

HOUSEHOLD RESPONSE TO MOTOR FUEL SHORTAGES AND HIGHER PRICES IN SOUTHEASTERN WISCONSIN

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NUMBER 15

**HOUSEHOLD RESPONSE TO
MOTOR FUEL SHORTAGES AND HIGHER PRICES
IN SOUTHEASTERN WISCONSIN**

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STATEMENT OF THE EXECUTIVE DIRECTOR

In preparation for a major reevaluation of its adopted regional land use and transportation plans, the Southeastern Wisconsin Regional Planning Commission in 1972 undertook new surveys of travel and of public opinion concerning land use and transportation system development within the Region. These important behavioral and attitudinal surveys were undertaken shortly before the motor fuel shortages of 1973 made the public aware that an era of cheap petroleum derived motor fuel was coming to an end.

In order to provide some measure of the changes in travel habits and patterns and in public attitudes toward transportation facility improvements which this new public awareness may have fostered the Commission requested the University of Wisconsin-Milwaukee to assist it in a special survey of the residents of the Region. This survey was designed to determine the actual past and the probable future response of households to increases in the cost of motor fuel and to restrictions on its supply. The survey findings provide valuable information about phenomena that have been the subject of much speculation, and consequently those findings deserve careful consideration by all involved in land use and transportation planning.

The survey findings indicate that households within the Region are very reluctant to change their travel habits and patterns, and that no significant shifts in such travel habits and patterns can be expected on the basis of foreseeable increases in the cost of motor fuel alone. Households are even more reluctant to consider residential relocation in response to higher motor fuel prices. Consequently, under the alternative of higher motor fuel prices, the basic pattern of trip generation and distribution within the Region may be expected to vary only slightly from the Commission's estimates. The survey further indicates that even restricted motor fuel availability would produce only relatively modest changes in residential location and travel patterns, the latter being related primarily to non-work trip purposes such as shopping.

Importantly, the results of the survey indicate that higher motor fuel prices and restricted motor fuel availability are most likely to influence the choice of mode for the journey to work. Increasing motor fuel prices could be expected to modestly increase carpooling and transit use. Only under severely restricted motor fuel availability, however, can a substantial increase in carpooling and transit use be expected, each mode approximately doubling under severe constraints. Traffic flow volumes, however, could be expected to be relatively little affected even with such doubling.

Interestingly, the survey indicates that, in spite of the 1973 motor fuel shortage and subsequent increase in motor fuel prices, approximately 65 percent of the responding households still believe that the proposed regional freeway system should be completed, results not inconsistent with the findings of the Commission's 1972 public opinion survey and the results of the public referendum held on certain proposed freeway segments in Milwaukee County in November 1974.

The survey thus indicates that households within the Region prefer to maintain their current heavy reliance upon the automobile and that policy alternatives that restrict the ability to maintain current travel patterns, such as fuel rationing or higher fuel taxes, will be unpopular. These attitudes, unfortunately, can be expected to cause households to support transportation policy alternatives that may be less effective in reducing motor fuel consumption, such as increased vehicle registration fees, than other less popular, but more effective, policies.

Respectfully submitted,



Kurt W. Bauer
Executive Director

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Chapter I

THE IMPACT OF THE ENERGY CRISIS UPON TRAVEL BEHAVIOR: BACKGROUND, HYPOTHESES, AND METHODOLOGY

INTRODUCTION

In the fall of 1973, the actions of the Organization of Oil-Exporting Countries (OPEC) resulted in the era of inexpensive motor fuel in the United States coming to an end. Households made certain adjustments to the short-term fuel shortages and to the long-term fuel price increases that developed as a consequence of OPEC's actions. Specific aggregate statistics concerning car sales by vehicle type, traffic counts, toll revenues, gasoline tax revenues, and public transportation ridership give some indication of the total response to the combination of restricted availability and higher prices of fuel.¹ Yet, significantly little attention has been devoted to determining at the household level the consequences of these factors on travel behavior. Such information would enable planners to draw general conclusions concerning the probable effects of certain locational, economic, and demographic variables on household adjustment strategies to higher fuel prices and/or restricted availability of fuel. Such information would assist in the effort by planners to develop land use and transportation plans to cope with the alternative futures of higher fuel prices and/or restricted fuel availability.

This study concentrated upon the past and prospective travel behavior of individuals in southeastern Wisconsin in an effort to provide information on these important questions.² The first section of this chapter places the energy crisis in an overall perspective. Section two discusses previous studies dealing with the influence of the energy crisis upon travel behavior. The research objectives are outlined in section three. In sections four and five, the research hypotheses and methodology, respectively, are presented.

THE INITIATION OF A STRESSFUL SITUATION THROUGH LIMITATIONS ON THE FUEL SUPPLY AND INCREASES IN FUEL PRICES

During the post-World War II era, American cities physically expanded as the total population increased, and individual households began to locate in single family homes in suburban areas. The relatively inexpensive price of automobiles and fuel in the United States in the post-World War II decades encouraged this residential dispersion. The speed, comfort, convenience, and economy of the automobile enabled families to locate at greater distances from employment locations.³ Concurrently, federal, state, county, and local governments made massive financial commitments for the construction and maintenance of high speed, all-weather highway facilities. The post-World War II era has witnessed the near completion of a 42,500 mile system of interstate highways as well as thousands of miles of urban expressways and suburban roads. The much-improved highway network allowed trucking firms to become major transporters of manufactured

¹ See, for example, John F. Sacco, "Impact of the Energy Shortage on Travel Patterns and Attitudes, Transportation Research Record 561, Transportation Research Board, National Research Council, Washington, D. C., 1976, pp. 1-11.

² The information provided in this report is abstracted from the following source: Thomas M. Corsi, *A View of Real and Potential Energy Shortages: An Analysis of Household Decision-Making Under Stress and Uncertainty*, Ph.D. Dissertation, Department of Geography, University of Wisconsin-Milwaukee, August 1976.

³ The influence of the automobile upon the structure of American cities is a well documented phenomenon. See, for example, Louis K. Loewenstein, *The Location of Residences and Work Places in Urban Areas*, 1965; J. R. Meyer, et al, *The Urban Transportation Problem*, 1965; and Edward J. Taaffe, et al, *The Peripheral Journey to Work: A Geographic Consideration*, 1963.

goods. In turn, because of the presence of adequate highways in outlying areas, large factories located on the urban periphery in order to take advantage of lower land costs and larger available tracts to land.⁴

The net result of these interacting factors is what is commonly referred to as "urban sprawl." In many American cities, location is not dependent upon distance from major activities, but merely upon total commuting time from place to place by automobile. Individuals, as a result of their decision to locate on the urban periphery, must utilize their automobiles for long-distance commuting to work, to major shopping nodes, and to various recreation sites.

The use of the automobile in urban travel has become an increasingly more important consumer of energy due both to its increasing numbers and to its decreasing efficiency in average miles traveled per gallon of fuel consumed. Estimates indicate that urban automobile travel consumes approximately 40 percent of the total energy used in the transportation sector. This figure equals about 10 percent of the nation's energy consumption and 25 percent of the nation's use of petroleum.⁵

The urban systems of the United States, overwhelmingly tied to mass automotive transportation, were upset by a series of conditions beginning in the fall of 1973 when the Arab nations imposed an embargo on crude oil to America because of its role in the Arab-Israeli conflict. In addition, the Organization of Oil-Exporting Countries (OPEC) imposed substantial increases in the price of crude oil in 1973. Although the embargo was subsequently lifted, the higher prices of oil and consequently of motor fuel remained.

Individual households until late 1973 had made decisions dealing with their choice of residence, their travel patterns, and their household expenditures based upon the ready availability and cheap price of fuel. In late 1973 they were faced with a new stressful situation as a result of the embargo and the higher cost of fuel. Each household had to develop a certain trade off, or coping, strategy in order to deal with the situation. This study examines in detail the type of coping strategies adopted by households in south-eastern Wisconsin for certain actual and potential situations marked by higher fuel prices and restricted availability of fuel.

PREVIOUS RESEARCH FINDINGS

While the impact of the energy crisis upon household travel patterns has been a subject of intense interest and debate over the past few years, there have been relatively few empirical studies of the problem at the household level. Many of the contentions concerning past and prospective travel adjustments by households are based upon aggregate statistics, such as traffic counts, rather than upon information obtained directly from households. A typical example can be found in a report prepared for the Federal Office of Technology Assessment at the request of the U. S. Senate Committee on Appropriations, Transportation Subcommittee. The report makes the following statement based upon aggregate data:

It appears that during the embargo, most people continued to use the automobile for work trips and basic shopping trips and totally eliminated more discretionary trips rather than seeking to maintain previous mobility levels by carpooling or substituting transit trips for auto trips. [One of the few areas that good data on the trip making impacts of the fuel crisis exists [is] in the

⁴ *The importance of highways in the selection of industrial locations has been documented in a number of studies. See, for example, Julia A. Connally and Charles O. Meiburg, "The Washington Capital Beltway and Its Impact on Industrial and Multi-Family Expansion in Virginia," Highway Research Board Record 217 (1968), pp. 9-27; Edward V. Kiley, "Highways as a Factor in Industrial Location," Highway Research Board Record 75 (1964), pp. 48-52; and Carl F. Ojala and Paul F. Rizza, "Route 128: A Study of Industry Location Factors," Atlanta Economic Review 20 (October 1970), pp. 36-39.*

⁵ *Gorman, Gilbert, "Energy, Urban Form and Transportation Policy," Transportation Research 8 (1974), p. 269.*

Dutch Fork area in South Carolina.] In this area, weekday traffic declined by less than 15 percent while at the height of the crisis, weekend traffic was off more than 25 percent.⁶

Although such information is useful, it leaves many important questions unanswered. Aggregate statistics do not enable researchers to account for variations in the decision-making behavior of individuals through an analysis of locational, socio-economic, and demographic information. Only on the basis of more detailed information can conclusions be drawn about the influence of fuel shortages and higher fuel prices that are useful in land use and transportation planning.

In the summer of 1974, researchers at Northwestern University investigated the impact of higher fuel prices and restricted availability of fuel upon travel behavior by interviewing individual households in the northern suburbs of Chicago. The questionnaire obtained information on how higher fuel prices and/or restricted fuel availability could be expected to affect an individual's travel patterns with respect to work, shopping, and recreation trips. Data on mode choice and frequency to trips under various assumptions were obtained. The observed travel pattern variations were explained by reference to socio-economic and demographic data obtained from the survey. Some basic conclusions were:

The gasoline shortage of early 1974 did not have as severe an impact on the travel behavior of the northern suburbs of Chicago as was first thought. Since the availability of gasoline was not perceived as being very constrained and since the price increases appeared to have had little importance, few trips were eliminated. Automobile travel was reduced most by combining trips, particularly shopping trips. This was caused primarily by the inconvenience in purchasing gasoline. Apparently the demand for gasoline was price inelastic within the range of cost increases experienced . . . The rate or price increases may also affect travel behavior. A sudden 20 cent per gallon increase, perhaps in the form of a surcharge by the federal government, may have more of an impact than the steady one to five cent per month increases experienced during the eight months before the survey.⁷

In addition to the Northwestern University study that focused upon suburban residents in a major metropolitan area, Harvey and Ross examined the impact of restricted fuel availability on the travel patterns of residents in two medium-sized American cities: Akron, Ohio, and New Brunswick, New Jersey.⁸ The Harvey-Ross mail questionnaire of individual households, conducted during the spring of 1974, asked residents to report on changes in work, shopping, and recreation trips in view of either short-term or long-term restrictions in the supply of fuel.

The Harvey-Ross study conceptualized the higher prices and restricted availability of fuel as a stressful situation on individual households. In order to cope with existing or future stresses, households develop various strategies or adjustment processes. Harvey and Ross focused upon the journey to work and delineated distinct population subgroups on the basis of coping strategies adopted. Some households fall into a no-need-to-cope group which:

⁶ United States Congress, Office of Technology Assessment, *Energy, The Economy, and Mass Transit, Summary Report*, June 1975, p. 33.

⁷ Robert L. Peskin, Joseph L. Schofer, and Peter R. Stopher, Northwestern University, Evanston, Illinois, *The Immediate Impact of Gasoline Shortages on Urban Travel Behavior*, Prepared for the Federal Highway Administration, Washington, D. C., April 1975, p. 88.

⁸ Milton E. Harvey and William M. Ross, "The Spatial and Non-Spatial Implications of a Short and Long Term Gasoline Shortage," unpublished paper, Department of Geography, Kent State University, Kent, Ohio, 1976.

includes retired senior citizens who do not own cars; people not dependent on cars for work, shopping, or recreation; and very high-income households who, because of their wealth and associated peripheries, will not experience any significantly-related stress.⁹

Other households fall into groups that make only spatial adjustments (i.e., find another job or change residence) or groups that make only non-spatial adjustments (i.e., buy an economy car, enter a carpool, or use mass transit to work), or groups that make both spatial and non-spatial adjustments. The Harvey-Ross study contains a detailed analysis of the population on the basis of the above three groups. They found a willingness on the part of the sample population to make non-spatial adjustments in the journey to work, but a reluctance to make spatial adjustments in view of short- and long-term restrictions in fuel availability. Harvey and Ross suggest the need for additional studies in major metropolitan areas in order to develop a data base upon which "generalizations about the effect of the gasoline shortage or increased cost per gallon on the urban spatial and non-spatial adjustments of households can be made."¹⁰ This study of the household travel patterns in southeastern Wisconsin in view of the energy situation represents an effort to fill such a research gap.

RESEARCH OBJECTIVES

The study of the decision-making process of individual households in southeastern Wisconsin with respect to travel behavior in real and potential energy shortages had five major research objectives:

1. To determine what adjustments have in fact occurred in individual household travel behavior since the rapid increases in gasoline prices that began in late 1973.
2. To determine the ways in which individual households intend to adjust their travel behavior in response to further increases (20 cents per gallon) in gasoline prices.
3. To determine the ways in which individual households intend to adjust their travel behavior in response to potential restrictions (eight gallons per week per driver) in gasoline availability.
4. To determine the attitudes of individual households toward regional policies relating to existing and prospective transportation facilities.
5. To determine the implications of the study's findings upon transportation plans developed for southeastern Wisconsin prior to the energy crisis.

Under each objective, the study analyzed the response pattern for the entire sample of households in order to determine the dynamics of the urban system. In addition, a set of economic and geographic variables was utilized to account for variations in responses by individual households. Finally, the study determined whether an individual household's responses to one set of questions was a good predictor of its answers to the remaining sets of questions.

RESEARCH HYPOTHESES

To provide a framework for hypothesis testing and analysis, individual households in the study area were categorized on the basis of the coping strategy adopted for the various situations presented in the questionnaire (changes in travel behavior between 1973 and 1975, anticipated changes as a consequence of higher fuel prices, or restricted fuel availability). The Harvey-Ross formulation for coping strategies related to the journey to work was expanded to include shopping and recreation trips as well. Households in the Southeastern Wisconsin Region were categorized by whether or not they noted a preference for spatial or

⁹ *Ibid.*

¹⁰ *Ibid.*

non-spatial change (or a combination thereof) for each of the three trip categories. Specifically, the following items were classified as non-spatial changes in the journey to work: (1) a change in the mode of transportation for the journey to work; (2) the purchase of an additional smaller car; (3) the trading in of a larger car for a smaller car; or (4) the purchase of a motorcycle. A spatial change in the journey to work was indicated by a move in the place of residence closer to the place of employment. Although spatial journey to work changes could also be suggested by a change in job location, this option was not provided in the questionnaire due to the inability to differentiate among the multiplicity of reasons for a job change.

With respect to shopping behavior, the study equated the following actions with changes in non-spatial behavior: combining several shopping trips and combining shopping trips with other trips. Three items fit the category of spatial changes in shopping behavior: (1) a move in residential location closer to a major shopping area; (2) shopping at stores closer to home; and (3) making fewer shopping trips.

The report classified households which preferred public transportation or carpooling for long-distance vacations or for in-town social-recreation travel as making non-spatial changes in behavior. In contrast, the study considered actions either to cancel a vacation or to take a vacation of shorter distance as changes in spatial behavior.

Thus, each household was classified on the basis of whether it indicated a positive or negative response to the questions dealing with spatial and non-spatial changes in the journey to work, in shopping behavior, and in recreation travel. With six primary variables or factors, each with two response categories (yes and no), there were 64 possible response groups into which an individual household might be classified.

The Harvey-Ross formulation presents ways to simplify the overall response patterns of individual households. Table 1 shows a classification of households by the nature and number of coping strategies adopted to deal with the actual and potential situations presented to the household. Some households fall into a single coping group consisting of households which indicated a willingness to make only one change (either spatial or non-spatial) to the situations presented. Other households evidenced a willingness to make multiple adjustments to the situations. Some households may prefer multiple spatial changes while others may choose a combination of spatial and non-spatial changes. Certain households fall into a nondiscriminate group by denoting a willingness to make all possible modifications. Other households show an unwillingness to make any change and thus fall into a non-coping group, the characteristics of which were outlined by Harvey and Ross and cited above.

This delineation of household coping strategy in view of the stressful situation caused by real and potential energy shortages and higher fuel prices provides the basic framework for the analysis and explanation of observed variations in household response patterns. A central hypothesis of the study was that variations in household coping strategies were a function of the interaction among certain socio-economic, demographic, and geographic variables. The specific variables to be analyzed are: (a) income; (b) household size; (c) automobile ownership (size and number); (d) household employment characteristics; (e) distance to work; (f) house location; (g) age of household members; and (h) the educational level of the household head. The particular coping mechanism adopted by a household is a function of the complex interactions among these variables. The study made a major effort to determine both the independent influence of each of the variables as well as the influence of the interacting variable clusters.

RESEARCH METHODOLOGY

Two important aspects of research methodology need description: the study questionnaire and the analysis technique. This section addresses both of these issues in turn.

Study Questionnaire

With the consultation and assistance of the staff of the Southeastern Wisconsin Regional Planning Commission, a questionnaire was developed to determine how shortages and higher prices of gasoline have in the past influenced and may in the future influence the travel habits and patterns of households.

Table 1

**CLASSIFICATION OF HOUSEHOLDS BY NATURE
AND NUMBER OF COPING MECHANISMS**

A. Single Coping Group i. Non-Spatial Modification in Journey to Work (a) ii. Non-Spatial Modification in Shopping Patterns (b) iii. Non-Spatial Modification in Recreation Travel (c) iv. Spatial Modification in Journey to Work (d) v. Spatial Modification in Shopping Patterns (e) vi. Spatial Modification in Recreation Travel (f)
B. Double Coping Group i. Non-Spatial Modification (ac, bc, ab) ii. Spatial Modification (df, ef, de) iii. Spatial and Non-Spatial Modification (ad, ae, . . . cf)
C. Triple Coping Group i. Non-Spatial Modification (a, b, c) ii. Spatial Modification (e, e, f) iii. Spatial and Non-Spatial Modification (abe, . . . , bcf)
D. Quadruple Coping Group i. Spatial and Non-Spatial Modification (abcd, . . . , cdef)
E. Quintuple Coping Group i. Spatial and Non-Spatial Modification (abcde, . . . , bcdef)
F. Non-Discriminate Group i. All Copers
G. Non-Copers i. All Categories

Response to the Questionnaire

The questionnaire was mailed to a random sample of 9,881 residents in the Southeastern Wisconsin Region (which consists of the Counties of Washington, Ozaukee, Waukesha, Milwaukee, Walworth, Racine, and Kenosha) during November 1975. A letter signed by the Executive Director of the Southeastern Wisconsin Regional Planning Commission accompanied each questionnaire to explain the nature and purpose of the study. The questionnaires were mailed from the Urban Research Center at the University of Wisconsin—Milwaukee. The households in the survey were drawn from a reverse directory guide where applicable or from phone books in areas that had no available reverse directory. A total of 1,461 usable returns were received, representing a rate of return of 14.8 percent. The rate of return by county displayed the following variations: Kenosha (10.4 percent), Milwaukee (14.0 percent), Ozaukee (20.7 percent), Racine (13.8 percent), Walworth (10.2 percent), Washington (12.5 percent), and Waukesha (20.9 percent). Thus, the highest rate of return came from the predominantly suburban counties while the lowest rate of return came from the core areas of the major cities and from the predominantly rural areas. A discussion of the variations in return rates and the impact upon the analysis is documented in the following chapter.

Questionnaire Format: The study questionnaire had four sections, and is reprinted in Appendix A. In the first section the questions dealt with current travel and employment infor-

mation. This section outlined the manner in which current travel patterns had been influenced by the fuel price increases that had occurred between the fall of 1973 and 1975.

Section II of the questionnaire discussed each household's anticipated travel behavior changes to an additional 20 cent increase in the price of gasoline and a restriction in the amount of fuel available per driver per week (eight gallons).

Section III of the questionnaire focused upon the household's attitudes concerning transportation costs and policies. Specifically, a household's attitudes toward government policies to bring about greater fuel conservation, to complete the planned freeway system, and to support public transportation were obtained.

A final section of the questionnaire obtained certain socio-economic and demographic information. The survey asked the educational and income level of the household members as well as the age of and total number of household members.

Representativeness of Energy Use Survey: In 1972, SEWRPC conducted a comprehensive home interview survey as part of the continuing land use-transportation planning effort. The survey obtained detailed information on household travel patterns in the Region. The characteristics and accuracy levels of the 1972 SEWRPC home interview survey are well known, and therefore a comparison between the 1972 SEWRPC survey and the 1975 Energy Use Travel Survey provides a good indication of the representativeness of the respondents to the Energy Use survey. Specifically, the following population characteristics were available for comparison between the surveys: (1) occupation of household head; (2) age of household head; and (3) number of vehicles per household.

Table 2 provides the comparison between the Energy Use Travel survey and the 1972 SEWRPC survey on the basis of the occupation of the household head. From the regional totals, it is apparent that the Energy Use survey overrepresented individuals in professional occupations. In the 1972 survey, SEWRPC reported that 16.8 percent of the Region's household heads were employed in professional occupations. The corresponding figure in the Energy Use survey was 28.3 percent. Professionals were overrepresented in each individual county in the Region by percentages similar to the regional totals. The Energy Use survey also slightly overrepresented sales workers. For the entire Region, the SEWRPC survey found that 6.7 percent of the household heads were engaged in sales, while the corresponding figure in the Energy Use survey was 8.4 percent. In all but Kenosha and Walworth Counties sales workers were overrepresented in the Energy Use survey.

The Energy Use survey, in contrast, slightly underrepresented the following occupation groups: clerical workers, craftsmen, operatives, service workers, and laborers. The highest percentage difference between the 1975 Energy Use survey and the 1972 SEWRPC survey occurred for operatives. In the 1972 survey, in the entire Region, 16 percent of the household heads were employed as operatives while the corresponding figure in the 1975 survey was only 10 percent. The second highest difference occurred with respect to craftsmen. Here, the corresponding regional totals in 1972 and 1975 were 20 and 17 percent, respectively. In summary, the major contrast between the two surveys is that the Energy Use survey had a higher percentage of professionals and sales workers and a lower percentage of operatives and craftsmen. This overrepresentation of professional workers in the 1975 Energy Use survey would also be reflected in an overrepresentation of higher income households in the 1975 Energy Use survey as well.

Table 3 presents the comparison between the surveys on the basis of the age of the household head. One interesting finding is that the Energy Use survey underrepresented households whose heads were in the 65-and-above age bracket. Thus, in the 1972 SEWRPC survey, for the entire Region, 19.8 percent of the household heads were aged 65 and above. The corresponding figure in the 1975 Energy Use survey was only 8.8 percent. The 1975 Energy Use survey also underrepresented household heads in the 19-24 age bracket. The 1975 survey had only 5 percent of the households with heads in this age bracket, while the corresponding figure in the 1972 survey was 8 percent. In contrast, the 1975 Energy Use survey overrepresented households whose heads were in the 25-to-54 age bracket. Thus, households with middle-aged heads were overrepresented in the Energy Use survey while households with either very young or very old heads were underrepresented.

Table 4 compares the 1972 and 1975 surveys on the basis of the number of vehicles per household. For the entire Region, the 1972 SEWRPC survey found that 16.8 percent of the households had no vehicles, while only 5.6 percent had three or more vehicles. The corresponding figures for the 1975 Energy Use survey were 2.4 and 14.2 percent. Thus, the Energy Use survey overrepresented households with three or more vehicles and underrepresented households with no vehicles. The 1975 Energy Use survey also overrepresented households with two vehicles and underrepresented households with one vehicle. These basic patterns prevailed on a county as well as a regional basis.

In summary, the 1975 Energy Use survey overrepresented certain households. Primarily, the survey overrepresented workers engaged in professional occupations, households with middle-aged heads, and

Table 2

**OCCUPATION OF HOUSEHOLD HEAD AS COMPARED IN 1975 ENERGY USE
TRAVEL SURVEY AND IN SEWRPC 1972 ORIGIN-DESTINATION SURVEY**

Occupational Category	Percentage by County by Survey ^a							
	Ozaukee and Washington Counties		Milwaukee County		Waukesha County		Racine County	
	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey
Professional . .	26.14	17.79	28.05	16.84	29.57	19.77	27.97	14.54
Managers	29.55	22.22	16.50	16.90	22.61	24.79	22.03	17.44
Clerical	3.41	6.06	9.39	11.05	4.35	5.79	5.93	6.28
Sales	9.09	7.02	8.12	6.37	10.43	8.99	9.32	6.54
Craftsmen . . .	14.77	21.70	16.50	18.80	19.13	21.15	15.25	24.60
Operative	13.64	16.17	11.04	16.86	6.52	11.71	12.71	17.45
Service	2.27	4.92	6.35	8.60	3.04	4.44	4.24	6.72
Laborer	1.14	4.13	3.81	4.56	4.35	3.37	2.54	6.42

Occupational Category	Percentage by County by Survey ^a					
	Kenosha County		Walworth County		Regional Total	
	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey
Professional	25.93	14.10	37.93	14.99	28.31	16.84
Managers	12.96	17.81	20.69	25.99	18.90	18.78
Clerical	7.41	7.27	3.45	7.27	7.57	9.14
Sales	3.70	3.82	3.45	6.98	8.42	6.65
Craftsmen	27.78	21.19	10.34	18.00	17.06	20.01
Operative	9.26	18.02	6.90	14.56	10.41	16.16
Service	3.70	8.95	13.79	7.10	5.36	7.56
Laborer	9.26	8.84	3.45	5.09	3.83	4.85

^a The percentages in this table are based only upon the specific occupational categories listed. Thus, certain occupational categories (farmers, private household workers) are excluded from this table.

households that owned two or more vehicles. It is understandable that these specific household types were overrepresented on a special-interest questionnaire dealing with gasoline prices and availability. The overrepresented household types generally have extensive, diversified travel patterns that would be most seriously influenced by changes in gasoline price and/or availability. Households that were underrepresented (households with young or old heads and households with no vehicles) generally have less extensive and diversified travel patterns and, hence, less to lose from changes in gasoline price and availability. Thus, the 1975 Energy Use questionnaire appealed to precisely those households whose travel potentially would be most seriously affected by changes in price and availability of gasoline. The survey attempted to focus upon the decision-making strategy of such households. Nevertheless, figures throughout the text that reflect regional totals must be interpreted with the understanding that the above-mentioned groups are overrepresented.

Table 3

**AGE OF HOUSEHOLD HEAD AS COMPARED IN 1975 ENERGY USE
TRAVEL SURVEY AND IN SEWRPC 1972 ORIGIN-DESTINATION SURVEY**

Age Grouping	Percentage by County by Survey							
	Ozaukee and Washington Counties		Milwaukee County		Waukesha County		Racine County	
	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey
19-24	3.26	6.02	6.88	8.61	1.63	4.74	1.52	7.42
25-29	22.82	9.83	16.40	10.64	8.98	8.21	12.88	10.42
30-34	11.96	10.50	13.76	8.52	14.29	10.66	15.15	10.59
35-44	31.52	22.36	17.43	17.23	27.76	24.56	17.42	17.71
45-54	11.96	18.92	20.30	18.00	26.53	22.77	21.21	19.23
55-64	13.04	15.80	15.48	16.12	15.51	14.68	19.70	15.45
65 and Over	5.43	16.56	9.75	20.89	5.31	14.38	12.12	19.18

Age Grouping	Percentage by County by Survey					
	Kenosha County		Walworth County		Regional Totals	
	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey	1975 Energy Use Survey	1972 SEWRPC Survey
19-24	4.76	7.41	0.00	13.77	5.01	8.01
25-29	6.35	10.97	18.75	5.19	14.83	10.07
30-34	15.87	9.37	6.25	5.65	13.79	9.04
35-44	26.98	18.32	25.00	16.92	20.68	18.53
45-54	20.63	18.03	25.00	16.92	21.03	18.69
55-64	20.63	15.39	12.50	17.65	15.88	15.88
65 and Over	4.76	20.51	12.50	23.99	8.77	19.79

Analysis Technique

Since the variables collected in the questionnaire were predominately categorical or qualitative, standard multiple regression techniques were inapplicable. Goodman in a series of recent articles has suggested specific procedures for the analysis of multidimensional contingency tables with qualitative variables.¹¹ While

¹¹ For example: "The Analysis of Cross-Classified Data: Independence, Quasi-Independence, and Interactions in Contingency Tables," *Journal of the American Statistical Association*, 63 (December 1968), p. 1091; "The Analysis of Multidimensional Contingency Tables: Stepwise Procedures and Direct Estimation Methods for Building Models for Multiple Classifications," *Technometrics* 13 (February 1971), p. 33; "A General Model for the Analysis of Surveys," *American Journal of Sociology* 77 (1972), p. 1035; "How to Ransack Social Mobility Tables and Other Kinds of Cross-Classification Tables," *American Journal of Sociology* 75 (1969), p. 1; "A Modified Multiple Regression Approach to the Analysis of Dichotomous Variables," *American Sociological Review* 37 (February 1972), p. 28; and "The Multivariate Analysis of Qualitative Data: Interactions Among Multiple Classifications," *Journal of the American Statistical Association* 65 (March 1970), p. 226.

Table 4

**NUMBER OF VEHICLES PER HOUSEHOLD AS COMPARED IN 1975 ENERGY USE
TRAVEL SURVEY AND IN SEWRPC 1972 ORIGIN-DESTINATION SURVEY**

By County By Survey	Percentage of Households with 0 Vehicles	Percentage of Households with 1 Vehicle	Percentage of Households with 2 Vehicles	Percentage of Households with 3 or more Vehicles
Ozaukee and Washington Energy Use 1972 SEWRPC	0.0 6.2	21.7 45.7	63.0 38.3	15.2 9.8
Milwaukee Energy Use 1972 SEWRPC	3.1 21.4	44.9 51.1	40.6 23.6	11.5 3.9
Waukesha Energy Use 1972 SEWRPC	0.8 5.5	19.5 38.5	58.9 45.9	20.7 10.1
Racine Energy Use 1972 SEWRPC	3.0 13.0	31.1 50.5	47.7 29.9	18.2 6.7
Kenosha Energy Use 1972 SEWRPC	0.0 14.1	44.4 50.1	38.1 30.3	17.5 5.5
Walworth Energy Use 1972 SEWRPC	3.1 11.4	28.1 52.6	56.3 28.1	12.5 7.9
Regional Total Energy use 1972 SEWRPC	2.4 16.8	37.4 49.2	46.0 28.4	14.2 5.6

the classical chi-square analysis of a two-way contingency table provides information concerning the independence of two variables, it does not estimate the effects of the variables upon each other. The Goodman analysis techniques for multidimensional contingency tables, however, do provide for the measurement of the independent effect of all variables under investigation as well as of all possible interaction terms.

By utilizing the Goodman techniques, the researcher is not limited to the investigation of variable pairs, but is able to determine the interaction effects of three, four, or five independent variables upon a dependent variable under investigation. In a Goodman model to explain variations in a particular dependent variable, the researcher is able to determine the statistical significance of the individual main effect for each independent variable in the model as well as of all possible interaction terms. Thus, in general, the Goodman techniques are patterned after the more familiar analysis of variance techniques.

In short, the Goodman techniques enable the researcher to provide a detailed, comprehensive analysis of categorical or qualitative information. In the past, many studies have not subjected such data to multivariate analysis due to the inapplicability of standard multiple regression techniques. The Goodman techniques, however, supply the researcher with an excellent opportunity to remedy this shortcoming.

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Chapter II

MAJOR RESEARCH FINDINGS

INTRODUCTION

This chapter presents the study's main research findings. An analysis is provided of both the patterns of coping mechanisms selected between 1973 and 1975 and intended changes preferred under the alternative futures and their relationship to socio-economic, demographic, and geographic variables. In addition, the public policy preferences of individual households and their relationship to socio-economic, demographic, and geographic variables are discussed.

COPING MECHANISMS SELECTED BETWEEN 1973 AND 1975 AND INTENDED CHANGES PREFERRED UNDER THE ALTERNATIVE FUTURES

This section presents the major research findings with respect to changes in travel behavior made between 1973 and 1975 and intended changes preferred under the alternative futures.

Changes Adopted Between 1973 and 1975

This study documented the following major occurrences with respect to changes in travel behavior between 1973 and 1975:

1. Over 75 percent of the respondent households made multiple adjustments in travel behavior in response to the higher fuel prices that occurred between 1973 and 1975 (see Tables 5 and 6). The most common coping strategy involved some combination of spatial and non-spatial change in travel behavior. In all, six travel categories were analyzed. The categories consisted of spatial and non-spatial changes in shopping and recreation travel and the journey to work.¹² The effectiveness of the strategies chosen by households varied widely. Thus, the entire set of coping mechanisms selected by an individual household may not have reduced its total fuel consumption very much. The households may have failed to choose the one significant coping mechanism that would have made an important reduction in fuel consumption. Thus, quantity of coping mechanisms adopted does not necessarily give an indication of the effectiveness of a particular adjustment strategy.
2. Households preferred an adjustment strategy of careful retreat. They made changes that caused the least disruption to their pre-crisis travel patterns and put off hard decisions that would involve major changes. Thus, approximately 70 percent of the respondent households made one or more of the following changes in shopping behavior: (1) combined several shopping trips; (2) combined shopping trips with other trips; (3) went on fewer shopping trips; or (4) shopped at stores closer to home. (Collectively, changes one and two constitute non-spatial shopping changes, while changes three and four constitute spatial shopping changes.) Such alternatives were not generally difficult for households to make (see Table 7).
3. In response to the 1973-1975 situation, approximately 50 percent of the households made one or more of the following adjustments: (1) purchased an additional car that was smaller than cars already owned; (2) traded in a larger car for a smaller car; (3) sold one car and did not replace it; (4) postponed purchase of a second car; (5) purchased a motorcycle; or (6) shifted modes for the journey to work. (Collectively, these six actions constitute non-spatial journey to work changes.)

¹² A spatial change in travel behavior involved one of the following actions by a household: (1) a reduction in the length of a trip made; or (2) a reduction in the frequency or an elimination of a particular trip. A non-spatial change in travel behavior involved one of the following actions by a household: (1) a substitution of mode (e.g., car to bus) or vehicle type (e.g., large car to small car) for a particular trip; or (2) a combination of trip purposes on a particular trip.

Table 5

**DISTRIBUTION OF SAMPLE HOUSEHOLDS BY NATURE AND NUMBER OF COPING MECHANISMS SELECTED
BETWEEN 1973 AND 1975 AND INTENDED CHANGES PREFERRED UNDER THE ALTERNATIVE FUTURES**

Response Groups ^a	Change Action						Percentage Distribution Southeastern Wisconsin Region		
	Non-Spatial Shopping Change	Non-Spatial Journey to Work Change	Non-Spatial Recreation Change	Spatial Journey to Work Change	Spatial Shopping Change	Spatial Recreation Change	1973-1975	Higher Prices	Restricted Fuel Availability
1	NO	NO	NO	NO	NO	NO	9.172	4.928	2.738
2	YES	NO	NO	NO	NO	NO	3.286	1.848	0.890
3	NO	YES	NO	NO	NO	NO	3.012	1.369	1.711
4	YES	YES	NO	NO	NO	NO	2.533	0.890	0.753
5	NO	NO	YES	NO	NO	NO	1.437	0.958	--
6	YES	NO	YES	NO	NO	NO	1.369	0.890	0.890
7	NO	YES	YES	NO	NO	NO	0.684	0.890	0.753
8	YES	YES	YES	NO	NO	NO	1.095	1.437	1.300
9	NO	NO	NO	NO	YES	NO	2.190	1.095	0.684
10	YES	NO	NO	NO	YES	NO	8.556	3.560	2.122
11	NO	YES	NO	NO	YES	NO	1.848	1.369	1.164
12	YES	YES	NO	NO	YES	NO	7.529	4.312	2.533
13	NO	NO	YES	NO	YES	NO	1.437	1.164	0.890
14	YES	NO	YES	NO	YES	NO	4.928	2.738	2.190
15	NO	YES	YES	NO	YES	NO	1.232	1.848	1.848
16	YES	YES	YES	NO	YES	NO	5.955	7.187	9.582
17	YES	YES	NO	YES	YES	NO	0.753	--	--
18	YES	NO	NO	NO	NO	YES	1.369	0.890	--
19	YES	YES	NO	NO	NO	YES	1.437	1.574	1.027
20	YES	YES	YES	NO	NO	YES	--	1.027	0.753
21	NO	NO	NO	NO	NO	YES	0.890	--	--
22	NO	NO	NO	NO	YES	YES	1.437	0.753	--
23	NO	YES	NO	NO	NO	YES	0.958	--	--
24	YES	NO	NO	NO	YES	YES	7.734	4.244	2.396
25	NO	YES	NO	NO	YES	YES	1.780	2.053	1.437
26	YES	YES	NO	NO	YES	YES	10.268	8.419	7.118
27	YES	NO	YES	NO	YES	YES	3.901	5.544	3.833
28	NO	YES	YES	NO	YES	YES	--	1.437	1.027
29	YES	YES	YES	NO	YES	YES	6.434	29.911	38.809
30	YES	YES	NO	YES	YES	YES	1.095	0.753	1.232
31	YES	YES	YES	YES	YES	YES	0.753	2.190	6.776
32	YES	YES	YES	YES	YES	NO	--	--	0.890
Subtotal							95.072	95.278	95.346
Percentage in response groups with less than 10 observations							4.928	4.722	4.654
Total							100.000	100.000	100.000

^a Response groups with less than 10 observations are not included in the table.

In approximately 20 percent of the households at least one wage earner made a shift in the mode used for the journey to work.

- Over 40 percent of the households made changes in recreation travel in response to the 1973-1975 situation. Cancelling plans for a long-distance vacation and taking vacations of shorter distances were more frequent adjustments than was the use of public transportation for vacations since the latter adjustment involved a higher out-of-pocket cost especially for households with children.

Table 6

**CLASSIFICATION OF HOUSEHOLDS BY NATURE AND NUMBER OF COPING MECHANISMS SELECTED
BETWEEN 1973 AND 1975 AND INTENDED CHANGES PREFERRED UNDER THE ALTERNATIVE FUTURES**

Coping Group	Percentage Distribution Southeastern Wisconsin Region		
	1973-1975	Higher Prices	Restricted Fuel Availability
A. Single Coping Group			
i. Non-Spatial Modification in Journey to Work (a)	3.012	1.369	1.711
ii. Non-Spatial Modification in Shopping Patterns (b)	3.286	1.848	0.890
iii. Non-Spatial Modification in Recreation Travel (c)	1.437	0.958	--
iv. Spatial Modification in Journey to Work (d)	--	--	--
v. Spatial Modification in Shopping Patterns (e)	2.190	1.095	0.684
vi. Spatial Modification in Recreation Travel (f)	0.890	--	--
Total	10.815	5.270	3.285
B. Double Coping Group			
i. Non-Spatial Modification (ac, bc, ab)	4.586	2.670	2.396
ii. Spatial Modification (df, ef, de)	1.437	0.753	--
iii. Spatial and Non-Spatial Modification (ad, ae cf)	14.168	6.983	4.176
Total	20.191	10.406	6.572
C. Triple Coping Group			
i. Non-Spatial Modification (abc)	1.095	1.437	1.300
ii. Spatial Modification (def)	--	--	--
iii. Spatial and Non-Spatial Modification (abe bcf)	24.640	16.769	11.431
Total	25.735	18.206	12.731
D. Quadruple Coping Group			
i. Spatial and Non-Spatial Modification (abcd, , cdef) . .	20.877	23.614	22.313
Total	20.877	23.614	22.313
E. Quintuple Coping Group			
i. Spatial and Non-Spatial Modification (abcde bcdef) .	7.529	30.664	40.931
Total	7.529	30.664	40.931
F. Non-Discriminate Group			
i. All Copers	0.753	2.190	6.776
Total	0.753	2.190	6.776
G. Non-Copers			
i. All Categories	9.172	4.928	2.738
Total	9.172	4.928	2.738
Subtotal	95.072	95.278	95.346
Percentage in response groups with less than 10 observations	4.928	4.772	4.654
Total	100.000	100.000	100.000

Table 7

**HOUSEHOLD RESPONSE TO SPECIFIC COPING ACTIONS BETWEEN 1973
AND 1975 AND INTENDED CHANGES PREFERRED UNDER THE ALTERNATIVE FUTURES**

Spatial and Non-Spatial Modifications	1973-1975			Higher Prices			Restricted Fuel Availability		
	Percentage Yes	Percentage No	Percentage No Response	Percentage Yes	Percentage No	Percentage No Response	Percentage Yes	Percentage No	Percentage No Response
A. Non-Spatial Modification in Journey to Work									
i. Purchase an additional car that is smaller than cars presently owned . . .	14.10	67.69	18.21	16.22	62.63	21.15	21.01	59.34	19.65
ii. Trade in a larger car for a smaller car	17.11	65.98	16.91	39.43	43.25	17.32	48.53	35.52	15.95
iii. Sell one car and not replace it	5.40	75.70	18.89	17.86	58.18	23.96	27.17	50.79	22.04
iv. Postpone purchase of a second car . . .	16.08	64.20	19.71	31.69	42.57	25.74	40.18	35.46	24.36
v. Purchase a motorcycle	5.47	74.67	19.84	9.17	67.28	23.55	12.80	65.43	21.77
vi. Shift in mode for journey to work (wage earner No. 1, No. 2, or No. 3)	19.92	73.30	6.78	--	--	--	--	--	--
B. Non-Spatial Modification in Shopping Patterns									
i. Combine several shopping trips	62.63	20.12	17.25	72.48	9.79	17.73	78.44	5.61	15.95
ii. Combine shopping trips with other trips	59.34	24.09	16.57	70.77	13.83	15.40	79.74	6.84	13.42
C. Non-Spatial Modification in Recreation Travel									
i. Use bus, train, or plane for long-distance vacation	21.90	56.54	21.56	44.49	34.63	20.88	57.91	24.09	18.00
ii. Use carpool for in-town social recreation travel	13.55	60.71	25.74	30.60	45.24	24.16	41.62	35.93	22.45
iii. Use bus for in-town social recreation travel	3.22	71.04	25.74	11.29	62.90	25.81	21.83	54.89	23.28
D. Spatial Modification in Journey to Work									
i. Move closer to place of employment	5.40	74.88	19.72	5.41	70.77	23.82	10.75	68.04	21.21
E. Spatial Modification in Shopping Patterns									
i. Move closer to major shopping area . . .	3.29	76.86	19.85	3.90	72.55	23.55	8.35	70.43	21.22
ii. Go on fewer shopping trips	59.48	26.56	13.96	73.58	12.11	14.31	80.70	6.02	13.28
iii. Shop at stores closer to home	48.39	33.27	18.34	60.51	21.36	18.13	70.57	14.37	15.06
F. Spatial Modification in Recreation Patterns									
i. Cancelled plans for a long-distance vacation	26.49	52.09	21.42	45.24	32.99	21.77	56.06	24.78	19.16
ii. Took a vacation of shorter distance . .	32.92	45.81	21.22	54.28	25.12	20.60	57.90	21.97	20.13

Summary	1973-1975 Percentage of Sample Making: at Least One Change for a Given Category	Higher Prices Percentage of Sample Making: at Least One Change for a Given Category	Restricted Fuel Availability Percentage of Sample Making: at Least One Change for a Given Category
A. Non-Spatial Modification in Journey to Work.	49.56	68.65	80.29
B. Non-Spatial Modification in Shopping Patterns	71.87	79.81	85.01
C. Non-Spatial Modification in Recreation Travel	32.58	60.03	72.01
D. Spatial Modification in Journey to Work.	5.40	5.41	10.75
E. Spatial Modification in Shopping Patterns	71.04	81.04	86.72
F. Spatial Modification in Recreation Patterns	41.34	62.22	67.76

5. The 1973-1975 situation did not bring about any significant amount of residential relocation to alleviate stress. Only 5 percent of the households moved closer to their place of employment in response to the higher fuel prices between 1973 and 1975.
6. Finally, 9 percent of the respondent households made no change in travel at all between 1973 and 1975. These households constitute the group of households which felt no need to select an adjustment strategy in response to the 1973-1975 situation of higher fuel prices.

Changes Adopted Under the Alternative Futures

This study documented the following major occurrences with respect to changes in travel behavior under the following alternative futures: (1) an increase in the price of gasoline by 20 cents per gallon, but no limit placed on gasoline availability, and (2) a restriction in the amount of gasoline per driver to eight gallons per week, although the price of gasoline would remain at current levels. These restrictions were assumed to last for at least five years.

1. Households were much more likely to adopt multiple adjustment strategies (usually five) for energy conservation under the alternative futures of higher prices and restricted fuel availability than under the 1973 to 1975 situation (see Tables 5 through 7). Approximately 7.5 percent of the households made adjustments in five travel categories between 1973 and 1975. The corresponding figure under the alternative of higher prices was 30 percent while the figure under restricted fuel availability was 40 percent. Household willingness to experiment with change in almost all travel categories (spatial and non-spatial changes in work, shopping, and recreation travel) increases under the alternative future situations. However, as between 1973 and 1975, adjustment strategies under the alternative futures vary widely in their effectiveness. Although many households would make changes in five of six travel categories under the alternative futures, these changes might not reduce their total fuel consumption very much.
2. Although the frequency of modifications under the situations of higher fuel prices and restricted fuel availability is substantially greater than in response to the 1973 to 1975 situation, the basic coping pattern is similar. Under the alternative futures, households continued to prefer an adjustment strategy of careful retreat. They favor changes that might cause little disruption to current travel patterns and avoid changes that would involve serious disruptions.
3. Spatial and non-spatial changes in shopping behavior would be adopted by more than three-fourths of the respondents under the alternative futures of higher prices and restricted fuel availability.
4. Approximately 68 percent of the respondents said they would make one of the following adjustments under a situation of additional gasoline price increases, and 80 percent also said they would make one of the same changes under a situation of restricted fuel availability: (1) purchase an additional smaller car; (2) trade in a larger car for a smaller car; (3) sell one car and not replace it; (4) postpone purchase of a second car; (5) purchase a motorcycle; or (6) shift the mode for the journey to work.
5. According to the respondents, the increase in the price of gasoline by an additional 20 cents per gallon would have a substantially less severe mode shift impact on the journey to work than would the initiation of gasoline rationing (see Table 8). Respondent households were more willing to utilize carpools and public transportation for the journey to work under conditions of restricted fuel availability. Under gasoline rationing, the percentage of respondent workers who are auto drivers would decline from its present (November 1975) level of 68.6 to a level of 45.7, a 33 percent decline.¹³ Under gasoline rationing, the percentage of respondent workers who are carpoolers

¹³ The percentage of auto driver work trips represented in the 1975 Energy Use Travel survey is higher than the corresponding figure in the 1972 SEWRPC home interview survey—68.6 percent compared with 65.1 percent, respectively—because the 1975 Energy Use survey overrepresented households with extensive and diversified travel patterns, primarily households headed by occupationally mobile persons or households with two or more vehicles.

Table 8

MODE OF TRANSPORTATION FOR JOURNEY TO WORK—ALL WAGE EARNERS

Mode of Transportation Utilized	Percentage of Sample November 1975	Percentage of Sample Under Higher Prices	Percentage of Sample Under Restricted Fuel Availability
Auto driver	68.6	63.4	45.7
Passenger in family car	9.5	3.3	3.6
Auto part-way; bus part-way	2.5	2.1	2.8
Carpool	7.2	13.2	17.7
Bus	5.0	6.1	10.1
Motorcycle	0.2	0.9	2.6
Bicycle	0.5	1.5	2.5
Walk	5.7	7.2	8.4
Other	0.7	2.2	6.7

would increase from its present (November 1975) level of 7.2 percent to a level of 17.7 percent, while the corresponding figures for bus riders are 5.0 and 10.0 percent.

6. Even under the alternative futures, sample households were very reluctant to move their residence to a place closer to their job. Under the alternative of higher fuel prices, only 5.4 percent of the households were willing to do so, while the corresponding figure under the restricted fuel availability alternative was 10.8 percent.
7. Under the alternative futures, there was a substantial decline in the "no-need-to-cope" group in comparison with the 1973-1975 situation. The percentage of households classified as non-copers was 9.2 percent between 1973 and 1975, 4.9 percent under the alternative future of higher prices, and only 2.7 percent under the alternative of restricted fuel availability.

RELATIONSHIP BETWEEN SOCIO-ECONOMIC, DEMOGRAPHIC, AND GEOGRAPHIC VARIABLES AND COPING MECHANISMS ADOPTED

This section lists the significant research findings concerning the impact of socio-economic, demographic, and geographic variables upon variations in the response of households to individual coping mechanisms adopted under the three situations investigated.

Relationships Between Independent Variables and Coping Mechanisms Adopted Between 1973 and 1975
The following significant relationships between independent variables and coping mechanisms adopted were uncovered:

1. Households with younger heads were more likely than households with older heads to make non-spatial journey to work changes, spatial shopping changes and to move residences to places closer to employment. It may be argued that households with younger heads are more flexible in their travel patterns and less likely to be tied to a particular residential location. As a result, they are more likely to change journey to work patterns (purchasing a motorcycle, riding a bicycle, carpooling, or taking a bus) than households with older heads who have more rigid travel patterns. Furthermore, households with younger heads are more likely than home owners to change residential location in response to higher fuel prices.

2. Non-spatial shopping changes, spatial recreation changes, carpooling, the purchase of a new small car, and the trading in of a larger car for a smaller car were adopted by middle-income households at higher percentage rates than by either low- or high-income households. It is suggested that change rates are lower for the low-income households primarily because their travel patterns are less diverse and, hence, less subject to modification due to increases in fuel prices than are travel patterns among middle-income households. Change rates among high-income households (above \$25,000) are lower precisely because higher incomes make it possible for these households to afford the higher gasoline price.
3. Individuals with certain occupations had a tendency to respond in a similar fashion to the higher fuel prices that occurred between 1973 and 1975. The following specific examples were observed:
 - a. Sales workers were more likely to make a non-spatial recreation change (involving the use of public transportation for recreation) than were craftsmen, foremen, and operatives. Non-spatial recreation changes are generally less likely for a blue collar home owner with a large family than for a high-income sales worker who can afford the expense of a vacation on public transportation.
 - b. The clerical workers were the most likely group to move their residences closer to places of employment between 1973 and 1975. Many clerical household heads are home renters and, hence, better able to relocate in view of higher fuel prices than are professionals or managers who are likely to be home owners.
 - c. Professionals, managers, and blue collar workers who are most likely either to work in a central location or to work in establishments that have a large number of employees have the highest carpooling rates.
 - d. The highest percentage of households purchasing a smaller car between 1973 and 1975 occurred among sales persons. This indicated a greater tendency for sales persons, totally dependent upon the automobile, to attempt to maintain pre-energy crisis travel patterns by purchasing a more fuel-efficient auto.
4. Households with either one or two children had higher change rates with respect to non-spatial and spatial shopping changes than did households with either three or more or no children. It can be argued that households with more than three children (aged 15 and under) have more difficulty adjusting shopping patterns than do households with one or two children. Households with no children, in many instances, have two wage earners. As a result, adjustments in shopping patterns become more difficult than in situations in which one of the partners does not work.
5. The geographic location of the respondent influenced carpooling and spatial journey to work changes between 1973 and 1975. The highest carpooling rates occurred among respondents from Waukesha County, followed by respondents from the suburban and ex-urban Counties of Walworth, Ozaukee, and Washington. Individuals in these locations are more likely to have long commuting distances and hence are more likely to carpool. Households located in counties in which the Region's major metropolitan centers are situated had a slightly higher rate of spatial journey to work change than did households living in the ex-urban counties or in Waukesha County. It may be argued that since home ownership rates are lower in Milwaukee, Racine, and Kenosha Counties, the likelihood of respondents in these counties making a change in residential locations is greater than for households in counties with very high home ownership rates.

Relationships Between Independent Variables and Coping Mechanisms Preferred Under the Alternative Futures

There are many parallels in the manner in which socio-economic, demographic, and geographic variables affect changes in travel behavior under the alternative futures and the manner in which they affect travel behavior change between 1973 and 1975. The following significant relationships between independent variables and coping mechanisms adopted were uncovered:

1. In response to the 1973-1975 situation, households with younger heads were more likely than households with older heads to make non-spatial journey to work changes, spatial journey to work changes, and spatial shopping changes. Under the alternative futures, the greater tendency for households with younger heads to indicate a change intention than households with older heads is also noted. Specifically, under the alternative of restricted fuel availability, non-spatial change in recreation travel and spatial change in the journey to work and in shopping behavior are significantly greater among households with younger heads than among households with older heads. Under the alternative of higher fuel prices, the same relationship is noted with respect to spatial change in shopping behavior.
2. Many coping mechanisms were more likely to be adopted by middle-income households than by either high- or low-income households between 1973 and 1975. This same finding applied under the alternative of higher fuel prices with respect to non-spatial changes in the journey to work and shopping and recreation travel. However, under the alternative of restricted fuel availability with respect to non-spatial changes in the journey to work and spatial and non-spatial changes in shopping travel, high-income households had higher rates of change than did low- or middle-income households. Thus, a restriction in fuel availability represents a more direct way than raising fuel prices to influence the travel patterns of high-income households. Consequently, higher fuel prices alone will not lead to major travel pattern changes especially for high-income groups.
3. In response to the 1973 to 1975 situation, it was noted that some occupational groups were more likely to make certain types of changes in travel behavior than other groups were. Thus, under the situation of restricted fuel availability, the sales workers were more likely to make non-spatial recreation changes than were craftsmen and operatives. Furthermore, under a situation of restricted fuel availability, non-spatial journey to work changes and spatial journey to work changes were significantly more likely for clerical and kindred workers than for professional and managerial groups.
4. Households with either one or two children had higher change rates with respect to non-spatial and spatial shopping changes under both alternative futures than did households with either three or more or no children.
5. The basic explanatory patterns emerging from an analysis of intended behavior under the alternative futures are similar to the patterns that emerged from an analysis of behavior change between 1973 and 1975. In all cases, behavior change between 1973 and 1975 contributed significantly to an explanation of behavioral change intentions under the alternative futures. In certain models, the number of significant explanatory variables is greater under the alternative futures than it was in the analysis of behavior between 1973 and 1975. Nevertheless, the explanatory power and direction of influence remain fairly consistent throughout the analysis.

RELATIONSHIP BETWEEN SOCIO-ECONOMIC, DEMOGRAPHIC, AND GEOGRAPHIC VARIABLES AND PUBLIC POLICY PREFERENCES

The questionnaire obtained information on household attitudes toward a series of specific transportation costs and policies that may substantially influence travel patterns in southeastern Wisconsin. Public attitudes in the following major policy areas were investigated: (1) gasoline price preferences; (2) freeway construction attitudes; (3) attitudes toward bus transportation costs; (4) opinions on local sources of public subsidy for bus transportation; and (5) attitudes toward measures to bring about greater conservation in the use of fuel.

The discussion emphasized the relationship between socio-economic, demographic, and geographic variables and public policy preferences. The basic conclusion emerging is that households prefer those policy alternatives that minimize costs or maximize benefits to themselves. Households seek to maintain current travel patterns at current prices. They are most willing to accept policy changes that will adversely affect any group other than themselves. Opposition is greatest to these policy alternatives that increase the costs to

the household or threaten to disrupt current travel patterns. The following paragraphs summarize the major research findings on each public policy issue.

Gasoline Price Preference

Households were asked to determine a gasoline price threshold beyond which they would make significant changes in their travel patterns. Approximately 30 percent of the households cited 80 or more cents per gallon as their price threshold for gasoline. Only 9.9 percent of the households stated that a gasoline price level of 50-59 cents per gallon (the actual level of gasoline prices at the time of the survey) would bring about significant changes in travel patterns. An analysis of the results suggests that high-income households or households with wage earners in certain occupation groups (i.e., sales workers, managers, officers, and proprietors) have very high gasoline price thresholds. In contrast, low-income households or households with wage earners in certain occupation groups (craftsmen, foremen, and operatives and private household workers and laborers) have very low gasoline price thresholds. Thus, continuing increases in gasoline prices are not likely to affect the travel habits of consumers in the highest income group but will affect consumers in lower income groups.

Freeway Construction

Approximately 65 percent of the respondent households felt either that the planned freeway system should be completed or that the planned freeway system should be completed and expanded. Only 27 percent of the households believed that the construction of freeways should be stopped. Suburban households with a heavy reliance upon the automobile and a need to shorten lengthy work trips were more likely to support additional freeway construction than were low-income households or households with older heads (see Tables 9 and 10).

Bus Transportation Costs

Approximately 70 percent of the respondents believed that public transportation costs should be shared between the rider and a combination of federal, state, and/or local support. About 25 percent of the respondents believed that transportation costs should be assumed entirely by the rider. Individuals opposed to public financing of bus systems were more likely to be high-income, suburban households with no bus service currently available to them. In spite of the fact that only a small percentage of the Region's households utilize the bus system on a day-to-day basis, there is substantial support for the maintenance of a bus transportation system in the Region.

Local Sources of Public Subsidy for Bus Transportation

The questionnaire obtained attitudes on the sources of local funds needed for a public transportation subsidy. The specific local sources considered were property tax, sales tax, income tax, and vehicle tax. In this study, only 6.8 percent of the respondents believed that local funds for a subsidy should come from a local property tax. In contrast, 28.9 percent felt that a local sales tax should be utilized to collect the transportation subsidy, while 18 percent preferred the local income tax. The category claiming the highest percentage of households was the one favoring a local vehicle tax (with 31.3 percent of the households). A sizeable percentage of the respondents (15 percent) did not favor any of the stated local sources. In fact, many of the households in this group were opposed to the use of any local funds for a public transportation subsidy. A review of the independent variables suggested that response to the bus transportation tax question seemed to be generated, in large measure, by the household's own self-interest. Thus, support for increases in local property tax, although low throughout the Region, was even lower in Milwaukee County which has the highest property tax. Support for the use of a local income tax was highest among low-income groups (least affected by any increases) and lowest among high-income groups (most affected by any increases). Support for the use of a local vehicle tax was greatest among households with young heads and lowest among households in Waukesha County—the most automobile-reliant county in the Region. In general, there was greater support in the Region for the use of either a local sales tax or a local vehicle tax than for either a local property tax or local income tax.

Measures to Bring About Greater Fuel Conservation

Respondents were asked to list their preferences (first, second, third, and fourth choice) for a series of policy suggestions designed to achieve greater conservation in the use of gasoline. The four specific policy

Table 9

**RELATIONSHIP BETWEEN GEOGRAPHIC LOCATION
AND FREEWAY CONSTRUCTION ATTITUDES**

Geographic Location	Complete Construction of Planned Freeways	Complete and Expand Planned Freeways	Stop Constructing Freeways	Other	Total
Suburban and Ex-urban Counties ^a . .	42.15	15.70	34.71	7.44	100.00
Milwaukee County.	47.79	17.56	27.33	7.33	100.00
Waukesha County	51.05	22.78	19.83	6.33	100.00
Racine and Kenosha Counties	44.86	11.89	31.89	11.35	100.00
Total	47.47	17.53	27.30	7.70	100.00

^aOzaukee, Walworth, and Washington Counties.

Figures represent percentage totals.

choices were: (1) place a higher tax on a gallon of gasoline; (2) place a higher registration fee on large cars than on small cars; (3) ration gasoline, and (4) offer free or reduced price for bus transportation.

Among the 1,445 respondents identified by geographic location, the policy action most frequently indicated as first choice was the placement of a higher registration fee on larger than on smaller cars. Approximately 36 percent of the respondents gave this action on their first choice. Logically, placement of higher registration fees on larger cars than on smaller ones represents a policy action that entails the least threat to existing travel patterns and costs. Once the higher fee is assessed, the action in no way represents a restriction on the amount of driving an individual may do. The policy action that was the first choice of 27 percent of the households was the offer of free or reduced price for bus transportation. Again, this type of action represents no basic threat to an individual household's current travel pattern. In contrast, the two policy alternatives mentioned that do represent threats to either the cost or the amount of driving that households may engage in are least often mentioned as the first choice of respondents. Thus, only 17 percent of the households gave gas rationing as their first choice while the corresponding figure for higher gasoline taxes was 14 percent.

The general theme of household attitudes toward the four specific policy alternatives considered is clear: households give greater support to the policy alternatives that have the least adverse impact upon them. For example, households that own compact or sub-compact cars are much more likely to support higher registration fees on larger cars than are households owning only large or medium size cars. Households with high incomes and the ability to afford higher gasoline prices give greater preference to an alternative to increase gasoline taxes than do lower income households who have greater difficulty paying increased prices. In general, the policy alternative most frequently chosen (higher registration fees on larger cars than on smaller cars) represents the least threat of all the alternatives to the current travel habits of the Region's households.

Conclusion

Any policy alternatives that may restrict a household's ability to maintain current travel patterns will be unpopular. There is widespread support for the completion of the planned freeway system in the Region. There also is widespread support for public transportation in the Region. Yet, this support in no way is indicative of a widespread intention to utilize public transportation for the journey to work. The simple fact is that households prefer to maintain their current heavy reliance upon the automobile. They will

Table 10

**RELATIONSHIP BETWEEN HOUSEHOLD INCOME
AND FREEWAY CONSTRUCTION ATTITUDES**

Household Income Groups	Complete Construction of Planned Freeways	Complete and Expand Planned Freeways	Stop Constructing Freeways	Other	Total
Under \$6,999	31.18	18.28	40.86	9.68	100.00
\$ 7,000 - \$14,999 . .	45.91	15.18	29.77	9.14	100.00
\$15,000 - \$24,999 . .	52.30	17.68	24.13	5.89	100.00
\$25,000 or More . . .	46.40	23.87	21.17	8.56	100.00
Total	47.52	17.78	26.90	7.80	100.00

Figures represent percentage totals.

support policy alternatives that do not interfere with this pattern or do not adversely affect them economically. Thus, policy alternatives to ration gasoline, for example, will be extremely unpopular. However, low income households will prefer gasoline rationing to substantial increases in gasoline prices that will, by economic necessity, restrict their travel patterns but will not affect the travel patterns of high-income households.

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Chapter III

CONCLUSIONS

INTRODUCTION

This chapter is designed to suggest how the survey findings apply to regional planning needs. Specifically, the first section specifies the planning implications of the survey results and the second section suggests some implications of the survey and the need for future research. The comments set forth herein are largely based on the most drastic eventuality—the restricted availability of motor fuel, rather than on the less drastic eventuality of a significant price increase in motor fuel.

PLANNING IMPLICATIONS OF SURVEY RESULTS

In 1972, the Southeastern Wisconsin Regional Planning Commission conducted a home interview survey in order to provide the data base for a reevaluation of its transportation-land use plans first developed on the basis of 1963 data. This section discusses the manner in which the results from the 1975 Energy Use survey might be incorporated into the reevaluation process.

In SEWRPC's plan reevaluation report, the technique to be applied in the quantitative test and evaluation of alternative transportation plans is described as:

These new transportation planning techniques required the formulation and application of mathematical models which permit both the existing and potential traffic demand within an urban region to be simulated and assigned to any given transportation system. The complete sequence of travel simulation occurs in four stages:

1. Trip Generation; in which the total number of person trips generated in each subarea of the planning area is determined using relationships found to exist between land use and travel by analyses of the planning inventory data.
2. Modal Split; in which the total number of person trips generated in each subarea of the planning area is divided into those using transit and those using automobile and in which the person trips using automobiles are further converted to vehicle trips.
3. Trip Distribution; in which the person and vehicle trips generated in each "origination" subarea are linked to subarea of "destination" and interzonal travel desire lines established for both transit and highway travel.
4. Traffic Assignment; in which the interzonal trips are assigned to existing and proposed transit and highway facility networks. The travel simulation may also be conducted using a different sequence of stages; specifically, trip distribution can be simulated prior to the determination of modal split. In this instance, the originating total person trips are first allocated to destination zones, thus establishing total person interzonal desire lines. This is followed by the determination of the number of interzonal trips which will use the automobile and transit modes; the further conversion of person trips using the automobile to vehicle trips; and the assignment of internal trips to transit and highway facility networks.¹⁴

¹⁴*Southeastern Wisconsin Regional Planning Commission, Planning Report No. 25, A Land Use Transportation Plan for Southeastern Wisconsin-2000, "Development and Application of Planning Models," Volume Two, Chapter IV, Preliminary Draft.*

The following paragraphs indicate how each of the steps in the simulation modeling process might be influenced by the Energy Use survey results.

Trip Generation

In the plan reevaluation process, SEWRPC estimated both trip productions and trip attractions in the Region. Trip production rates were analyzed and forecast through the use of the disaggregate technique of cross-classification analysis. Trip generation rates were explained on the basis of two variables: household size and auto availability, the two independent variables best able to account for variations in trip production rates. Trip attractions were analyzed and forecast by means of multiple regression based upon land uses in the various zones. Trip generation rates were developed and projected for the following types of trips: home-based work trips, home-based shopping trips, home-based other trips (including personal business, medical-dental, social-eat meal, and recreation) and non-home-based trips. Trip generation rates were calculated for the following subregional units: the Milwaukee urban area, the Racine urban area, the Kenosha urban area, and all remaining areas within the Region. According to the SEWRPC report:

Separate models for each trip purpose were developed for these four areas because analysis of regional household trip-making as surveyed in 1963 and 1972 indicated substantial differences in trip frequency between urban and rural areas within the Region and between urban areas of different size within the Region.¹⁵

The urban areas had higher trip generation rates than the rural areas.

According to results from the Energy Use survey, the following considerations dealing with trip generation should be noted:

1. Under the conditions of higher fuel prices and/or restricted fuel availability, the basic pattern of higher trip generation rates in urban areas as opposed to rural areas should remain essentially unchanged. Results from the Energy Use survey indicated that change rates (especially for shopping behavior and journey to work) were lower in Milwaukee County than they were in the suburban and ex-urban Counties of Walworth, Washington, and Ozaukee.
2. In the home-based work category, person trips would vary only slightly from SEWRPC's estimates under the alternatives of higher prices and restricted fuel availability. Individuals would continue going to work, although their modes of transportation to work may differ. The only exception is that, under a situation of restricted fuel availability, a small percentage of wage earners said that they would quit their jobs rather than continue the commuting journey. Such actions, of course, would slightly reduce home-based journey to work trips, especially among second wage earners in a household. The survey results suggest that under a restricted fuel availability situation about 7 percent of wage earners would get to work by "other means"; of these respondents a large percentage wrote on the questionnaire that they would simply quit their jobs, if fuel availability were restricted. In short, overall trip generation data for the home-based work trip analyzed by SEWRPC for the Region would be affected only slightly by the alternative future of restricted fuel availability.
3. The results from the Energy Use survey suggest considerable shopping behavior changes under restricted fuel availability and higher fuel prices. Thus, the trip generation rates estimated for households may be reduced in view of the alternative futures presented. However, certain variables influence the rate of shopping change among households. A lower percentage of households in Milwaukee County said that they would change shopping behavior under the alternative future of restricted fuel availability than did households in Racine, Kenosha, Waukesha, and the suburban and ex-urban Counties of Washington, Walworth, and Ozaukee. Furthermore, shopping changes may be expected to increase under both alternative futures as the number of autos in the household increases. Change rates among households with no autos will be substantially below change rates

¹⁵ *Ibid.*

among households with three or more autos. Finally, there is a higher rate of shopping behavior change among households with one or two children than among households with either three or more or no children. In short, under either of the alternative futures, trip generation rates for shopping may decline significantly. As a result, under an assumption of restricted fuel availability, the shopping trip numbers utilized by SEWRPC in the trip generation tables should be reevaluated.

Trip Distribution

Results from the Energy Use survey suggest that the distribution of work and shopping trips in the Region may be affected under the alternative futures in the following manner:

1. Home-Based Journey to Work Trips—The Energy Use study found that the 1973-1975 situation did not bring about any significant amount of residential relocation to alleviate stress. Even under the alternative futures of higher prices and restricted fuel availability, sample households were very reluctant to move their residences to places closer to their jobs. Thus, desire lines connecting trip ends and their associated trip length distribution for the journey to work in the Region should remain essentially unchanged. The vast majority of wage earners will still be traveling from current residences to current work places under the alternative futures. The only substantial change may be the manner in which wage earners get to the place of employment.
2. Home-Based Shopping Trips—Trip lengths for home-based shopping, however, may change under the alternative futures. As noted in the analysis, spatial and non-spatial changes in shopping behavior were adopted by more than three-fourths of the respondents under the alternative futures of higher prices and restricted fuel availability. Many households indicated that they would shop at stores closer to their homes more frequently under the alternative futures. Thus, the desire lines for shopping trips may experience some variations under restricted fuel availability. Specifically, smaller shopping areas in neighborhoods may increase their traffic at the expense of the large regional shopping centers. SEWRPC's analysis noted an increase in the mean distance traveled for shopping trips between 1963 and 1972 and attributed the increase to the construction of the regional shopping centers. Under the alternative futures, the frequency of long trips to the regional shopping centers may decline as households attempt to conserve fuel and to save fuel costs.

Mode Choice and Auto Occupancy

The results from the Energy Use survey suggest that the alternative futures of higher prices and restricted fuel availability are most likely to influence mode choice for the journey to work. The disaggregate mode choice model utilized by SEWRPC (logit model) for determining probability of transit trips and auto person trips relies upon a series of comparisons of observed user and system attributes. Specifically, the following are considered: number of automobiles per household, the difference in costs (out-of-pocket) between auto and transit, the difference in in-vehicle time (total time spent inside the mass transit vehicle or the auto) between auto and transit, and the difference in out-of-vehicle time (includes any walking time for automobile travel, and all walking, waiting, and transferring time associated with travel on mass transit) between auto and transit. According to the Energy Use survey, the increase in the price of gasoline by an additional 20 cents per gallon would have a substantially less severe mode shift impact on the journey to work than would the initiation of gasoline rationing. In November 1975, approximately 68 percent of the wage earners were auto drivers. Under a situation of higher prices, over 63 percent would continue as auto drivers. The most important influence that higher fuel prices would have would be to decrease the percentage of wage earners who are passengers in family cars from 9.5 percent to 3.3 percent, increase the percentage of wage earners who are carpoolers from 7.2 percent to 13.2 percent, and increase the percentage of wage earners who are bus riders from 5.0 percent to 6.1 percent. Thus, in November 1975, 21.7 percent of the wage earners were passengers in family cars, carpoolers, or bus riders. Under a situation of higher prices, 22.6 percent fell into these same categories. The increase in carpooling under the alternative of higher fuel prices might bring about a greater auto occupancy if wage earners who ordinarily rode as passengers in family cars would obtain additional riders in the car for the journey. Increases in auto occupancy, of course, would influence the vehicle trips in the Region (person trips divided by auto occupancy) and, thus, would influence the traffic assignment models.

Changes in the journey to work would be more substantial under a restricted fuel availability situation. According to the survey the percentage of wage earners who are auto drivers would decline from its present

level of 68.6 percent to a figure of 45.7 percent under the alternative of restricted fuel availability. Carpooling would increase from its present level of 7.2 percent to a level of 17.7 percent under restricted fuel availability. Bus ridership would increase from its present level of 5.0 percent to a level of 10.1 percent.

Traffic Assignment

As mentioned, traffic assignment refers to the assignment of trips to the specific existing and proposed transit and highway facility network. The changes discussed in the preceding paragraphs would affect only the number of trips (especially auto trips) to be assigned to the transportation network. The basic traffic assignment process, however, would be unchanged since nothing in the study suggested that the basic rationale for choosing a route between an origin and destination (i.e., minimum time path) would be changed. With fewer trips to load onto the system, specific proposed freeway and arterial street and highway improvements, for example, may no longer be needed. Congestion on existing overloaded facilities might be relieved. This would change the operating speeds and therefore the least time-paths through the network. In view of the findings of the Energy Use survey, however, planners now have the basis to test the sensitivity of their traffic assignment models. The test runs could, for example, determine the amount of trip reduction required to reduce the need for the construction of specific freeway or arterial street and highway links. In short, the Energy Use survey provides a basis for checking the sensitivity of traffic assignment results to alternative futures.

SURVEY IMPLICATIONS AND FUTURE RESEARCH

The Energy Use survey recorded household attitudes toward the impact of higher fuel prices and restricted fuel availability upon travel patterns at one point in time. In addition to documenting how households adjusted travel patterns in view of the increased gasoline price between 1973 and 1975, it ascertained the manner in which households anticipated making travel pattern adjustments in view of the alternative futures of higher fuel prices and restricted fuel availability. The analysis provides a detailed explanation of the contribution of socio-economic, demographic, and geographic variables to observed variations in response to the three situations presented. This information will be useful to regional planners who need to assess how changing fuel prices and fuel availability might influence regional travel patterns and thus bring about changes in the regional transportation system. The general conclusion noted throughout the study is that households will select coping mechanisms that minimize the disruption to their current travel patterns. However, changes will be much more dramatic under a situation of restricted fuel availability than under a situation of higher fuel prices, especially in the mode for the journey to work and among households in the highest income bracket.

The survey methodology utilized in the study had some limitations that are noted in the following paragraphs:

1. There was a greater tendency for households with diversified travel patterns to return the questionnaire than for households with less diversified travel patterns. As a consequence, the analysis emphasized the description of the contribution of socio-economic, demographic, and geographic variables rather than observed figures reflecting overall regional totals.
2. The questionnaire format utilized did not enable the researcher to properly estimate variations in the response to certain questions or the intensity of changes. For example, many households suggested that they made spatial and non-spatial changes in shopping behavior. The questionnaire did not differentiate between an individual who made substantial and regular shopping behavior changes and an individual who made minor and infrequent changes. The only differentiation was between households that indicated a change and those that indicated no change.
3. The current investigation was limited to the assessment of household coping mechanisms and attitudes at one point in time. As a consequence it becomes difficult to separate short term influences on behavior response from the underlying change intentions.

There are, of course, a number of ways that the existing study could be improved upon. The following specific suggestions are noted:

1. More detailed information should be collected on the decision-making strategy of a more limited number of representative or typical households. A more limited sample would enable the researcher to carefully document travel behavior. Thus, an accurate determination could be made of how travel behavior intentions are translated into actual travel behavior changes. Perhaps a travel diary could be kept by each household over an extended time period. This would provide a more detailed information base concerning household travel behavior adjustments to changing circumstances over time. The problems intrinsic to a mail questionnaire administered at one point in time could be largely avoided by means of the suggested approach.
2. Information collected from the more limited sample should not, however, be limited exclusively to travel behavior. Transportation is a derived demand. Thus, in most instances, no intrinsic value is placed upon the travel itself but primarily upon the activities engaged in at the destination point(s). Thus, if the cost of transportation increases substantially or its availability decreases, households will be faced with alternative behavior strategies that encompass far more than their travel behavior alone. Households may postpone purchases of durable goods in order to maintain travel. Alternatively, households may prefer to postpone certain activities rather than others. In short, the current questionnaire was limited to an analysis of travel behavior decisions. It is suggested that much information can be learned from an analysis of a more comprehensive set of alternatives.

SUMMARY

The results suggest that the transportation planning process only needs substantial revision under conditions of excessive fuel price increases or restricted fuel availability. Moderate and gradual increases in fuel prices are unlikely to bring about significant modifications in the travel patterns of households with respect to the transportation planning process.

Author's Acknowledgment

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APPENDIX

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

916 NO. EAST AVENUE

• P.O. BOX 769

• WAUKESHA, WISCONSIN 53186

• TELEPHONE (414) 547-6721

Serving the Counties of:

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November 10, 1975

Dear Householder:

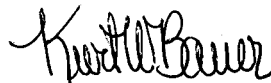
An important factor that presently concerns officials responsible for the planning and development of freeway and transit facilities is how shortages and higher prices of motor fuel may affect the travel habits and patterns of the public. Consequently, the Urban Research Center, University of Wisconsin-Milwaukee and the Southeastern Wisconsin Regional Planning Commission are jointly undertaking a research project to determine response of the traveling public to the motor fuel problem. By carefully answering the enclosed questionnaire, you will be making an important contribution to the planning of transportation facilities for this area and, thereby, performing a valuable public service.

The questionnaire is intended for completion only by the head of the household and/or spouse. Please answer the questions to the best of your ability.

When you have completed the questionnaire, please place it in the envelope provided and drop it in any U. S. mailbox. Your answers will be kept entirely confidential and will be compiled with others for planning purposes only.

Thank you for your cooperation in this matter.

Sincerely,



K. W. Bauer
Executive Director

ENERGY USE-TRAVEL SURVEY

This study of travel and energy use is being conducted to assist planning of improved transportation facilities. It is being conducted by the Urban Research Center-University of Wisconsin-Milwaukee and the Southeastern Wisconsin Regional Planning Commission. All information received will be held strictly confidential and will be used for statistical purposes only. Any questions you may have can be answered by calling 547-6721 ext. 248 between 8:00 a.m. and 5:00 p.m.

SECTION I

CURRENT TRAVEL AND EMPLOYMENT INFORMATION

About two years ago there were shortages of gasoline and the price of gasoline started increasing. We would like to know the way your travel today (as of November 1, 1975) has been affected, if any, by the increased prices of gasoline. Your answers to the following questions will provide this information.

1. What is the make, model, and year of each vehicle (autos, motorcycles, trucks, and recreational vehicles) in your household?

Vehicle Type	Make/Model	Year	For Office Use Only
Example: Auto	Chevy Impala	1968	☐
_____	_____	_____	☐
_____	_____	_____	☐
_____	_____	_____	☐

2. What is the job description of each wage earner in the household? If a wage earner holds more than one job, report only for the primary job.

Occupation or Profession	Employer's Name and Address	Description of Employer	For Office Use Only
Example: Foreman	Allis Chalmers 70th & Greenfield	Manufacturing Heavy Equipment	☐
Wage Earner 1 _____	_____	_____	☐
Wage Earner 2 _____	_____	_____	☐
Wage Earner 3 _____	_____	_____	☐

3. By what mode of transportation does each wage earner usually go to work? (Enter one choice for each wage earner.)

Wage Earner 1	Wage Earner 2	Wage Earner 3
☐	☐	☐
1) Auto driver 2) Passenger in family car 3) Auto part-way; bus part-way 4) Carpool If yes; when was carpool started? Wage Earner 1 _____ month _____ year _____	5) Bus 6) Motorcycle 7) Bicycle 8) Walk 9) Other (Specify) Wage Earner 1 _____ Wage Earner 2 _____ Wage Earner 3 _____	
Wage Earner 2 _____ month _____ year _____		
Wage Earner 3 _____ month _____ year _____		

4. Is your home within walking distance of a bus route?

Yes ☐ No ☐

If yes, what is the distance to the nearest bus stop? _____ blocks

5. What is the one-way distance and about how long does it take each wage earner to go to work?

Wage Earner 1	Wage Earner 2	Wage Earner 3
Miles _____	Miles _____	Miles _____
Minutes _____	Minutes _____	Minutes _____

6. How does each wage earner feel about the distance traveled to work every day? (Enter one choice for each wage earner.)

Wage Earner 1	Wage Earner 2	Wage Earner 3
☐	☐	☐
1) Too far 2) Slightly too far 3) Satisfactory		

7. What changes have been made in the way that each wage earner travels to work now compared to the way that he/she traveled to work before higher gasoline prices? (Enter one choice for each wage earner.)

Wage Earner 1	Wage Earner 2	Wage Earner 3
☐	☐	☐
1) No change 2) Shift from auto driver to carpool 3) Shift from auto driver to bus 4) Shift from auto driver to motorcycle, bicycle, or walk 5) Shift from auto driver to passenger in family car 6) Shift from auto driver to auto part-way; bus part-way 7) Shift from passenger in family car to bus	8) Shift from passenger in family car to auto part-way; bus part-way 9) Other (Specify) Wage Earner 1 _____ Wage Earner 2 _____ Wage Earner 3 _____	

8. By what mode of transportation does the person who usually shops go to the store?

Enter one choice	1) Auto driver 2) Passenger in family car 3) Auto part-way; bus part-way 4) Carpool 5) Bus	6) Motorcycle 7) Bicycle 8) Walk 9) Other (Specify)
☐		

9. What changes have been made in the way that people in your household now shop compared to the way they shopped before higher gasoline prices?

	Yes	No
1) Go on fewer shopping trips	☐	☐
2) Combine several shopping trips	☐	☐
3) Combine shopping trips with other trips	☐	☐
4) Shop at stores closer to home	☐	☐
5) Other (Specify) _____		

10. What changes have been made in your household's current social-recreation travel compared to social-recreation travel before higher gasoline prices?

	Yes	No
1) Used bus, train, or plane for long-distance vacation	☐	☐
2) Cancelled plans for a long-distance vacation	☐	☐
3) Took a vacation of shorter distance	☐	☐
4) Sold a recreation vehicle	☐	☐
5) Reduced in-town social-recreation driving	☐	☐
6) Used carpool for in-town social-recreation travel	☐	☐
7) Used bus for in-town social-recreation travel	☐	☐
8) Other (Specify) _____		

11. There were a number of other adjustments that a household may have made since the cost of gasoline increased. Do the following describe your household?

	Yes	No
1) Purchased an additional car that was smaller than cars already owned	☐	☐
2) Traded in a larger car for a smaller car	☐	☐
3) Sold one car and did not replace it	☐	☐
4) Postponed the purchase of a second car	☐	☐
5) Purchased a motorcycle	☐	☐
6) Moved closer to place of employment	☐	☐
7) Moved closer to major shopping area	☐	☐
8) Used telephone instead of traveling	☐	☐
9) Other (Specify) _____		

SECTION II

RESPONSE TO FUTURE SITUATIONS

There are a series of questions in this section about how your household might change its travel patterns in response to future situations. Part A deals with general attitudes, while Parts B and C deal with two possible situations.

Part A: General Attitudes

1. At what point do you believe the price per gallon of gasoline would create a significant change in your future travel habits?

50-59 cents	60-69 cents	70-79 cents	80-89 cents	90-99 cents	\$1.00 or more
☐	☐	☐	☐	☐	☐

2. A number of suggestions relating to future gasoline price and availability have been mentioned recently. Three such suggestions are listed below. What is your first choice (1), second choice (2), and third choice (3)?

☐	Maintain price of gasoline at present level but place a limit of 8 gallons of gasoline per week per driver.
☐	Permit price of gasoline to increase by 20 cents per gallon but have no limit on the amount of gasoline.
☐	Permit price of gasoline that may be purchased to increase by 10 cents per gallon but place a limit of 12 gallons of gasoline per week per driver.

Part B: Situation 1 - Higher Gasoline Prices

Assume that within the next thirty days the current price of gasoline will increase by 20 cents per gallon, but that no limits will be placed on gasoline availability. Indicate by answering the following questions how you think your household would adjust to this situation.

1. By what mode of transportation would each wage earner usually go to work under situation 1. (Enter one choice for each wage earner.)

Wage Earner 1	Wage Earner 2	Wage Earner 3
☐	☐	☐
1) Auto Driver	8) Walk	
2) Passenger in family car	9) Other (Specify) _____	
3) Auto part-way; bus part-way		
4) Carpool	Wage Earner 1 _____	
5) Bus	Wage Earner 2 _____	
6) Motorcycle	Wage Earner 3 _____	
7) Bicycle		

2. By what mode of transportation would the person who usually shops go to the store under Situation 1?

Enter one choice	1) Auto driver	6) Motorcycle
☐	2) Passenger in family car	7) Bicycle
	3) Auto part-way; bus part-way	8) Walk
	4) Carpool	9) Other (Specify) _____
	5) Bus	

3. How would household members change their current shopping patterns under Situation 1?

	Yes	No
1) Go on fewer shopping trips	☐	☐
2) Combine several shopping trips	☐	☐
3) Combine shopping trips with other trips	☐	☐
4) Shop at stores closer to home	☐	☐
5) Other (Specify) _____		

4. How would the household's current social-recreational travel change under Situation 1?

	Yes	No
1) Use bus, train, or plane for long-distance vacation	☐	☐
2) Cancel plans for a long-distance vacation	☐	☐
3) Take a vacation of shorter distance	☐	☐
4) Sell recreational vehicles	☐	☐
5) Reduce in-town social-recreation driving	☐	☐
6) Use a carpool for in-town social-recreation travel	☐	☐
7) Use bus for in-town social-recreation travel	☐	☐
8) Other (Specify) _____		

5. There are a number of other adjustments that a household might make if Situation 1 existed. Would the following describe your household?

	Yes	No
1) Purchase an additional car that is smaller than cars presently owned	☐	☐
2) Trade in a larger car for a smaller car	☐	☐
3) Sell one car and not replace it	☐	☐
4) Postpone purchase of a second car	☐	☐
5) Purchase a motorcycle	☐	☐
6) Move closer to place of employment	☐	☐
7) Move closer to major shopping area	☐	☐
8) Use telephone instead of traveling	☐	☐
9) Other (Specify) _____		

6. Assume that under Situation 1 circumstances the household relocates. Rate the following characteristics according to their importance.

	Not Important	Somewhat Important	Very Important
1) Size of house	☐	☐	☐
2) Distance to primary wage earner's place of employment	☐	☐	☐
3) Distance to shopping center	☐	☐	☐
4) Quality of neighborhood	☐	☐	☐
5) Accessibility to bus route	☐	☐	☐
6) Amount of property taxes	☐	☐	☐
7) Distance to schools	☐	☐	☐
8) Quality of schools	☐	☐	☐
9) Accessibility to freeway	☐	☐	☐
10) Neighborhood safety	☐	☐	☐
11) Other (Specify) _____			

Part C: Situation 2 - Restricted Availability of Gasoline

Assume that within the next thirty days the amount of gasoline available per driver is restricted to 8 gallons per week, although the price of gasoline remains at current levels. These restrictions will last for at least 5 years. Indicate in the following questions how you think your household would adjust to this situation.

1. By what mode of transportation would each wage earner usually go to work under Situation 2?

Wage Earner 1	Wage Earner 2	Wage Earner 3
☐	☐	☐
1) Auto driver	8) Walk	
2) Passenger in family car	9) Other (Specify) _____	
3) Auto part-way; bus part-way		
4) Carpool	Wage Earner 1 _____	
5) Bus	Wage Earner 2 _____	
6) Motorcycle	Wage Earner 3 _____	
7) Bicycle		

2. By what mode of transportation would the person who usually shops go to the store under Situation 2?

Enter one mode

☐

- 1) Auto driver
- 2) Passenger in family car
- 3) Auto part-way; bus part-way
- 4) Carpool
- 5) Bus

- 6) Motorcycle
- 7) Bicycle
- 8) Walk
- 9) Other (Specify) _____

3. How would household members change their current shopping patterns under Situation 2?

- 1) Go on fewer shopping trips
- 2) Combine several shopping trips
- 3) Combine shopping trips with other trips
- 4) Shop at stores closer to home
- 5) Other (Specify) _____

Yes	No
☐	☐
☐	☐
☐	☐
☐	☐

4. How would the household's current social-recreational travel change under Situation 2?

- 1) Use bus, train, or plane for long-distance vacation
- 2) Cancel plans for a long-distance vacation
- 3) Take a vacation of shorter distance
- 4) Sell recreational vehicles
- 5) Reduce in-town social-recreation driving
- 6) Use a carpool for in-town social-recreation travel
- 7) Use bus for in-town social-recreation travel
- 8) Other (Specify) _____

Yes	No
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

5. There are a number of adjustments that a household might make if Situation 2 existed. Would the following describe your household?

- 1) Purchase an additional car that is smaller than cars presently owned
- 2) Trade in a larger car for a smaller car
- 3) Sell one car and not replace it
- 4) Postpone purchase of a second car
- 5) Purchase a motorcycle
- 6) Move closer to place of employment
- 7) Move closer to major shopping area
- 8) Use telephone instead of traveling
- 9) Other (Specify) _____

Yes	No
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

6. Assume that under Situation 2 circumstances the household relocates. Rate the following characteristics according to their importance.

- 1) Size of house
- 2) Distance to primary wage earner's place of employment
- 3) Distance to shopping center
- 4) Quality of neighborhood
- 5) Accessibility to bus route
- 6) Amount of property taxes
- 7) Distance to schools
- 8) Quality of schools
- 9) Accessibility to freeway
- 10) Neighborhood safety
- 11) Other (Specify) _____

Not Important	Somewhat Important	Very Important
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐
☐	☐	☐

SECTION III

ATTITUDES CONCERNING TRANSPORTATION COSTS AND POLICIES

In the following questions indicate your feelings about some suggested transportation policies.

1. A number of ways have been suggested to bring about greater conservation in the use of gasoline for private cars. Four such policies are listed below. What is your first choice (1), second choice (2), third choice (3), and fourth choice (4)?

☐	Place a higher tax on a gallon of gasoline
☐	Place a higher registration fee on large cars than on small cars
☐	Ration gasoline
☐	Offer free or reduced price for bus transportation

2. I think that we should: (Enter one choice in the space provided.)

☐	1) Complete the construction of the planned freeway system
	2) Complete and expand the planned freeway system
	3) Stop constructing freeways
	4) Other (Specify) _____

3. I think that the total cost of bus transportation should be borne: (Enter one choice in the space provided.)

☐	1) Completely by the riders who use it
	2) Partly by the riders who use it and partly by the communities served
	3) Completely by the communities it serves
	4) Partly by the riders who use it and partly by state and federal funding
	5) No one; public transportation should be eliminated
	6) Other (Specify) _____

4. If tax sources are required to subsidize public transportation, I think that local revenue to match federal and state subsidy funds should come from: (Enter one choice in the space provided.)

☐	1) Local property tax
	2) Local sales tax
	3) Local income tax
	4) Local vehicle tax
	5) Other (Specify) _____

5. What improvements would make bus transportation more attractive for each wage earner?

Wage earner 1 _____

Wage earner 2 _____

Wage earner 3 _____

SECTION IV

In order to determine if the responses we receive will be representative, it is necessary that we obtain the following information. This information will be used for statistical analysis only and will remain confidential.

1. What is the age of the head of the household? _____

What is the age of the spouse? _____

How many children 15 or younger are residing in the household? _____

How many children 16 or older are residing in the household? _____

How many other persons (grandparents, cousins, brothers, sisters, aunts, uncles, roommates, etc.) are residing in the household? _____

2. Please check the approximate gross family income (before taxes) in your household:

Enter one choice	1) Under \$3,000	5) \$10,000 - \$14,999
☐	2) \$3,000 - \$4,999	6) \$15,000 - \$24,999
	3) \$5,000 - \$6,999	7) \$25,000 - \$49,999
	4) \$7,000 - \$9,999	8) \$50,000 or more

3. What is the educational level of the head of the household?

Enter one choice	1) Some grade school	5) Some college
☐	2) Grade school graduate	6) College graduate
	3) Some high school	7) Post-graduate studies
	4) High school graduate	

Please offer any additional comments, criticisms, or suggestions you may have on this important transportation related issue in the space provided below.
