000
52 LODGING SERVICES	0.	-1476.621	78131.354	122284.000
53 PERSONAL SERVICES	0.	22.213	185285.955	202138.000
54 PHOTO,AMUSE&REC	0.	3629.276	190019.283	234854.000
55 MISC BUSINESS SVC	0.	2444.889	246098.457	580881.000
56 MISC REPAIR SVC	0.	1561.810	42084.293	88157.000
57 MED&DTH HEALTH SV	0.	363.968	515942.340	534604.000
58 EDUCATION SERVICE	0.	0.	425866.500	704252.000
59 OTHER SERVICES	0.	64.240	153016.588	201018.000
60 OUTDOOR REC	0.	0.	14106.500	20960.000
61 SCRAP	0.	0.	4397.103	20032.000
62 HOUSEHOLDS	0.	0.	2953231.781	11790000.000
63 PROPERTY PAYMENTS	0.	0.	107685.466	2377958.469
64 FEDERAL GOVT	0.	0.	1553103.484	2581677.000
65 STATE GOVT	0.	0.	304597.668	439600.047
66 LOCAL GOVT	0.	0.	92497.657	214506.590
67 DEPRECIATION	0.	0.	0.	697508.398
68 IMPORTS	393736.520	36.022	3642362.594	9040292.875
TOTAL VALUE ADDED	.000	.000	5011065.937	18096250.000
TOTAL PURCHASES	2585904.969	102647.467	27136543.500	51974046.000

APPENDIX V

CHANGES IN HOUSEHOLD GROUP EXPENDITURES

Scenario 1: Change in Group Expenditures Due to a 5 Cent Per Gallon Tax Increase in 1982 (1977$)

Income Level = Less Than $10,000

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	-.3645	.137	-.0499365	.34	-.01697841	304966.37	1.239	-64153.49
30	-.3645	.489	-.1782405	.34	-.06060177	125975.61	1.239	-94589.53
31	-.3645	.411	-.1498095	.34	-.05093523	643107.25	1.239	-405856.95
32	-.3645	.231	-.0841995	.34	-.02862783	38722.17	1.239	-13734.71
33	-.3645	.436	-.1589221	.34	-.05403351	196946.39	1.239	-131850.72
34	-.3645	.364	-.1326781	.34	-.04511055	50103.98	1.239	-28004.10
40	-.3645	.315	-.1148175	.34	-.03903795	40623.39	1.239	-19648.73
41	-.3645	.821	-.2992545	.34	-.10174653	532893.00	1.239	-671785.97
42	-.3645	.396	-.1443421	.34	-.04907631	485285.95	1.239	-295080.78
43	-.3645	.809	-.2948805	.34	-.10025937	605866.52	1.239	-752615.63
44	-.3645	.724	-.2638981	.34	-.08972535	198925.74	1.239	-221145.17
45	-.3645	.725	-.2642625	.34	-.08984925	147464.92	1.239	-164162.70
46	-.3645	.812	-.2959741	.34	-.10063119	547640.34	1.239	-682809.17
47	-.3645	.527	-.1920915	.34	-.06531111	356455.01	1.239	-288445.05
48	-.3645	1.492	-.5438341	.34	-.18490359	546243.69	1.239	-1251419.98
49	-.3645	.677	-.2467665	.34	-.08390061	323900.58	1.239	-336703.90
50	-.3645	.372	-.1355941	.34	-.04610199	336353.20	1.239	-192126.18
51	-.3645	.367	-.1337715	.34	-.04548231	78553.58	1.239	-44266.97
52	-.3645	1.312	-.4782241	.34	-.16259619	110290.61	1.239	-222187.80
53	-.3645	.463	-.1687635	.34	-.05737959	245592.62	1.239	-174599.93
56	-.3645	.629	-.2292705	.34	-.07795197	57252.62	1.239	-55296.01
57	-.3645	.411	-.1498095	.34	-.05093523	743453.72	1.239	-469184.35
58	-.3645	1.008	-.3674161	.34	-.12492147	495659.66	1.239	-767170.63
59	-.3645	.561	-.2044845	.34	-.06952473	164590.68	1.239	-141780.29
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 1: Change in Group Expenditures Due to a 5 Cent Per Gallon Tax Increase in 1982 (1977$)

Income Level = $10,000 to $19,999

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	-.2543	.415	-.1055345	.32	-.033771041	304966.37	1.239	-127605.00
30	-.2543	.308	-.0783244	.32	-.025063808	125975.61	1.239	-39120.54
31	-.2543	.092	-.0233956	.32	-.007486592	643107.25	1.239	-59653.90
32	-.2543	.131	-.0333133	.32	-.010660256	38722.17	1.239	-5114.45
33	-.2543	.713	-.1813159	.32	-.058021088	196946.39	1.239	-141581.07
34	-.2543	.543	-.1380849	.32	-.044187168	50103.98	1.239	-27430.88
40	-.2543	1.002	-.2548086	.32	-.081538752	40623.39	1.239	-41040.39
41	-.2543	.841	-.2138663	.32	-.068437216	532893.00	1.239	-451859.75
42	-.2543	.513	-.1304559	.32	-.041745888	485285.95	1.239	-251005.21
43	-.2543	.575	-.1462225	.32	-.046791201	605866.52	1.239	-351246.86
44	-.2543	.728	-.1851304	.32	-.059241728	198925.74	1.239	-146012.49
45	-.2543	.659	-.1675837	.32	-.053626784	147464.92	1.239	-97980.98
46	-.2543	.983	-.2499769	.32	-.079992608	547640.34	1.239	-542770.95
47	-.2543	.994	-.2527742	.32	-.080887744	356455.01	1.239	-357238.91
48	-.2543	1.388	-.3529684	.32	-.112949888	546243.69	1.239	-764440.25
49	-.2543	.556	-.1413908	.32	-.045245056	323900.58	1.239	-181574.21
50	-.2543	.011	-.0027973	.32	-.000895136	336353.20	1.239	-3730.40
51	-.2543	3.213	-.8170659	.32	-.261461088	78553.58	1.239	-254474.55
52	-.2543	1.666	-.4236638	.32	-.135572416	110290.61	1.239	-185259.80
53	-.2543	.407	-.1035001	.32	-.033120032	245592.62	1.239	-100780.70
56	-.2543	1.301	-.3308443	.32	-.105870176	57252.62	1.239	-75100.06
57	-.2543	.662	-.1683466	.32	-.053870912	743453.72	1.239	-496226.07
58	-.2543	1.402	-.3565286	.32	-.114089152	495659.66	1.239	-700646.95
59	-.2543	1.181	-.3003283	.32	-.096105056	164590.68	1.239	-195984.98
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 1: Change in Group Expenditures Due to a 5 Cent Per Gallon Tax Increase in 1982 (1977$)

Income Level = $20,000 and Up

SECTOR NUMBERS	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	-.1469	1.121	-.1646749	.34	-.055989466	304966.37	1.239	-211558.06
30	-.1469	.318	-.0467142	.34	-.015882828	125975.61	1.239	-24790.52
31	-.1469	.095	-.0139555	.34	-.004744871	643107.25	1.239	-37807.60
32	-.1469	.438	-.0643422	.34	-.021876348	38722.17	1.239	-10495.56
33	-.1469	.321	-.0471549	.34	-.016032666	196946.39	1.239	-39122.36
34	-.1469	.356	-.0522964	.34	-.017780776	50103.98	1.239	-11038.10
40	-.1469	.438	-.0643422	.34	-.021876348	40623.39	1.239	-11010.89
41	-.1469	.752	-.1104688	.34	-.037559392	532893.00	1.239	-247987.55
42	-.1469	.231	-.0339339	.34	-.011537526	485285.95	1.239	-69371.60
43	-.1469	.144	-.0211536	.34	-.007192224	605866.52	1.239	-53989.77
44	-.1469	.521	-.0765349	.34	-.026021866	198925.74	1.239	-64135.83
45	-.1469	.589	-.0865241	.34	-.029418194	147464.92	1.239	-53749.70
46	-.1469	.479	-.0703651	.34	-.023924134	547640.34	1.239	-162331.56
47	-.1469	.421	-.0618449	.34	-.021027266	356455.01	1.239	-92866.45
48	-.1469	.515	-.0756535	.34	-.025722191	546243.69	1.239	-174086.74
49	-.1469	.234	-.0343746	.34	-.011687364	323900.58	1.239	-46902.89
50	-.1469	.182	-.0267358	.34	-.009090172	336353.20	1.239	-37882.53
51	-.1469	.507	-.0744783	.34	-.025322622	78553.58	1.239	-24645.97
52	-.1469	1.058	-.1554202	.34	-.052842868	110290.61	1.239	-72209.81
53	-.1469	.691	-.1015079	.34	-.034512686	245592.62	1.239	-105018.40
56	-.1469	.681	-.1000389	.34	-.034013226	57252.62	1.239	-24127.62
57	-.1469	.336	-.0493584	.34	-.016781856	743453.72	1.239	-154584.25
58	-.1469	.604	-.0887276	.34	-.030167384	495659.66	1.239	-185264.64
59	-.1469	1.007	-.1479283	.34	-.050295622	164590.68	1.239	-102566.78
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 2: Change in Group Expenditures in the Long Run, from 1980 to 2000 (1977$)

Income Level = Less Than $10,000

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	-.2272	.137	-.0311264	.245	-.007625968	304966.37	1.37	-31861.59
30	-.2272	.489	-.1111008	.245	-.027219696	125975.61	1.37	-46977.54
31	-.2272	.411	-.0933792	.245	-.022877904	643107.25	1.37	-201567.36
32	-.2272	.231	-.0524832	.245	-.012858384	38722.17	1.37	-6821.29
33	-.2272	.436	-.0990592	.245	-.024269504	196946.39	1.37	-65483.14
34	-.2272	.364	-.0827008	.245	-.020261696	50103.98	1.37	-13908.13
40	-.2272	.315	-.0715691	.245	-.017534185	40623.39	1.37	-9758.48
41	-.2272	.821	-.1865312	.245	-.045700144	532893.00	1.37	-333640.03
42	-.2272	.396	-.0899712	.245	-.022042944	485285.95	1.37	-146550.69
43	-.2272	.809	-.1838048	.245	-.045032176	605866.52	1.37	-373783.78
44	-.2272	.724	-.1644928	.245	-.040300736	198925.74	1.37	-109830.90
45	-.2272	.725	-.1647201	.245	-.040356425	147464.92	1.37	-81530.85
46	-.2272	.812	-.1844864	.245	-.045199168	547640.34	1.37	-339114.56
47	-.2272	.527	-.1197344	.245	-.029334928	356455.01	1.37	-143255.17
48	-.2272	1.492	-.3389824	.245	-.083050688	546243.69	1.37	-621513.03
49	-.2272	.677	-.1538144	.245	-.037684528	323900.58	1.37	-167222.75
50	-.2272	.372	-.0845184	.245	-.020707008	336353.20	1.37	-95418.70
51	-.2272	.367	-.0833824	.245	-.020428688	78553.58	1.37	-21985.03
52	-.2272	1.312	-.2980864	.245	-.073031168	110290.61	1.37	-110348.73
53	-.2272	.463	-.1051936	.245	-.025772432	245592.62	1.37	-86714.41
56	-.2272	.629	-.1429088	.245	-.035012656	57252.62	1.37	-27462.56
57	-.2272	.411	-.0933792	.245	-.022877904	743453.72	1.37	-233018.68
58	-.2272	1.008	-.2290176	.245	-.056109312	495659.66	1.37	-381012.38
59	-.2272	.561	-.1274592	.245	-.031227504	164590.68	1.37	-70414.66
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 2: Change in Group Expenditures in the Long Run, from 1980 to 2000 (1977$)

Income Level = $10,000 to $19,999

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	-.1942	.415	-.0805931	.245	-.019745310	304966.37	1.37	-82496.68
30	-.1942	.308	-.0598136	.245	-.014654332	125975.61	1.37	-25291.41
31	-.1942	.092	-.0178664	.245	-.004377268	643107.25	1.37	-38566.22
32	-.1942	.131	-.0254402	.245	-.006232849	38722.17	1.37	-3306.49
33	-.1942	.713	-.1384646	.245	-.033923827	196946.39	1.37	-91532.10
34	-.1942	.543	-.1054506	.245	-.025835397	50103.98	1.37	-17734.05
40	-.1942	1.002	-.1945884	.245	-.047674158	40623.39	1.37	-26532.60
41	-.1942	.841	-.1633222	.245	-.040013939	532893.00	1.37	-292127.13
42	-.1942	.513	-.0996246	.245	-.024408027	485285.95	1.37	-162274.75
43	-.1942	.575	-.1116651	.245	-.027357950	605866.52	1.37	-227081.14
44	-.1942	.728	-.1413776	.245	-.034637512	198925.74	1.37	-94397.01
45	-.1942	.659	-.1279778	.245	-.031354561	147464.92	1.37	-63344.66
46	-.1942	.983	-.1908986	.245	-.046770157	547640.34	1.37	-350901.18
47	-.1942	.994	-.1930348	.245	-.047293526	356455.01	1.37	-230954.80
48	-.1942	1.388	-.2695496	.245	-.066039652	546243.69	1.37	-494210.28
49	-.1942	.556	-.1079752	.245	-.026453924	323900.58	1.37	-117387.65
50	-.1942	.011	-.0021362	.245	-.000523369	336353.20	1.37	-2411.70
51	-.1942	3.213	-.6239646	.245	-.152871327	78553.58	1.37	-164517.68
52	-.1942	1.666	-.3235372	.245	-.079266614	110290.61	1.37	-119770.38
53	-.1942	.407	-.0790394	.245	-.019364653	245592.62	1.37	-65154.68
56	-.1942	1.301	-.2526542	.245	-.061900279	57252.62	1.37	-48552.16
57	-.1942	.662	-.1285604	.245	-.031497298	743453.72	1.37	-320809.93
58	-.1942	1.402	-.2722684	.245	-.066705758	495659.66	1.37	-452967.94
59	-.1942	1.181	-.2293502	.245	-.056190799	164590.68	1.37	-126704.20
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 2: Change in Group Expenditures in the Long Run, from 1980 to 2000 (1977$)

Income Level = $20,000 and Up

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	-.1429	1.121	-.1601909	.51	-.081697359	304966.37	1.37	-341334.77
30	-.1429	.318	-.0454422	.51	-.023175522	125975.61	1.37	-39997.84
31	-.1429	.095	-.0135755	.51	-.006923505	643107.25	1.37	-61000.02
32	-.1429	.438	-.0625902	.51	-.031921002	38722.17	1.37	-16933.89
33	-.1429	.321	-.0458709	.51	-.023394159	196946.39	1.37	-63121.31
34	-.1429	.356	-.0508724	.51	-.025944924	50103.98	1.37	-17809.23
40	-.1429	.438	-.0625902	.51	-.031921002	40623.39	1.37	-17765.33
41	-.1429	.752	-.1074608	.51	-.054805008	532893.00	1.37	-400111.31
42	-.1429	.231	-.0330099	.51	-.016835049	485285.95	1.37	-111926.43
43	-.1429	.144	-.0205776	.51	-.010494576	605866.52	1.37	-87108.88
44	-.1429	.521	-.0744509	.51	-.037969959	198925.74	1.37	-103478.87
45	-.1429	.589	-.0841681	.51	-.042925731	147464.92	1.37	-86721.54
46	-.1429	.479	-.0684491	.51	-.034909041	547640.34	1.37	-261911.11
47	-.1429	.421	-.0601609	.51	-.030682059	356455.01	1.37	-149833.80
48	-.1429	.515	-.0735935	.51	-.037532685	546243.69	1.37	-280877.30
49	-.1429	.234	-.0334386	.51	-.017053686	323900.58	1.37	-75674.67
50	-.1429	.182	-.0260078	.51	-.013263978	336353.20	1.37	-61120.93
51	-.1429	.507	-.0724503	.51	-.036949653	78553.58	1.37	-39764.63
52	-.1429	1.058	-.1511882	.51	-.077105982	110290.61	1.37	-116505.70
53	-.1429	.691	-.0987439	.51	-.050359389	245592.62	1.37	-169440.15
56	-.1429	.681	-.0973149	.51	-.049630599	57252.62	1.37	-38928.30
57	-.1429	.336	-.0480144	.51	-.024487344	743453.72	1.37	-249411.34
58	-.1429	.604	-.0863116	.51	-.044018916	495659.66	1.37	-298912.09
59	-.1429	1.007	-.1439003	.51	-.073389153	164590.68	1.37	-165484.64
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 3: Change in Group Expenditures Due to a 10 Percent Improvement in Efficiency (1977$)

Income Level = Less Than $10,000

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	.8799	.137	.1205463	.31	.037369353	304966.37	1.778	202627.92
30	.8799	.489	.4302711	.31	.133384041	125975.61	1.778	298759.76
31	.8799	.411	.3616389	.31	.112108059	643107.25	1.778	1281893.65
32	.8799	.231	.2032569	.31	.063009639	38722.17	1.778	43380.89
33	.8799	.436	.3836364	.31	.118927284	196946.39	1.778	416448.48
34	.8799	.364	.3202836	.31	.099287916	50103.98	1.778	88450.52
40	.8799	.315	.2771685	.31	.085922235	40623.39	1.778	62060.24
41	.8799	.821	.7223979	.31	.223943349	532893.00	1.778	2121826.85
42	.8799	.396	.3484404	.31	.108016524	485285.95	1.778	932008.07
43	.8799	.809	.7118391	.31	.220670121	605866.52	1.778	2377126.23
44	.8799	.724	.6370476	.31	.197484756	198925.74	1.778	698483.77
45	.8799	.725	.6379275	.31	.197757525	147464.92	1.778	518505.65
46	.8799	.812	.7144788	.31	.221488428	547640.34	1.778	2156642.84
47	.8799	.527	.4637073	.31	.143749263	356455.01	1.778	911049.78
48	.8799	1.492	1.3128108	.31	.406971348	546243.69	1.778	3952592.34
49	.8799	.677	.5956923	.31	.184664613	323900.58	1.778	1063474.70
50	.8799	.372	.3273228	.31	.101470068	336353.20	1.778	606827.53
51	.8799	.367	.3229233	.31	.100106223	78553.58	1.778	139816.63
52	.8799	1.312	1.1544288	.31	.357872928	110290.61	1.778	701777.02
53	.8799	.463	.4073937	.31	.126292047	245592.62	1.778	551471.50
56	.8799	.629	.5534571	.31	.171571701	57252.62	1.778	174651.68
57	.8799	.411	.3616389	.31	.112108059	743453.72	1.778	1481912.39
58	.8799	1.008	.8869392	.31	.274951152	495659.66	1.778	2423097.42
59	.8799	.561	.4936239	.31	.153023409	164590.68	1.778	447811.12
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 3: Change in Group Expenditures Due to
a 10 Percent Improvement in Efficiency (1977$)

Income Level = $10,000 to $19,999

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	.6348	.415	.2634421	.3	.07903263	304966.37	1.778	428538.79
30	.6348	.308	.1955184	.3	.05865552	125975.61	1.778	131379.35
31	.6348	.092	.0584016	.3	.01752048	643107.25	1.778	200337.00
32	.6348	.131	.0831588	.3	.02494764	38722.17	1.778	17175.96
33	.6348	.713	.4526124	.3	.13578372	196946.39	1.778	475474.78
34	.6348	.543	.3446964	.3	.10340892	50103.98	1.778	92121.71
40	.6348	1.002	.6360696	.3	.19082088	40623.39	1.778	137826.84
41	.6348	.841	.5338668	.3	.16016004	532893.00	1.778	1517490.36
42	.6348	.513	.3256524	.3	.09769572	485285.95	1.778	842956.21
43	.6348	.575	.3650101	.3	.10950303	605866.52	1.778	1179600.23
44	.6348	.728	.4621344	.3	.13864032	198925.74	1.778	490356.90
45	.6348	.659	.4183332	.3	.12549996	147464.92	1.778	329051.64
46	.6348	.983	.6240084	.3	.18720252	547640.34	1.778	1822799.41
47	.6348	.994	.6309912	.3	.18929736	356455.01	1.778	1199723.14
48	.6348	1.388	.8811024	.3	.26433072	546243.69	1.778	2567236.20
49	.6348	.556	.3529488	.3	.10588464	323900.58	1.778	609784.59
50	.6348	.011	.0069828	.3	.00209484	336353.20	1.778	12527.90
51	.6348	3.213	2.0396124	.3	.61188372	78553.58	1.778	854607.38
52	.6348	1.666	1.0575768	.3	.31727304	110290.61	1.778	622161.98
53	.6348	.407	.2583636	.3	.07750908	245592.62	1.778	338454.00
56	.6348	1.301	.8258748	.3	.24776244	57252.62	1.778	252210.17
57	.6348	.662	.4202376	.3	.12607128	743453.72	1.778	1666486.72
58	.6348	1.402	.8899896	.3	.26699688	495659.66	1.778	2352997.78
59	.6348	1.181	.7496988	.3	.22490964	164590.68	1.778	658180.58
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

Scenario 3: Change in Group Expenditures Due to
10 Percent Improvement in Efficiency (1977$)

Income Level = $20,000 and Up

SECTOR NUMBER	PERCENT CHANGE IN INCOME	INCOME ELASTICITY	PERCENT CHANGE IN EXPENDITURES	FRACTION OF HOUSEHOLDS	% CHANGE IN GROUP EXPENDITURES	1972 HOUSEHOLD EXPENDITURES (IN 1000$)	POPULATION MULTIPLIER	CHANGE IN EXPENDITURES ($)
29	.4755	1.121	.5330355	.39	.207883845	304966.37	1.778	1127209.00
30	.4755	.318	.1512091	.39	.058971549	125975.61	1.778	132087.21
31	.4755	.095	.0451725	.39	.017617275	643107.25	1.778	201443.80
32	.4755	.438	.2082691	.39	.081224949	38722.17	1.778	55921.77
33	.4755	.321	.1526355	.39	.059527845	196946.39	1.778	208449.06
34	.4755	.356	.1692781	.39	.066018459	50103.98	1.778	58812.46
40	.4755	.438	.2082691	.39	.081224949	40623.39	1.778	58667.47
41	.4755	.752	.3575761	.39	.139454679	532893.00	1.778	1321310.43
42	.4755	.231	.1098405	.39	.042837795	485285.95	1.778	369620.95
43	.4755	.144	.0684721	.39	.026704119	605866.52	1.778	287664.96
44	.4755	.521	.2477355	.39	.096616845	198925.74	1.778	341724.09
45	.4755	.589	.2800695	.39	.109227105	147464.92	1.778	286385.42
46	.4755	.479	.2277645	.39	.088828155	547640.34	1.778	864923.76
47	.4755	.421	.2001855	.39	.078072345	356455.01	1.778	494804.57
48	.4755	.515	.2448825	.39	.095504175	546243.69	1.778	927556.87
49	.4755	.234	.1112671	.39	.043394169	323900.58	1.778	249904.95
50	.4755	.182	.0865411	.39	.033751029	336353.20	1.778	201843.30
51	.4755	.507	.2410785	.39	.094020615	78553.58	1.778	131316.96
52	.4755	1.058	.5030791	.39	.196200849	110290.61	1.778	384743.40
53	.4755	.691	.3285705	.39	.128142495	245592.62	1.778	559551.73
56	.4755	.681	.3238155	.39	.126288045	57252.62	1.778	128555.12
57	.4755	.336	.1597681	.39	.062309559	743453.72	1.778	823645.58
58	.4755	.604	.2872021	.39	.112008819	495659.66	1.778	987114.54
59	.4755	1.007	.4788285	.39	.186743115	164590.68	1.778	946489.21
	(A)	(B)	(C)=(A)*(B)	(D)	(E)=(C)*(D)	(F)	(G)	(H)=((E)/100) *(F)*(G)*1000

APPENDIX VI

LOCAL AND NATIONAL CONSUMER PRICE INDEX VALUES

Consumer Price Index for Urban Wage Earners and Clerical Workers, Dallas, Texas, 1964-1980

Item	YEAR													
	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
ALL ITEMS	100.0	104.5	111.3	117.8	121.3	124.9	132.0	145.3	158.2	167.7	180.2	194.0	218.6	255.6
FOOD	100.0	103.6	109.2	114.8	117.8	123.0	140.1	157.9	172.5	177.0	191.3	209.4	235.8	257.7
Food at Home	100.0	102.9	107.6	112.4	114.3	119.9	138.8	156.4	171.2	173.1	186.2	204.3	226.7	246.4
Cereals and Bakery Products	100.0	101.4	102.4	109.6	114.1	113.2	124.5	160.5	177.8	174.3	182.0	197.5	215.3	240.6
Meats, Poultry, Fish	100.0	101.9	110.3	115.1	114.5	126.9	158.5	156.5	172.4	172.0	172.1	194.8	223.3	239.5
Dairy Products	100.0	102.5	104.3	106.8	110.5	111.4	122.0	147.3	151.3	161.8	169.6	184.5	209.9	231.6
Fruits and Vegetables	100.0	107.1	108.5	112.2	117.4	124.1	139.3	155.3	167.4	168.6	187.3	211.3	222.4	237.3
Other Foods at Home	100.0	102.2	107.7	113.0	114.2	115.8	128.9	159.8	179.8	183.1	215.2	235.8	258.2	290.6
Food Away From Home	100.0	106.4	115.1	123.9	130.5	134.4	145.1	163.7	177.8	191.1	210.1	228.1	264.7	292.1
HOUSING	100.0	105.1	114.0	122.1	125.2	127.9	131.2	143.6	158.0	170.3	183.4	198.2	227.6	276.5
Shelter	100.0	105.2	116.8	127.7	130.5	133.6	136.4	148.4	162.9	173.3	185.3	206.3	245.8	310.6
Rent	100.0	102.6	106.0	110.1	111.6	111.8	113.4	116.9	122.1	129.2	140.3	155.5	172.6	191.2
Homeownership	100.0	106.6	121.8	135.8	139.1	143.5	146.6	162.6	181.3	193.0	205.4	229.2	278.5	363.8
Fuels and Utilities	100.0	104.0	107.6	112.4	114.7	116.5	120.9	127.8	143.8	170.1	191.6	207.3	216.1	238.9
Gas and Electricity	100.0	101.3	103.8	108.6	109.5	112.8	117.1	122.6	147.3	192.7	235.5	261.2	285.0	310.3
Household Furnishings and Operation	100.0	105.0	111.1	115.2	119.0	121.3	125.4	141.5	155.0	164.2	173.5	176.6	189.4	208.1
APPAREL AND UPKEEP	100.0	105.7	112.7	117.9	118.4	121.7	128.7	136.9	141.4	145.6	153.6	162.2	171.7	182.7
Men's and Boy's	100.0	107.4	116.1	123.3	123.3	125.5	129.6	143.2	146.5	148.5	154.2	162.4	172.6	180.4
Women's and Girl's	100.0	105.8	111.7	116.3	115.3	119.8	130.3	132.6	132.2	133.2	139.1	138.8	139.5	143.4
Footwear	100.0	106.2	112.9	119.8	121.3	125.4	131.3	136.9	141.7	147.6	156.8	165.0	182.5	193.0
TRANSPORTATION	100.0	103.5	106.9	111.0	117.5	119.9	123.4	142.4	156.5	170.3	183.2	188.8	216.2	259.3
Private	100.0	103.1	106.5	109.8	115.4	117.9	121.6	141.8	156.4	170.6	184.1	189.0	217.2	260.0
Public	100.0	108.0	112.0	124.8	144.4	145.7	146.6	151.6	159.7	166.2	171.8	181.0	190.4	243.0
HEALTH AND RECREATION	100.0	104.7	111.1	118.4	123.1	126.9	131.0	140.7	153.5	163.2	174.5	212.3	224.3	252.6
Medical Care	100.0	106.1	114.5	123.1	128.8	131.6	136.9	147.7	162.8	177.1	195.3	210.7	222.4	247.3
Personal Care	100.0	105.4	111.6	116.4	119.8	126.2	130.9	144.7	157.6	165.3	177.9	187.6	203.5	227.3
Reading and Recreation	100.0	104.4	110.1	115.7	119.1	121.8	124.5	132.4	145.4	154.7	159.9	174.0	183.3	205.3
Other Goods and Service	100.0	102.1	106.2	115.6	121.1	126.1	130.1	137.0	146.5	149.3	155.8	182.8	198.3	219.6

National Consumer Price Inflation Index

From current (constant) dollars	To constant (current) dollars multiply by the appropriate conversion factor										
	1967	1970	1973	1974	1975	1976	1977	1978	1979	1980	1981
1967	1.000	1.163	1.331	1.477	1.612	1.705	1.815	1.953	2.174	2.470	2.724
1970	0.860	1.000	1.144	1.270	1.386	1.466	1.561	1.679	1.869	2.124	2.342
1973	0.751	0.874	1.000	1.110	1.211	1.281	1.364	1.467	1.633	1.856	2.047
1974	0.677	0.787	0.901	1.000	1.091	1.154	1.229	1.322	1.472	1.672	1.844
1975	0.620	0.721	0.826	0.916	1.000	1.058	1.126	1.212	1.349	1.532	1.690
1976	0.587	0.682	0.781	0.866	0.945	1.000	1.065	1.145	1.275	1.449	1.598
1977	0.551	0.641	0.733	0.814	0.888	0.939	1.000	1.076	1.198	1.361	1.501
1978	0.512	0.595	0.682	0.756	0.825	0.873	0.929	1.000	1.113	1.265	1.395
1979	0.460	0.535	0.612	0.679	0.741	0.784	0.835	0.898	1.000	1.135	1.253
1980	0.405	0.471	0.539	0.598	0.653	0.690	0.735	0.791	0.881	1.000	1.103
1981	0.367	0.427	0.489	0.542	0.592	0.626	0.666	0.717	0.798	0.907	1.000

Source: U.S. Department of Labor, Bureau of Labor Statistics, Monthly Labor Review, Washington, D.C., monthly.

APPENDIX VII

SECTOR EQUIVALENCY TABLE

APPENDIX VII

Sector Equivalency Table

National Sector Number (RIMS-II)	Related Services	Local Sector Numbers (Input-Output Model)
1	Agricultural Products & Services	1 & 2
2	Forestry & Fisheries	---
3	Coal Mining	---
4	Crude Petroleum & Natural Gas	3
5	Other Mining	---
6	New Construction	4, 5, 6 & 7
7	Maintenance & Repair Construction	8
8	Food & Kindred Products	9
9	Textile Mill Products	10
10	Apparel	11
11	Paper & Allied Products	14
12	Printing & Publishing	15
13	Chemicals & Refined Petroleum	16 & 17
14	Rubber & Leather Products	18
15	Lumber & Furniture Products	12 & 13
16	Stone, Clay & Glass Products	19
17	Primary Metals	20
18	Fabricated Metals	21
19	Non-Electrical Machinery	22 & 23
20	Electrical Machinery	24
21	Motor Vehicles & Equipment	26
22	Other Transportation Equipment	25
23	Instruments	27
24	Miscellaneous Manufacturing	28
25	Transportation, Transit & Postal	29
26	Communications	30 & 31
27	Utilities	32, 33, 34 & 61
28	Wholesale Trade	35 - 39
29	Retail Trade	40 - 45 & 47
30	Eating & Drinking Establishments	46
31	Finance	48
32	Insurance	49
33	Real Estate	50
34	Lodging & Amusements	52, 54 & 60
35	Personal Services	53
36	Business Services	51, 55 & 56
37	Health Services	57
38	Other Services	58 & 59
39	Households	---

APPENDIX VIII

RELATIVE WEIGHT OF THE CONSUMER PRICE INDEX FOR THE U.S.

APPENDIX VIII

(Percent of all items)

Group and item	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)	Unrevised Urban Wage Earners and Clerical Workers
Expenditure category			
All items	100.000	100.000	100.000
Food and beverages	18.814	20.481	26.192
Food	17.719	19.298	24.045
Food at home	12.236	13.495	18.754
Cereals and bakery products	1.530	1.692	2.514
Cereal and cereal products	.385	.419	NA
Flour and prepared flour mixes	.104	.118	NA
Cereal	.164	.170	NA
Rice, pasta, and cornmeal	.117	.130	NA
Bakery products	1.145	1.273	NA
White bread	.324	.372	.543
Other bread	.115	.120	NA
Fresh biscuits, rolls, and muffins	.117	.132	NA
Fresh cakes and cupcakes	.135	.155	NA
Cookies	.147	.162	NA
Crackers and bread and cracker products	.081	.081	NA
Fresh sweetrolls, coffeecake, and donuts	.124	.139	NA
Frozen and refrigerated bakery products and fresh pies, tarts, and turnovers	.102	.111	NA
Meats, poultry, fish, and eggs	3.945	4.399	5.157
Meats, poultry, and fish	3.720	4.154	5.734
Meats	2.887	3.274	4.511
Beef and veal	1.430	1.584	2.022
Ground beef other than canned	.372	.418	.511
Chuck roast	.168	.185	.122
Round roast	.157	.174	.239
Round steak	.093	.116	.350
Sirloin steak	.101	.105	.185
Other beef and veal	.539	.587	NA
Pork	.955	1.104	1.483
Bacon	.168	.182	.343
Chops	.203	.235	.309
Ham other than canned	.178	.207	NA
Sausage	.131	.162	.223
Canned ham	.094	.107	.192
Other pork	.182	.210	NA
Other meats	.496	.586	1.005
Frankfurters	.110	.130	.148
Bologna, liverwurst, and salami	.104	.129	NA
Other luncheonmeats	.180	.227	NA
Lamb and organ meats	.101	.098	NA
Unpriced items 1/	.002	.002	NA
Poultry	.422	.451	.562
Fresh whole chicken	.167	.183	.391
Fresh and frozen chicken parts	.139	.147	NA
Other poultry	.116	.121	NA
Fish and seafood	.410	.429	.661
Canned fish and seafood	.153	.164	NA
Fresh and frozen fish and seafood	.257	.265	NA
Eggs	.224	.245	.424
Dairy products	1.654	1.821	2.757
Fresh milk and cream	.971	1.100	NA
Fresh whole milk	.706	.834	1.369
Other fresh milk and cream	.265	.267	NA
Processed dairy products	.683	.720	NA
Butter	.080	.080	.244
Cheese	.344	.356	NA
Ice cream and related products	.165	.180	NA
Other dairy products	.094	.098	NA
Fruits and vegetables	1.759	1.837	3.114
Fresh fruits and vegetables	.899	.945	1.319
Fresh fruits	.431	.444	.802
Apples	.086	.096	.216
Bananas	.050	.052	.131
Oranges	.090	.091	.185
Other fresh fruits	.204	.206	NA
Fresh vegetables	.468	.500	1.017
Potatoes	.101	.108	.243
Lettuce	.092	.096	.163
Tomatoes	.071	.077	.121
Other fresh vegetables	.204	.217	NA
Processed fruits and vegetables	.860	.892	1.296
Processed fruits	.419	.409	NA
Frozen fruit and fruit juices	.121	.115	NA
Fruit juices other than frozen	.154	.155	NA
Canned and dried fruits	.144	.140	NA
Processed vegetables	.441	.483	NA
Frozen vegetables	.113	.116	NA
Cut corn and canned beans except lima	.108	.125	NA
Other canned and dried vegetables	.220	.242	NA
Other foods at home	3.349	3.745	4.211
Sugar and sweets	.435	.466	.752
Candy and chewing gum	.211	.229	NA

See footnotes at end of table.

(Percent of all items)

Group and item	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)	Unrevised Urban Wage Earners and Clerical Workers
Expenditure category			
Food and beverages--Continued			
Sugar and artificial sweeteners	.116	.128	NA
Other sweets	.107	.103	NA
Fats and oils	.360	.390	.302
Margarine	.107	.109	.174
Nondairy substitutes and peanut butter	.072	.078	NA
Other fats, oils, and salad dressings	.181	.202	NA
Nonalcoholic beverages	1.913	.728	1.305
Cola drinks, excluding diet cola	.518	.350	.173
Carbonated drinks, including diet cola	.288	.316	NA
Roasted coffee	.250	.262	1.022
Freeze dried and instant coffee	.212	.207	.287
Other noncarbonated drinks	.258	.294	NA
Other prepared foods	.041	1.161	1.352
Canned and packaged soup	.108	.111	NA
Frozen prepared foods	.162	.170	NA
Snacks	.189	.207	NA
Seasonings, olives, pickles, and relish	.108	.112	NA
Other condiments	.100	.183	NA
Miscellaneous prepared foods	.160	.165	NA
Other canned and packaged prepared foods	.153	.180	NA
Food away from home	5.403	5.805	5.249
Lunch	1.758	1.993	NA
Dinner	1.789	1.945	NA
Other meals and snacks	1.058	1.306	NA
Unpriced items 1/	.098	.560	NA
Alcoholic beverages	1.095	1.183	1.147
Alcoholic beverages at home	.643	.975	NA
Beer and ale	.359	.490	.310
Whiskey	.201	.200	.311
Wine	.134	.108	.223
Other alcoholic beverages at home	.120	.110	NA
Alcoholic beverages away from home	.198	.227	NA
Unpriced items 1/	.054	.041	NA
Housing	41.988	40.579	34.658
Shelter	29.183	28.374	21.714
Rent, residential	5.624	5.532	4.531
Other rental costs	.772	.488	.410
Lodging while out of town	.458	.310	NA
Tenants' insurance	.074	.050	NA
Unpriced items 1/	.199	.122	NA
Homeownership	22.548	20.304	16.772
Home purchase	9.868	8.753	6.083
Financing, taxes, and insurance	9.211	8.505	6.925
Property insurance	.579	.501	.665
Property taxes	2.127	1.884	1.933
Contracted mortgage interest cost	6.505	6.145	4.336
Maintenance and repairs	3.466	3.303	3.787
Maintenance and repair services	2.800	2.722	2.831
Maintenance and repair commodities	.668	.581	.956
Paint and wallpaper, supplies, tools, and equipment	.141	.136	NA
Lumber, awnings, glass, and masonry	.063	.105	NA
Plumbing, electrical, heating, and cooling supplies	.052	.061	NA
Miscellaneous supplies and equipment	.061	.080	NA
Unpriced items 1/	.025	.025	NA
Fuel and other utilities	6.510	6.393	6.505
Fuels	4.283	4.252	4.086
Fuel oil, coal, and bottled gas	.897	.892	.100
Fuel oil	.748	.742	1.028
Other fuels	.147	.148	NA
Unpriced items 1/	.006	.006	NA
Gas (piped) and electricity	3.386	3.370	2.986
Electricity	2.106	2.079	1.344
Utility (piped) gas	1.280	1.291	1.642
Other utilities and public services	2.227	2.141	1.420
Telephone services	1.593	1.531	.893
Local charges	.827	.797	NA
Interstate toll calls	.414	.396	NA
Intrastate toll calls	.352	.338	NA
Water and sewerage maintenance	.442	.422	.535
Unpriced items 1/	.009	.007	NA
Household furnishings and operation	8.219	7.917	8.266
Housefurnishings	4.603	4.735	4.747
Textile housefurnishings	.536	.547	.517
Household linens	.292	.296	NA
Curtains, drapes, slipcovers, and sewing materials	.273	.250	NA
Unpriced items 1/	.002	.002	NA
Furniture and bedding	1.348	1.337	1.241
Bedroom furniture	.388	.403	NA
Sofas	.268	.279	NA
Living room chairs and tables	.288	.295	NA
Other furniture	.393	.358	NA

See footnotes at end of table.

(Percent of all items)

Group and item	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)	Nonretail Urban Wage Earners and Clerical Workers
Expenditure category			
Housing--Continued			
Appliances including TV and sound equipment	1.724	1.894	1.940
Television and sound equipment	.847	.919	NA
Television	.407	.419	.273
Sound equipment	.450	.500	NA
Household appliances	.877	.975	.930
Refrigerator and home freezer	.227	.234	.196
Laundry equipment	.200	.231	NA
Other household appliances	.440	.489	NA
Stoves, dishwashers, vacuums, and sewing machines	.235	.250	NA
Office machines, small electric appliances, and air conditioners	.205	.229	NA
Unpriced items 1/	.009	.001	NA
Other household equipment	.963	.962	NA
Floor and window coverings, infants', laundry, cleaning, and outdoor equipment	.198	.183	NA
Clocks, lamps, and decor items	.172	.134	NA
Tableware, serving pieces, and nonelectric kitchenware	.305	.318	NA
Lawn equipment, power tools, and other hardware	.207	.234	NA
Unpriced items 1/	.107	.110	NA
Housekeeping supplies	1.557	1.610	1.569
Soaps and detergents	.322	.370	.566
Other laundry and cleaning products	.263	.280	NA
Cleansing and toilet tissue, paper towels and napkins	.249	.261	NA
Stationery, stationery supplies, and gift wrap	.232	.217	NA
Miscellaneous household products	.271	.298	NA
Lawn and garden supplies	.232	.191	NA
Housekeeping services	2.053	1.960	2.125
Postage	.184	.168	.209
Moving, storage, freight, household laundry, and dry cleaning services	.432	.375	NA
Appliance and furniture repair	.351	.313	NA
Unpriced items 1/	.060	.041	NA
Apparel and upkeep	5.800	5.836	9.011
Apparel commodities	5.130	5.201	7.610
Apparel commodities less footwear	4.422	4.443	6.257
Men's and boys'	1.666	1.644	2.430
Men's	1.317	1.257	NA
Suits, sport coats, and jackets	.378	.278	NA
Coats and jackets	.191	.138	NA
Furnishings and special clothing	.246	.248	NA
Shirts	.228	.223	NA
Dungarees, jeans, and trousers	.317	.345	NA
Unpriced items 1/	.018	.024	NA
Boys'	330	.387	NA
Coats, jackets, sweaters, and shirts	174	.155	NA
Furnishings	.058	.066	NA
Suits, trousers, sport coats, and jackets	.143	.173	NA
Unpriced items 1/	.015	014	NA
Women's and girls'	2.014	2.081	3.257
Women's	1.692	1.683	NA
Coats and jackets	.195	209	256
Dresses	.378	.424	462
Separates and sportswear	.390	.410	NA
Underwear, nightwear, and hosiery	400	.434	NA
Suits	.193	185	NA
Unpriced items 1/	.124	.141	NA
Girls'	.352	.397	NA
Coats, jackets, dresses, and suits	.125	.145	NA
Separates and sportswear	.102	.156	NA
Underwear, nightwear hosiery, and accessories	.078	.090	NA
Unpriced items 1/	.006	006	NA
Infants' and toddlers'	.127	.144	.122
Other apparel commodities	.564	.575	.462
Sewing materials and notions	.179	.179	NA
Jewelry and luggage	.385	.396	NA
Footwear	.708	.757	1.353
Men's	.232	.252	NA
Boys' and girls'	188	.217	NA
Women's	296	.288	NA
Apparel services	.669	636	1.101
Laundry and dry cleaning other than coin operated	.371	.388	NA
Other apparel services	242	247	NA
Unpriced items 1/	(2)	(2)	NA
Transportation	19.028	20.424	17.286
Private	16.931	19.150	11.993
New cars	4.040	4.275	1.924
Used cars	4.020	3.825	2.095
Gasoline	4.205	4.786	3.155
Automobile maintenance and repair	1.316	1.664	1.126
Body work	206	.212	NA

See footnotes at end of table.

(Percent of all items)

Group and item	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)	Unrevised Urban Wage Earners and Clerical Workers
Expenditure category			
Transportation--Continued			
Automobile drive train, brake, and miscellaneous mechanical repair	.332	.382	NA
Maintenance and servicing	.573	.621	NA
Power plant repair	.405	.449	NA
Other private transportation	4.150	4.868	3.883
Other private transportation commodities	.733	.815	.793
Motor oil, coolant, and other products	.091	.106	NA
Automobile parts and equipment	.642	.708	NA
Tires	.456	.504	.278
Other parts and equipment	.186	.204	NA
Other private transportation services	3.416	3.854	2.890
Automobile insurance	1.955	2.182	1.917
Automobile finance charges	.767	.993	NA
Automobile rental, registration, and other fees	.694	.699	NA
State registration	.319	.356	.306
Drivers' license	.029	.033	NA
Automobile inspection	.020	.023	NA
Other automobile related fees	.253	.217	NA
Unpriced items 1/	.044	.040	NA
Public transportation	1.097	.985	1.296
Airline fare	.483	.350	.193
Intercity bus fare	.047	.035	.061
Intracity mass transit	.435	.503	.799
Taxi fare	.095	.082	.171
Intercity train fare	.011	.009	.072
Unpriced items 1/	.026	.026	NA
Medical care	4.369	4.492	6.889
Medical care commodities	.859	.780	.781
Prescription drugs	.391	.322	.390
Anti-infective drugs	.081	.066	NA
Tranquilizers and sedatives	.065	.053	NA
Circulatories and diuretics	.054	.045	NA
Hormones, diabetic drugs, biologicals, and prescription medical supplies	.065	.054	NA
Pain and symptom control drugs	.059	.048	NA
Supplements, cough and cold preparations, and respiratory agents	.066	.055	NA
Nonprescription drugs and medical supplies	.468	.458	NA
Eyeglasses	.105	.103	NA
Internal and respiratory over-the-counter drugs	.260	.263	.392
Nonprescription medical equipment and supplies	.103	.092	NA
Medical care services	4.111	3.712	6.107
Professional services	2.008	1.916	3.004
Physicians' services	.990	.974	1.779
Dental services	.748	.699	.921
Other professional services	.235	.220	NA
Unpriced items 1/	.036	.022	NA
Other medical care services	2.103	1.797	3.103
Hospital and other medical services	.355	.307	NA
Hospital room	.162	.141	.383
Other hospital and medical care services	.192	.164	NA
Unpriced items 1/	.002	.001	NA
Entertainment	4.086	3.910	3.685
Entertainment commodities	2.423	2.497	2.121
Reading materials	.630	.563	NA
Newspapers	.334	.328	.566
Magazines, periodicals, and books	.295	.235	NA
Sporting goods and equipment	.690	.715	NA
Sport vehicles	.411	.436	NA
Indoor and warm weather sport equipment	.084	.081	NA
Bicycles	.093	.097	.116
Other sporting goods and equipment	.086	.085	NA
Unpriced items 1/	.015	.017	NA
Toys, hobbies, and other entertainment	1.104	1.219	NA
Toys, hobbies, and music equipment	.549	.624	NA
Photographic supplies and equipment	.220	.211	NA
Pet supplies and expense	.305	.349	NA
Unpriced items 1/	.030	.034	NA
Entertainment services	1.662	1.413	1.564
Fees for participant sports	.503	.410	NA
Admissions	.285	.271	NA
Other entertainment services	.208	.178	NA
Other goods and services	4.395	4.367	5.453
Tobacco products	1.202	1.454	1.361
Cigarettes	1.089	1.341	.870
Other tobacco products and smoking accessories	.112	.113	NA
Personal care	1.752	1.813	2.562
Toilet goods and personal care appliances	.791	.871	1.249

See footnotes at end of table.

(Percent of all items)

Group and item	All Urban Consumers (CPI-U)	Urban Wage Earners and Clerical Workers (CPI-W)	Unrevised Urban Wage Earners and Clerical Workers
Expenditure category			
Other goods and services--Continued			
Products for the hair, hairpieces, and wigs	.211	243	NA
Dental and shaving products	.156	.162	NA
Cosmetics, bath and nail preparations, manicure and eye makeup implements	.248	.271	NA
Other toilet goods and small personal care appliances	.177	.195	NA
Personal care services	.961	.942	1.264
Beauty parlor services for females	.652	.611	.728
Haircuts and other barber shop services for males	.308	.331	NA
Unpriced items 1/	.001	(2)	NA
Personal and educational expenses	1.441	1.100	1.030
School books and supplies	.189	.180	.207
Personal and educational services	1.252	.934	.823
Tuition and other school fees	1.012	.724	NA
College tuition	.800	.450	NA
Elementary and high school tuition	.175	.147	NA
Unpriced items 1/	.171	.147	NA
Personal expenses	.240	.210	NA
Commodity and service group			
All items	100.000	100.000	100.000
Commodities	59.310	62.100	62.306
Food and beverages	18.814	20.481	20.192
Commodities less food and beverages	40.495	41.679	38.114
Nondurables less food and beverages	17.231	18.202	20.350
Apparel commodities	5.138	5.201	7.610
Nondurables less food, beverages, and apparel	12.093	13.001	12.740
Durables	23.264	23.477	15.764
Services	40.690	37.840	37.694
Rent, residential	5.624	5.322	4.531
Household services less rent	20.389	18.379	16.691
Transportation services	8.029	8.303	9.312
Medical care services	4.111	3.712	8.107
Other services	4.537	3.924	4.074
Special groups:			
All items less food	82.281	80.702	79.955
All items less shelter	70.817	73.620	78.286
All items less mortgage interest costs	93.495	93.855	95.064
All items less medical care	95.031	95.508	93.111
Commodities less food	41.591	42.862	38.261
Nondurables less food	18.327	19.385	22.497
Nondurables less food and apparel	13.189	14.184	14.887
Nondurables	30.045	38.063	40.542
Services less rent	35.066	32.518	33.164
Services less medical care	36.580	34.128	31.586
Domestically produced farm food	9.905	10.890	15.040
Selected beef cuts	1.421	1.478	1.772
Imported food and fishery products	2.331	2.598	NA
Gasoline, motor oil, coolant, and other products	4.290	4.893	5.380
Insurance and finance	12.702	12.418	10.190
Utilities and public transportation	8.710	8.486	5.702
Housekeeping and home maintenance services	4.853	3.882	4.849
Energy	8.579	9.155	7.462
All items less energy	91.421	90.845	92.538
All items less food and energy	73.702	71.547	68.493
Commodities less food and energy	30.397	37.077	33.781
Energy commodities	5.194	5.785	4.480
Services less energy	57.305	348470	34.712

[1] Not actually priced; imputed from priced items.
[2] Less than .001 percent.

NA = not available because of the restructuring of the market baskets.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Relative Importance of Components in the Consumer Price Indexes, 1977, (April 1980).

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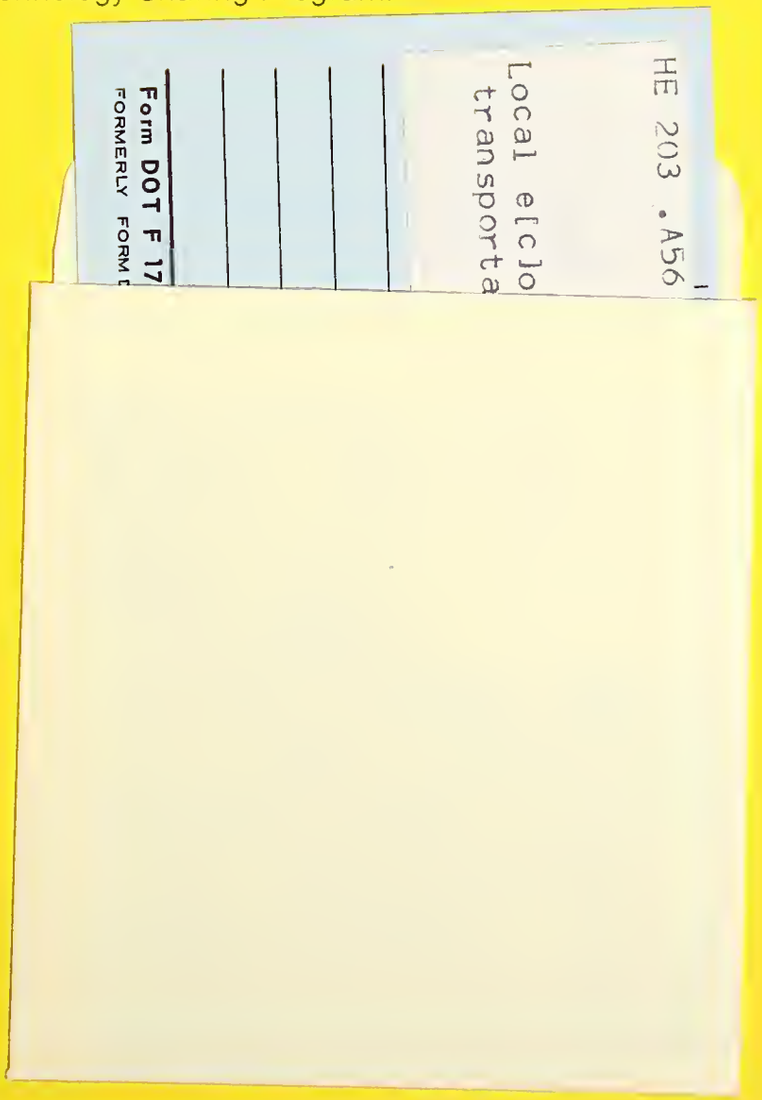

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