A Metropolitan Transportation Plan For National Energy Contingencies

August 1977

North Central Texas Council of Governments

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Preface

The Steering Committee of the Regional Transportation Policy Advisory Committee directed the North Central Texas Council of Governments to develop a program by which the mobility of the workers of the region would be maintained in the event of contingency situations which would restrict local fuel supplies. The following report is in response to this direction.

The energy crunch is not like the situation with wheat, where one has a poor crop this or that year. Rather, it is a problem that took a long time in coming - even though the point of general recognition seemed to come suddenly - and it will take a long time in going. . . .We are in trouble because of inadequate planning in the past, including insufficient research and development on new energy sources.

To be viable, any [energy] policy must rest on a solid foundation of fact. . . . there are two basic realities that we must understand in order to produce a viable policy for energy. The first of these deals with the realities of nature, the second with the realities of people. The reality of nature tells us that the age of "cheap" energy is over. . .

The reality of people tells us that if 6% of the world's population consume 33% of the world's energy (as we do in the United States) and if this group continues (as we are) to increase that usage at the rate of more than 4% per year, and depends increasingly (as we are) for the sources to come from outside our shores- these realities tell us that unstable situations, political and economic, are likely to result.

THE FUTURIST, February 1975, p. 22.

Glenn T. Seaburg,
"Opportunities in Today's
Energy Milieu"

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I. Introduction

The "Energy Crisis" of 1973-1974: A Synopsis

On October 19, 1973, the Arab petroleum exporting nations imposed an immediate embargo on oil shipments to the United States as well as to other "unfriendly" countries which did not support its cause during the Arab-Israeli "Yom Kippur" War. The cutoff produced a 10 percent reduction in the nation's oil supply at a critical time when energy consumption was reaching an all-time high level. The resulting fuel shortfall produced considerable, though temporary, modifications in the American lifestyle. Home thermostats were turned down to conserve heating fuel, lights were switched off to save electricity, and unemployment rose as factories shut down due to insufficient energy to run their machinery.

Furthermore, the reduction in fuel supplies produced a dramatic impact on the American transportation system. Throughout the nation, and especially along the populous East Coast, service stations closed as gasoline supplies were depleted. Stations which managed to remain open often experienced long lines of autos and sometimes unruly customers. The price of gasoline rose dramatically. As the difficulty in purchasing fuel heightened, travel, especially by auto, was significantly reduced. At the same time, a considerable number of Americans searched for travel alternatives to the automobile. For the first time, many Americans discovered that walking, bicycling, carpooling, and using transit were attractive modes of transportation.

The "energy shortage" also altered public attitudes, and some degree of acceptance developed for energy conservation measures. Perhaps most significantly, many came to realize that the era of cheap and plentiful fuel supplies had come to an end.

Background: The Energy Gap

While the general public has become aware of the nation's energy problem only since the onset of the Arab oil embargo, the roots of the energy shortage can be traced to trends in production and consumption that have persisted since the turn of the century. The major and most fundamental energy problem that we face today is the growing gap between energy consumption and domestic production. Since 1950, total U. S. energy use has more than doubled while domestic energy production has risen at only half that rate.[1]

The difference between consumption and domestic production has been made up by increasing amounts of imported foreign fuel, mainly petroleum. Since the mid-1950's, the U. S. has gone from a net exporter of energy to an importer of over 15 percent of its current demand including over 40 percent of its oil[2] and, in recent months imported oil has occassionally exceeded our domestic production.[3] It is this basic "energy gap" which precipitated the problems experienced during the 1973-1974 oil shortage and which is expected to continue to influence the U. S. energy outlook (Figure I-1).

Figure I-1 shows the past and expected future trends of U. S. petroleum consumption and production. The increasing amounts of imported oil needed to meet rising U. S. demands and the declining domestic production shown here will make the United States more vulnerable to foreign oil import cutoffs in the future.

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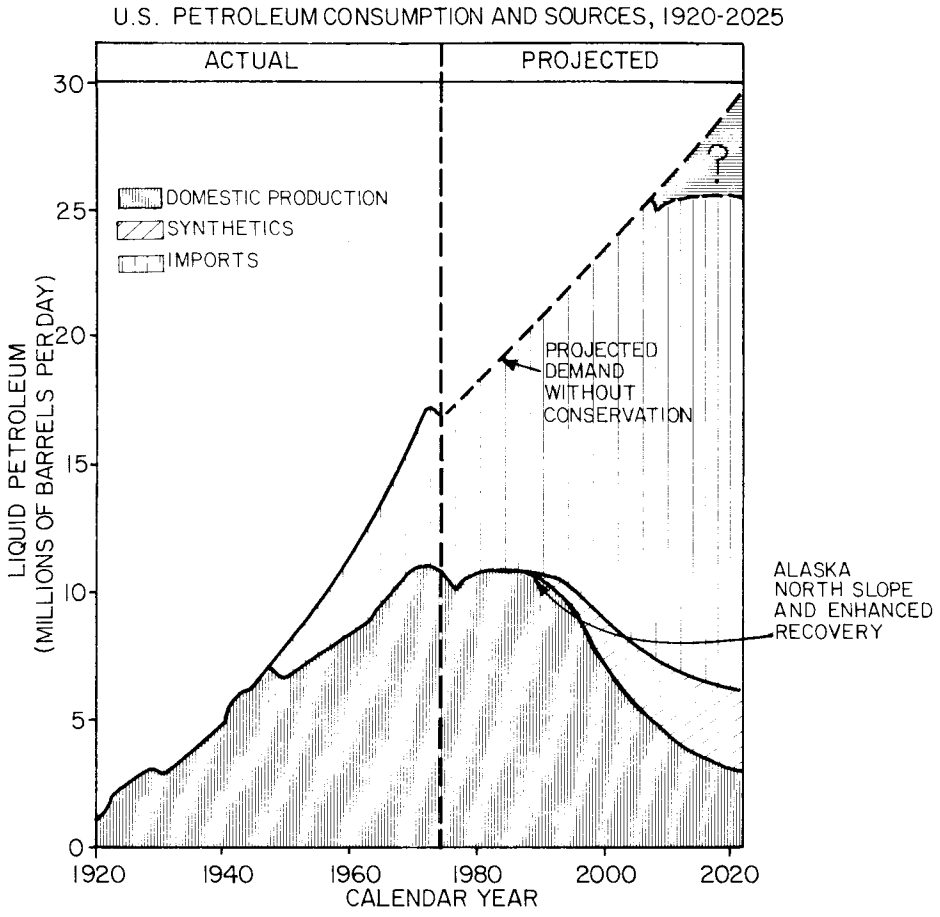
[1] The Ford Foundation Energy Policy Project, Exploring Energy Choices, A Preliminary Report, (Washington, D. C.: 1974), p. 1.

[2] Ibid.

[3] Federal Energy Administration, "Federal Energy News," Friday, March 26, 1976.

FIGURE I-1



Source: U. S. Department of Transportation, "Automotive Fuel Economy Program," Federal Register, January 13, 1977, p. 2879.

North Central Texas and the Energy Problem

The uninterrupted flow of foreign petroleum imports to satisfy the nation's energy gap is not a certainty. The political stability of the Arab world, from which over one-third of the imported oil comes,[4] has not improved much since the 1973 Arab-Israeli War. Recent developments in such places as Lebanon could very well escalate into an explosive confrontation resulting in another oil embargo.

[4]The Bureau of National Affairs, Energy Users Report, Number 157, August 12, 1976.

How will another such "crisis" affect North Central Texas? The proposed federal gasoline conservation measures (i.e. gasoline allocation and coupon rationing) generally are national solutions and are intended to equalize the impact of the shortage throughout the country. However, since local consumption patterns differ, site specific problems will remain to be resolved by each individual area. The North Central Texas Region, if it desires to minimize the adverse economic repercussions of an energy shortage on the local economy, must therefore be prepared to resolve it own transportation problems. It is the purpose of this study to address this issue by identifying such potential local problems and suggesting actions through which they may be alleviated.

Assumptions and Objectives

Another oil embargo or similar supply interruption in the near term would result in a 10 percent to 25 percent reduction in national petroleum supplies.[5] If such a reduction were to occur, the federal government plans to implement gasoline-diesel fuel allocation and/or rationing programs.[6] These programs would be administered by federal and state governments.

With these scenarios in mind, this study recommends a program of actions which, if followed, would minimize the adverse effects of these measures on the passenger ground transportation systems of the Dallas-Fort Worth Metropolitan Area. The problems experienced by individual auto users, public transportation providers, and cities in the area are identified and analyzed with regard to these contingencies. While it is not the purpose of this study to delineate ways in which fuel can be conserved, energy conservation is indeed a by-product of many of the suggested actions.

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[5] The Federal Energy Administration estimates a 12% to 21% shortage is possible during the 1977-78 period. FEA, Economic Impact Analysis, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, September 1976, p. 8.

[6] Federal Energy Administration, Environmental Impact Assessment, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, September 1976, p. 1.

Since the continued economic growth and competitiveness of the region is of the utmost importance, the maintenance of the work trip is the major area of concern here. Because most of these trips are made by automobile (about 90 percent locally), this study pays special attention to the auto users who may experience difficulties in reaching their places of employment. At the same time, suggestions are made so those who desire to use alternate transportation modes (transit, carpools, paratransit) will find them available in their community.

Assuming that the effects of another oil shortage will be similar to that of the 1973-1974 embargo, local transit operations can expect a significant increase in ridership. Under such circumstances, these transit systems should operate as efficiently as possible and make the greatest use of available resources. If possible, new services should be considered where the demand exists. In addition, provisions should be formulated to maintain essential paratransit resources, notably taxicab and elderly and handicapped services.

As with the transportation of people, the transportation of goods can also be expected to be impacted by a future energy shortage. Higher fuel costs will translate into higher costs for goods and services as will lower speed limits. The availability of fuel during rationing or allocation is another serious problem for private enterprise. These concerns are not addressed in this report, however, since individual firms must develop their own contingency plans appropriate for their particular situation. For this reason, this report does not address these private decisions.

Finally, it was determined that the objectives of this plan should adhere to a number of specified guidelines. These are:

- The energy strategies should be short-range responses. They must be implementable within three months of the initiation of a supply interruption.
- The strategies must be locally effective. They must be applicable to the needs and characteristics of the Dallas-Fort Worth Metropolitan Area, or, more specifically, the Intensive Study Area (defined in the following discussion).

- The recommended measures should encourage voluntary, rather than mandatory, energy actions.
- Since the plan only considers problems which may occur in the near-term, it is applicable up to the 1980 target year.

The Study Area

The recommendations of this report deal with the geographic area termed the Intensive Study Area (Figure I-2). This area includes Dallas and Tarrant Counties as well as portions of seven surrounding North Central Texas Counties. The major cities are Dallas (population 870,000) and Fort Worth (386,000) which are surrounded by numerous suburban communities, the largest of which are Arlington (139,000), Garland (128,000), Grand Prairie (65,000), Irving (118,000), Mesquite (68,000), and Richardson (68,000). As of January 1, 1977, the population of the Intensive Study Area was approximately 2,450,000.[7]

Like many other urban areas which experienced the bulk of their population growth after World War II, the Dallas-Fort Worth area has a strong automobile orientation. According to the 1970 Census, both the Dallas and Fort Worth urbanized areas had a relatively high 1.5 autos per household, with 88.5 percent of Dallas workers using an automobile to get to work and 92.2 percent of the workers using their automobiles for this purpose in Fort Worth. Related to this highway orientation is a relatively low population density of 1,880 persons per square mile for the combined Dallas-Fort Worth urbanized area in 1970.

Public Transportation systems in the area include the Dallas Transit System with a total fleet of 407 buses operating over 471.5 route miles for an annual total of 12,500,000 scheduled miles and 25,100,000 revenue passengers in 1976. CITRAN, the mass transit system in the City of Fort Worth, operates 121 buses providing 2,675,000 scheduled

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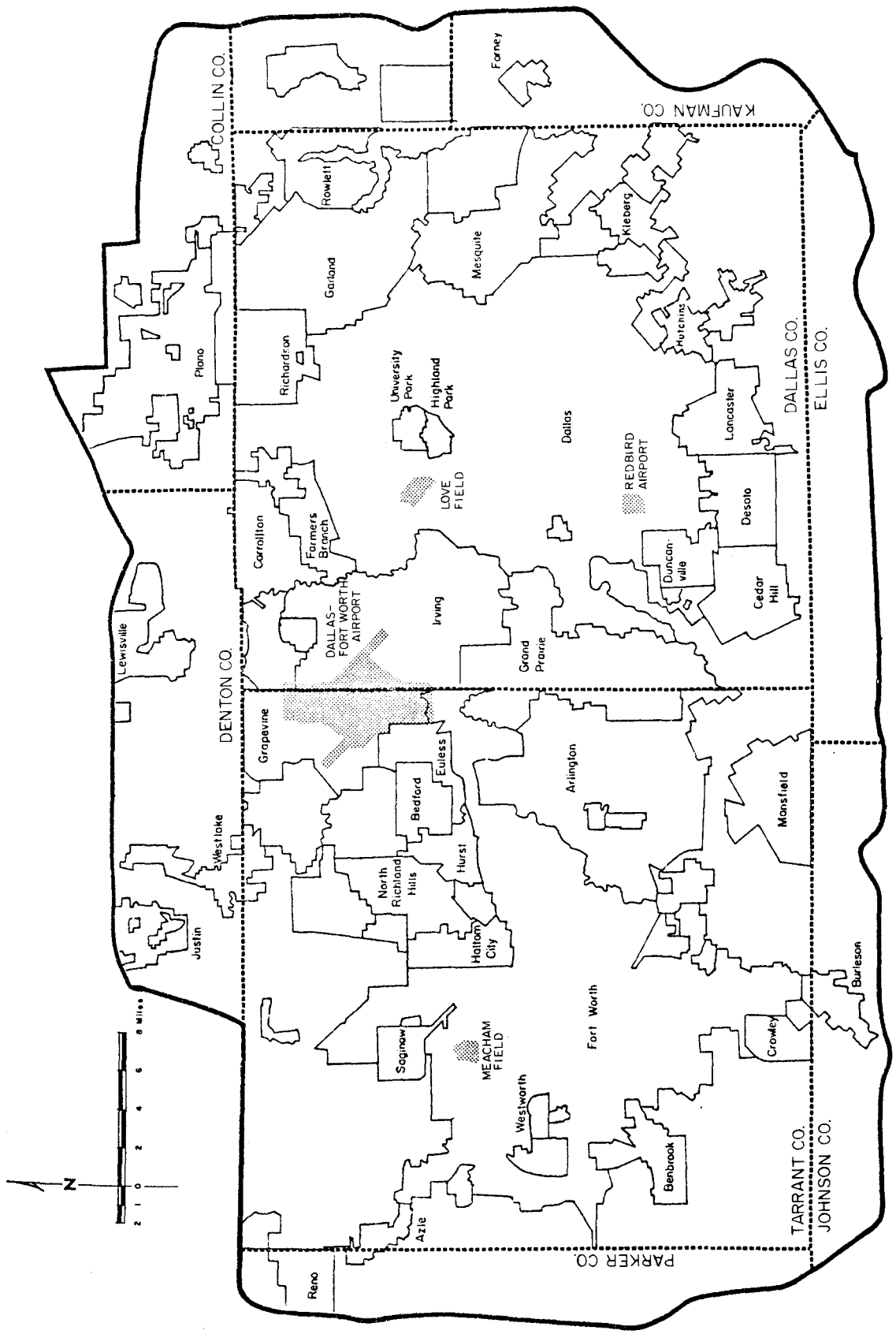
[7] North Central Texas Council of Governments estimates, 1977.

FIGURE I-2

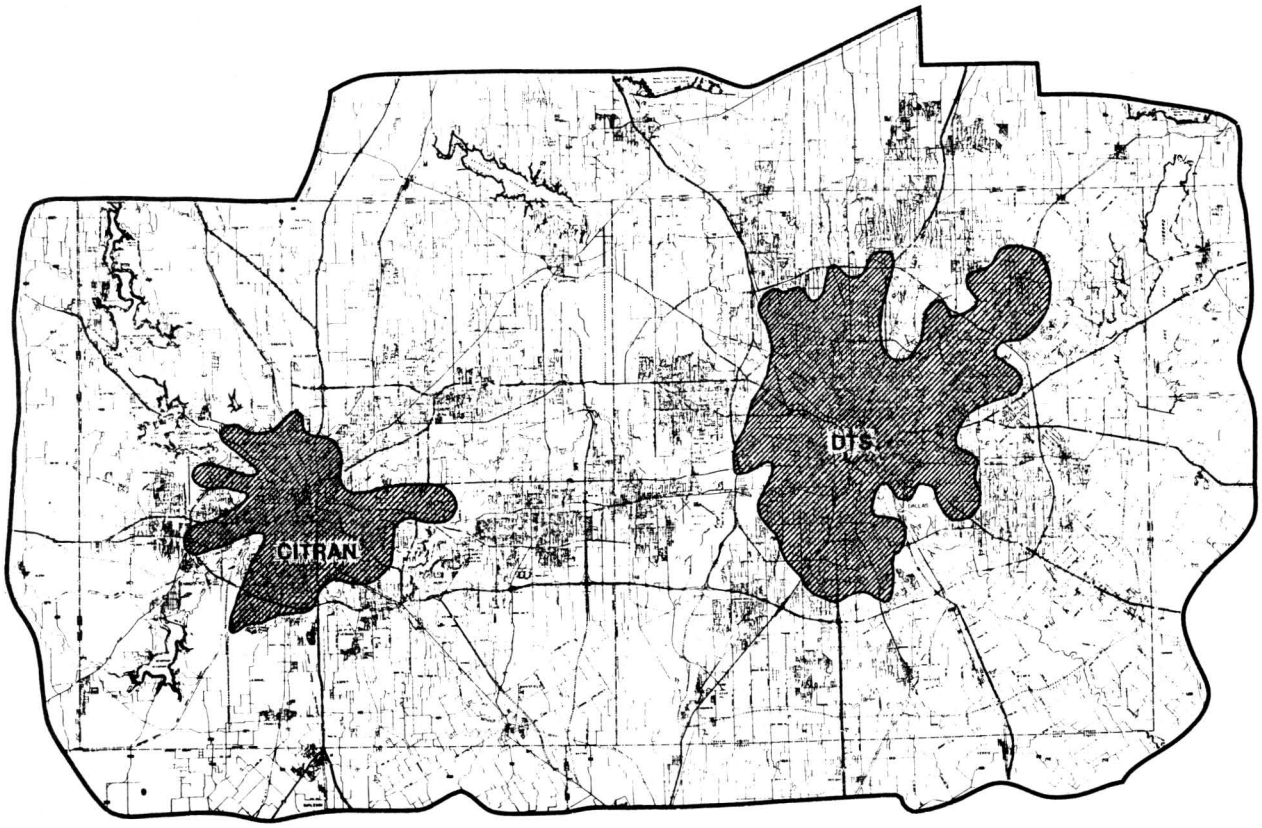


INTENSIVE STUDY AREA

vehicle miles annually. Total revenue passengers in the 1976 for CITRAN were 4,361,000. Figure I-3 shows the areas served by these bus systems. Major private bus companies providing intercity service within the North Central Texas region include Texas Motor Coaches, Continental Trailways, Greyhound, and Transportation Enterprises, Incorporated.

FIGURE I-3

TRANSIT SERVICE AREAS



There are 14 taxicab companies in operation in the Intensive Study Area with a total licensed fleet size in excess of 700 vehicles. Although a statistical profile of taxicab operations in the Dallas-Fort Worth area has not been completed from the data gathered to date, it is estimated that taxicabs in the Intensive Study Area transport from three to five million passengers a year, and total annual taxicab mileage appears to be on the order of 20 to 40 million miles a year.

Study Approach

Why would an interruption of the nation's oil supply affect the transportation system? The following chapter, Chapter II, attempts to answer this basic question by establishing the critical relationship between the present ground transportation system and petroleum supply.

An important step in the development of a transportation energy contingency plan is the examination of the impact of fuel shortages on national and local transportation patterns. Chapter III contains an analysis of the 1973-1974 Arab oil embargo with special attention to its effects on the North Central Texas area. From this examination, it is possible to identify the areas of greatest concern to contingency planning efforts.

Chapter IV describes the federal allocation and rationing contingencies as they are currently proposed. It outlines the regulations which present the most serious implications to transportation operations in the local area.

The next task is to identify the local transportation problems which will occur as a result of the imposition of these federal programs. Chapter V presents this problem analysis by examining the effects and implications identified in Chapters III and IV. Chapter VI then examines some of the major strategy implementation considerations and problems expected locally. And finally, Chapter VII outlines specific recommendations which, it is felt, adequately address the major transportation problems likely to develop during a "crisis" period. Figure I-4 outlines the basic study approach of this report.

II. Transportation and Petroleum Use

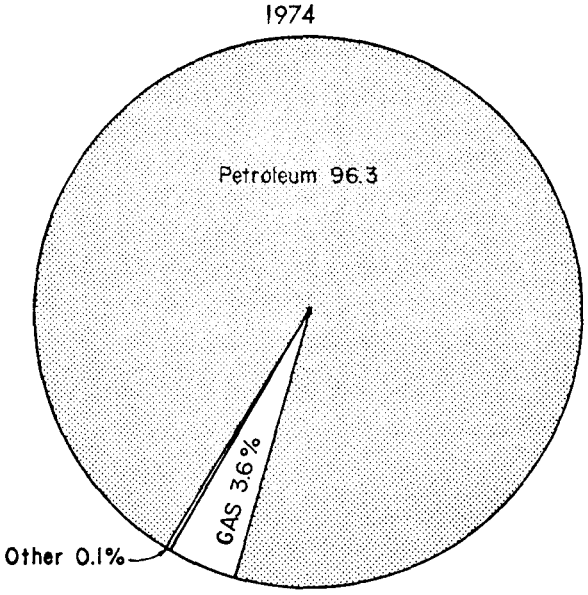
The energy gap, or more specifically, the nation's petroleum shortage has far-reaching implications on transportation for two basic reasons:

- Transportation is extremely dependent upon petroleum-based fuels (gasoline, diesel fuel, jet fuel, etc.). Approximately 96 percent of all transportation energy is supplied by petroleum products[1] (Figure II-1).
- The transportation sector is the largest petroleum user in the United States. It consumes over 50 percent of all petroleum used in the nation[2] (Figure II-2). Automobiles alone now account for nearly one-third of total petroleum consumption.

FIGURE II-1

TRANSPORTATION ENERGY SOURCES

1974



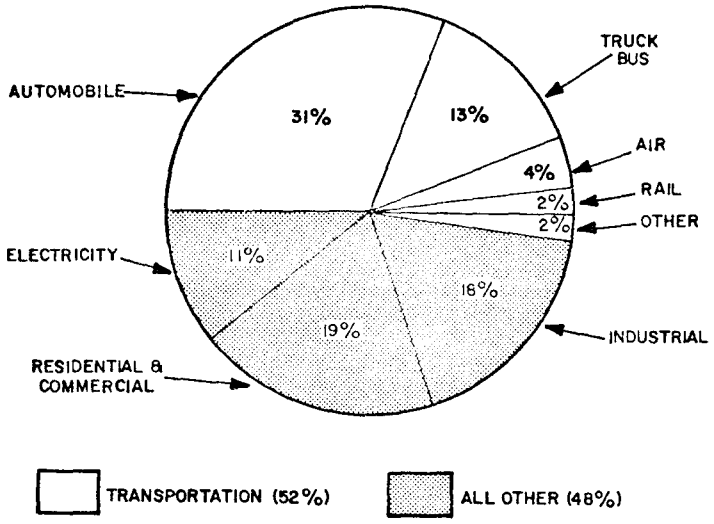
Source: U. S. Department of Transportation, Energy Statistics, p. 110, U. S. Government Printing Office, Washington, D.C., 1975.

[1] Walter Dupree, and John Corsentino, United States Energy Through the Year 2000, Revised (Washington, D. C.: U. S. Department of Interior, December 1975), p. 56.

[2] Stanford Research Institute, Patterns of Energy Consumption in the United States, Prepared for the Office of Science and Technology (Washington, D.C.: Executive Office of the President, January 1972), p. 26.

FIGURE II-2

U.S. PETROLEUM CONSUMPTION BY SECTOR



Source: Federal Register, January 13, 1977, p. 8.

Trends in Energy Consumption

The U.S. began to import petroleum shortly after the end of World War II. This coincides with the rise in automobile utilization by the American public after the War. Whereas automobile ownership was once considered a luxury, today, eight of every ten American households have at least one car and four in ten families have two cars or more.[3] There are currently over 100 million automobiles and over 25 million trucks, buses, and other assorted registered vehicles, four times the amount in 1945.[4]

The consequential growth in vehicle miles traveled (VMT) by these assorted vehicles (Figure II-3) and an increase in the miles each vehicle travels per year (Figure II-4) are largely responsible for the 4.3 percent annual transportation energy consumption

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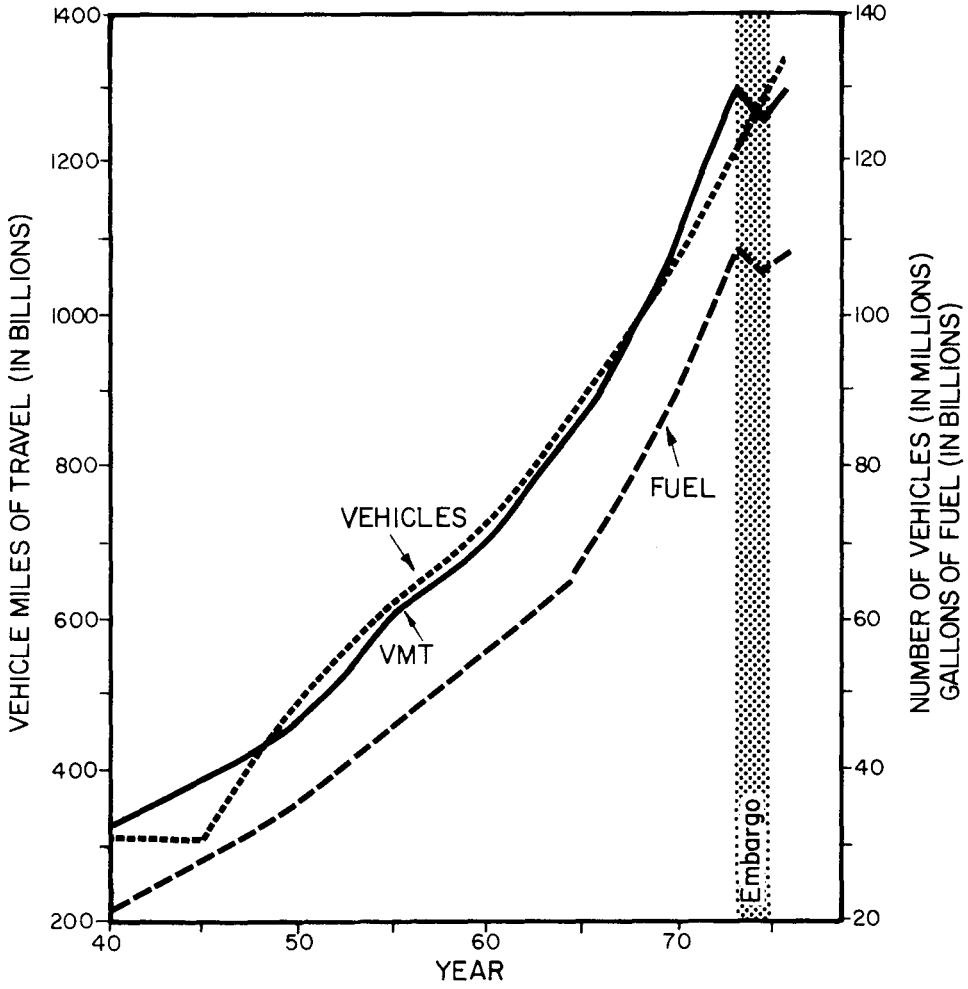
[3] Exploring Energy Choices, p. 4.

[4] Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, (Detroit, Michigan: Statistics Department, MVMA, 1976), p. 29.

growth rate since 1960.[5] These vehicle miles driven in the U.S. have doubled every 15 years since 1940 reaching 1.3 trillion miles in 1973.[6]

FIGURE II-3

NATIONAL VEHICLE MILES OF TRAVEL,
VEHICLES AND FUEL CONSUMPTION



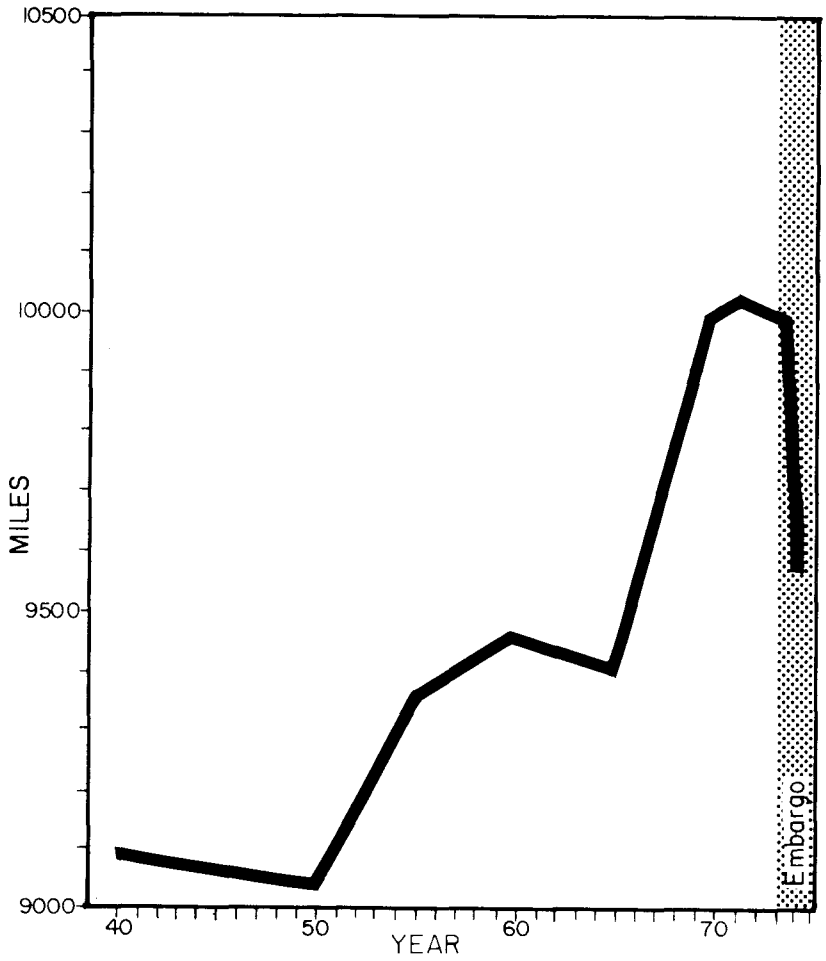
Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76.

[5] Exploring Energy Choices, p. 4.

[6] FHWA, Highway Travel Forecasts (Washington, D.C.: U.S. Government Printing Office, 1974), p. 11.

FIGURE II-4

AVERAGE ANNUAL MILES TRAVELED PER VEHICLE



Source: Taken from Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, p. 29.

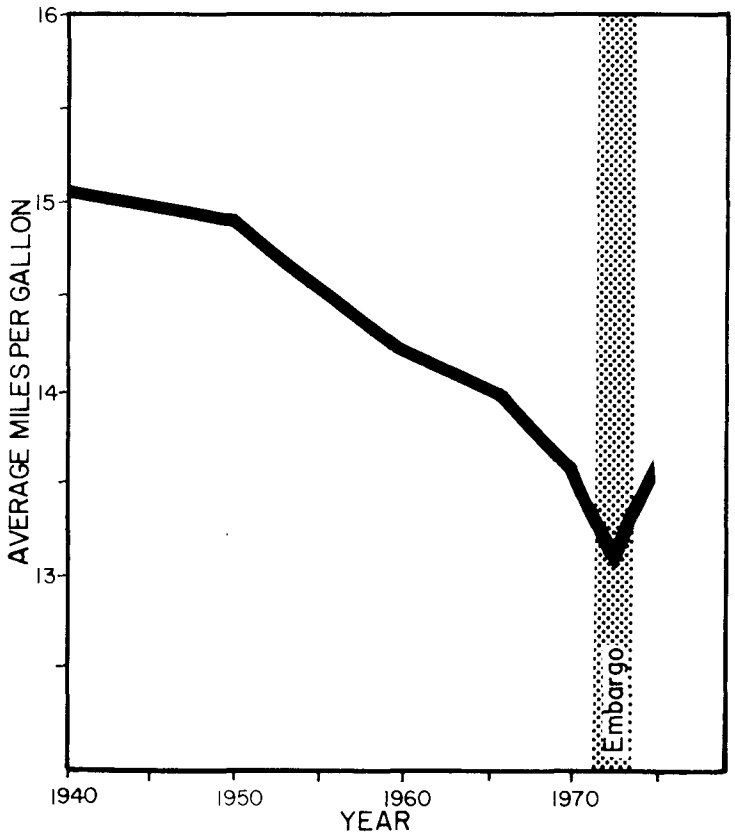
The rise in transportation energy consumption has also resulted from reduced vehicle efficiency. There has been a shift in both passenger and freight transport towards less energy efficient modes. In 1940, the average American car operated at over 15 miles per gallon of gasoline.[7] By 1973, this rate has dropped to 13 mpg mainly due to an increase in auto weight and the common use of accessories such as air conditioning, power steering, automatic transmission and emission control devices (Figure II-5). Since 1973, however, in response to government regulations which call for greater

[7] Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, p. 70.

auto energy efficiency, an increase in the miles per gallon for newly manufactured cars has resulted in a general increase in the fuel-efficiency of American automobiles (from 13 mpg in 1973 to 13.5 mpg in 1974).[8]

FIGURE II-5

AVERAGE FUEL EFFICIENCY
OF U. S. PASSENGER CAR FLEET



Source: Motor Vehicle Manufacturers Association, Motor Vehicle Facts and Figures '76, p. 70.

The rise of the automobile's importance in American society has resulted in a decrease in the utilization of transit and other more fuel-efficient modes. Automobiles, which carry about 85 percent of all inter-city and 95 percent of intra-urban passenger traffic

[8] Ibid.

are less efficient than modes such as railroads and buses which carry only 3 percent[9] of this traffic now, as compared to over 40 percent during World War II. Within the Intensive Study Area, automobiles carry over 88 percent of all work passengers compared to only 5.5 percent for buses[10] (Table II-1).

TABLE II-1

DAILY WORK TRIPS BY MODE

Dallas - Tarrant Counties

Mode	Trips	Percent
Private auto, driver	649,102	75.9
Private auto, passenger	106,722	12.5
Bus	47,105	5.5
Walked	21,365	2.5
Other (bicycle, etc.)	15,513	1.8
Worked at home	13,335	1.6
Taxi	1,226	0.1
Subway	593	<0.1
TOTAL	854,961	100.0

Source: U.S. Department of Commerce, 1970 Census of Population and Housing, Census Tracts, Dallas and Fort Worth, (Washington, D.C.: U.S. Government Printing Office, April 1972), Table P2. Taxi ridership from unpublished Census tabulations.

As Figure II-6 points out, a standard sized auto with one occupant is the least energy efficient of the most commonly utilized models for the journey to work. The superiority of transit and automobile ride-sharing with regard to energy efficiency is clearly evident from this figure.

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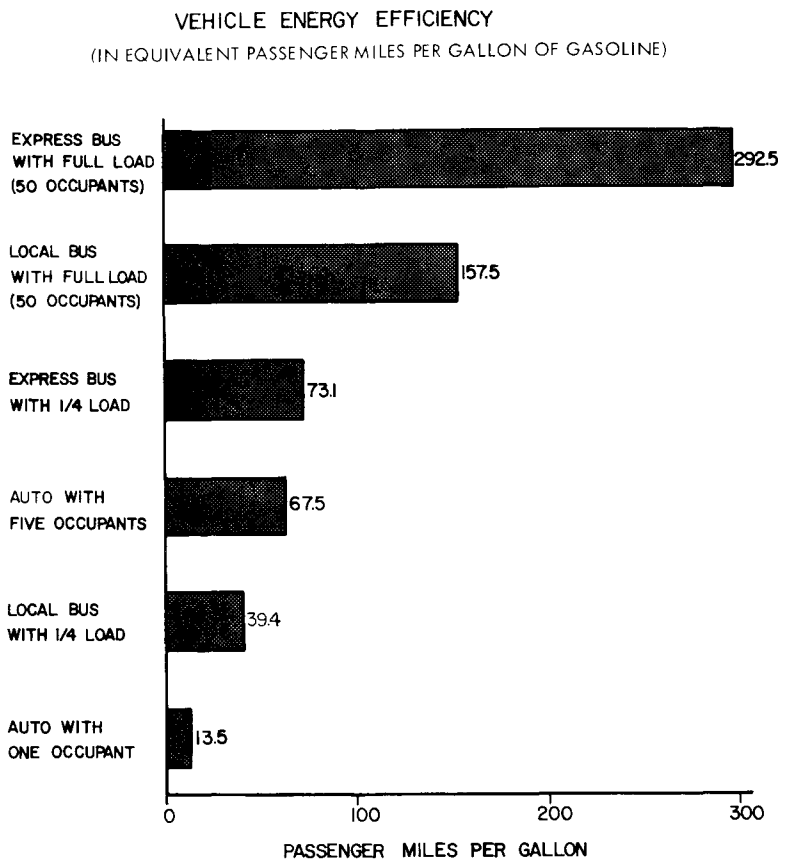
[9] Exploring Energy Choices, p. 5.

[10] U. S. Department of Commerce, 1970 Census of Population and Housing, Census Tracts, Dallas and Fort Worth SMSA, (Washington D.C.: U.S. Government Printing Office, April, 1972).

FIGURE II-6



Source: Barker, William G., Transportation and Limited Energy, North Central Texas Council of Governments, June 3, 1975, p. 8.

Other Transportation-Related Petroleum Uses

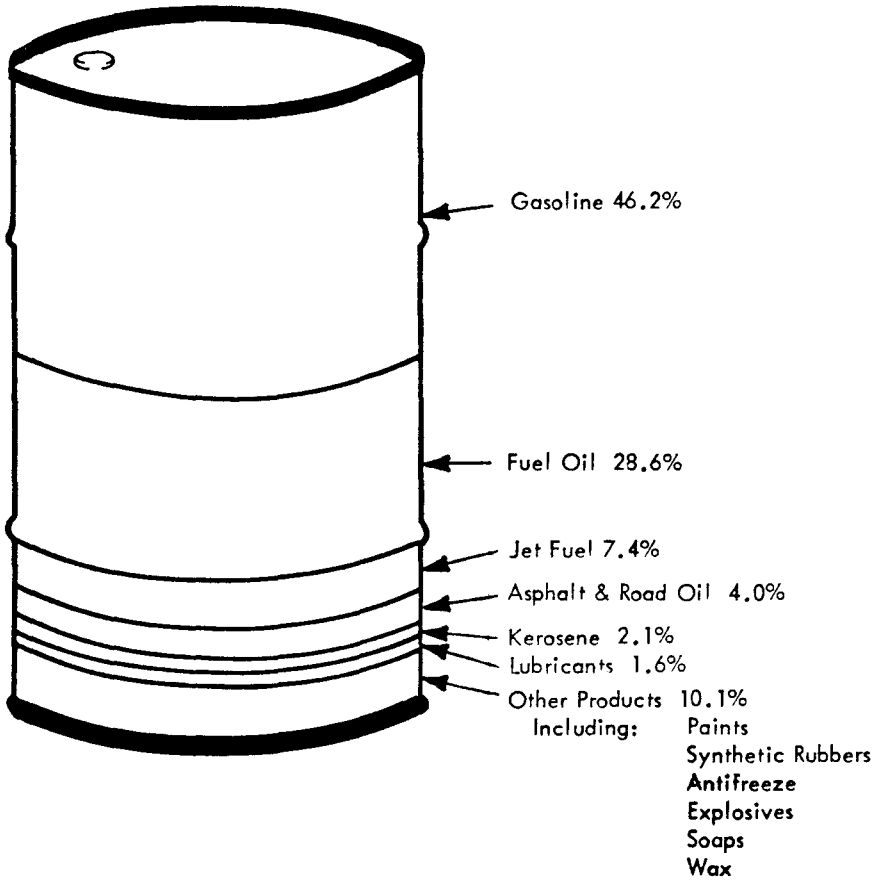
Besides the direct use of petroleum products for fuel, oil is very important to other aspects of the transportation industry. For example, petroleum-based products are extensively used in highway construction. Approximately 94,000 gallons of petroleum products are used in the construction of one lane-mile of highway.[11] In addition,

[11] U.S. Department of Transportation, Federal Highway Administration, Highway Statistics 1974, (Washington, D.C.: U.S. Government Printing Office, 1974), p. 104.

numerous other products, including synthetic rubber for tires, paints, lubricants and antifreeze, used extensively in the transportation industry, are manufactured from petroleum (Figure II-7). Other indirect uses of energy for automobiles include energy used in such processes as petroleum refining, automobile manufacturing, automobile sales, and auto repairs and maintenance. Figure II-8 depicts these indirect and direct uses of energy for automobiles.

FIGURE II-7

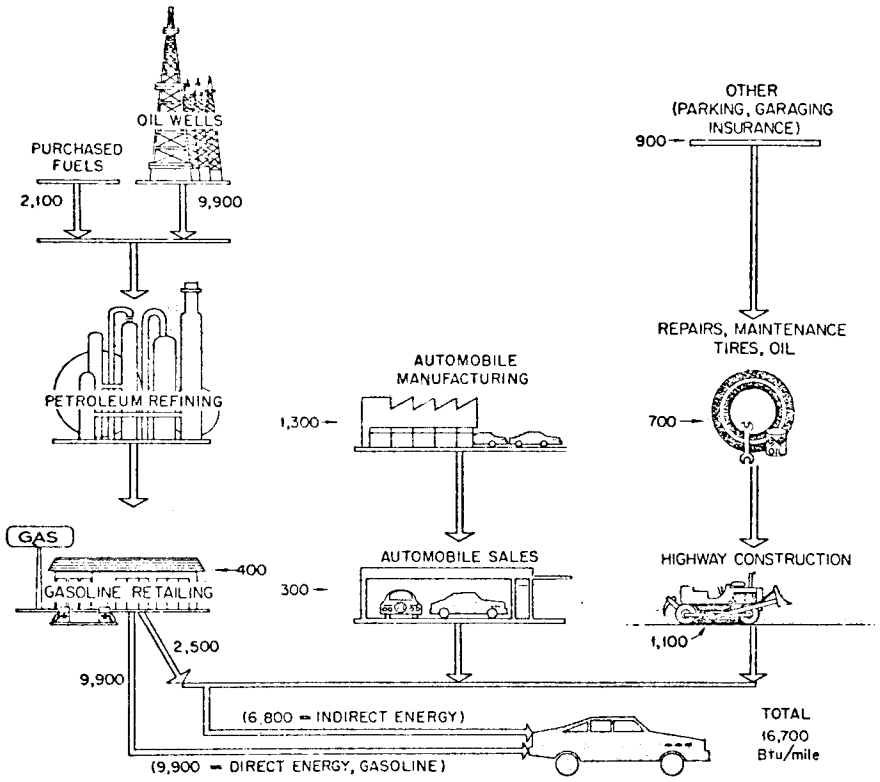
WHAT A BARREL OF CRUDE OIL PROVIDES



Source: U.S. Bureau of Mines, Mineral Yearbook, 1971.

FIGURE II-8

DIRECT AND INDIRECT ENERGY USE FOR AUTOMOBILE, 1971



Source: Eric Hirst, Direct and Indirect Energy Requirements for Automobiles (Oak Ridge, Tennessee: Oak Ridge National Laboratory, February, 1974) p. 14.

Conclusions

The discussion in this chapter has identified the importance of energy, and more specifically, petroleum in transportation. The current high dependence of transportation on petroleum and petroleum products, combined with the uncertainty of obtaining sufficient supplies of this product, is a complex situation which became a serious problem during the winter of 1973-1974 when Arab oil suppliers stopped importing petroleum to the United States. The following chapter examines the impact of this petroleum shortfall on national and local transportation.

III. Impact of the Oil Embargo

The impact of the 1973-1974 oil embargo was felt throughout all sectors of American society. The public, for the first time, came to the realization that the era of cheap, plentiful fuel had come to an end. Many Americans were awakened to the need to conserve energy, even to the extent of modifying their life styles. Through a series of governmental actions and pleas for conservation, numerous federal, state and local energy saving policies were initiated, and transportation, due to its high dependence on petroleum and apparent large potential for energy savings, became a major target for these conservation policies.

The impacts of the embargo manifested themselves differently at the various levels of observation: national, state, and local. The following discussion briefly identifies the major national changes and examines the local impact in a more detailed manner.

Extent of the Embargo

At the time of the embargo, the Arab nations were supplying approximately 14 percent of America's oil supply.[1] By December 1973, due to the Arab boycott and curtailed supplies by other nations, imports to the U. S. were 22 percent lower than they had been in October 1973. As can be seen in Table III-1, the degree of Arab boycott participation varied for each country. Some nations, such as Kuwait and Iraq, halted all oil exports while others, such as Saudi Arabia and Libya, allowed reduced shipments to be

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[1] Federal Energy Administration, Project Independence, November, 1974.
It should be noted that not all Middle East oil suppliers participated in the embargo. Those participating included Algeria, Iraq, Kuwait, Libya, Qatar, Saudi Arabia and the United Arab Emirates. Iran, a non-Arab Muslim nation did not support the boycott.

TABLE III-1

EMBARGO PERIOD CRUDE OIL IMPORTS
TO THE UNITED STATES
(THOUSANDS OF BARRELS)

Country of Origin	1973 September	1973 October	1973 November	1973 December	1973 Total
Algeria*	3,715	3,690	891	28	43,619
Angola	621	2,901	2,584	1,509	17,753
Bolivia	196	400	--	295	891
Canada	29,951	29,789	28,693	25,908	365,370
Columbia	--	--	--	294	778
Ecuador	986	1,523	1,132	1,933	17,229
Egypt*	--	782	--	--	5,296
Indonesia	7,470	4,789	6,173	8,074	73,055
Iran	6,165	7,544	7,318	13,768	78,990
Iraq*	515	364	505	--	2,034
Kuwait*	1,334	1,724	1,393	--	14,703
Libya*	4,603	5,095	3,748	579	48,585
Mexico	237	5	--	--	489
Nigeria	12,278	15,976	13,187	16,371	163,687
Qatar*	1,222	543	273	74	2,663
Saudi Arabia*	17,967	23,075	18,493	5,663	168,525
Trinidad	1,810	1,991	1,776	2,029	21,739
Tunisia	244	672	596	840	6,541
U.A.R.*	2,652	1,920	3,197	--	25,764
Venezuela	12,151	13,113	13,611	12,268	125,742
Total Imported**	104,117	115,905	103,570	89,633	1,183,996

* Nations participating in the embargo

** Includes other sources not listed

Source: Energy Facts II, Science Policy Research Division, Congressional Research Service, August 1975, p. 286.

continued. Table III-2 shows the national petroleum shortage for selected months during this embargo period. The greatest shortfall occurred during February 1974, when the available fuel supply was nearly 17 percent less than the unconstrained demand.

TABLE III-2

ESTIMATED EMBARGO PETROLEUM SHORTAGES
(MILLIONS BARRELS/DAY)

	1973 Oct-Dec (Avg.)	1974 Jan	Feb	Oct-Feb (Avg.)
1. Unconstrained Demand a/	18.8	20.1	20.9	19.5
2. Domestic Production b/	10.9	10.6	10.9	10.8
3. Imports b/	6.4	5.4	5.2	6.0
4. Changes in Stocks b/	-0.1	-1.1	-1.0	-0.5
5. Total Consumption b/	17.7 c/	17.3	17.4	17.6
Shortfall (1) - (5)	1.1	2.8	3.5	1.9
Percent Shortfall d/	5.9%	13.9%	16.7%	9.7%

a/ Estimated by FEA as being the demand that would have occurred in the absence of the embargo.

b/ Source: Bureau of Mines. Data are not available for March 1974.

c/ Total consumption is not the sum of 2,3 and 4 because of rounding errors and because exports and processing gains have been omitted.

d/ Percent shortfall is shortfall as percent of unconstrained demand.

Source: Federal Energy Administration, The Economic Impact of the Oil Embargo on the American Economy, August 8, 1974, p. 2.

Federal Government Response

Recognizing that a shortfall of this magnitude in America's oil supply would have a disastrous effect on the national economy, President Nixon addressed the public on November 7, 1973, to urge public conservation by stressing transportation-related measures such as restricting maximum highway speed limits (initially to 50 mph) and

encouraging individuals to voluntarily drive less to conserve gasoline. In a second speech on November 25, the President requested that all gasoline stations be voluntarily closed on Sundays and again stressed the need for energy conservation. At the same time, numerous governmental and private organizations produced media campaigns aimed at educating the public on energy conservation needs and actions.

When it appeared that voluntary conservation measures would not be sufficient to handle the oil shortfall, the Federal Government adopted legislation which required mandatory conservation actions. The Emergency Petroleum Allocation Act of November, 1973, initiated price controls and mandatory fuel supply allotments to service stations and other end users. The Emergency Highway Energy Conservation Act of January, 1974, set the legal maximum highway speed limit at 55 miles per hour. Additionally, the Federal Energy Office (FEO) was established during this time to coordinate and administer this federal policy. Table III-3 lists the major developments during this period.

Public Awareness

Perhaps the most significant change during the "energy crisis" was the realization by the public of the existing energy problem. This was often demonstrated by public participation and interest in voluntary energy conservation programs and manifested by changes in personal travel habits.

Public opinion and reaction to the crisis in the Dallas-Fort Worth metropolitan area differed in some ways from that of the nation as a whole. When asked in a 1975 poll,[2] "How important a problem do you feel the energy shortage is for this country?", fully 60 percent of the national respondents indicated that it was a "most important" or

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[2] James R. Murray, et. al., The Impact of the 1973-1974 Oil Embargo on the American Household (Chicago: National Research Center, University of Chicago, December, 1974), p. 177.

TABLE III-3

SIGNIFICANT EVENTS AND DATES
1973-1974 ENERGY SHORTAGE

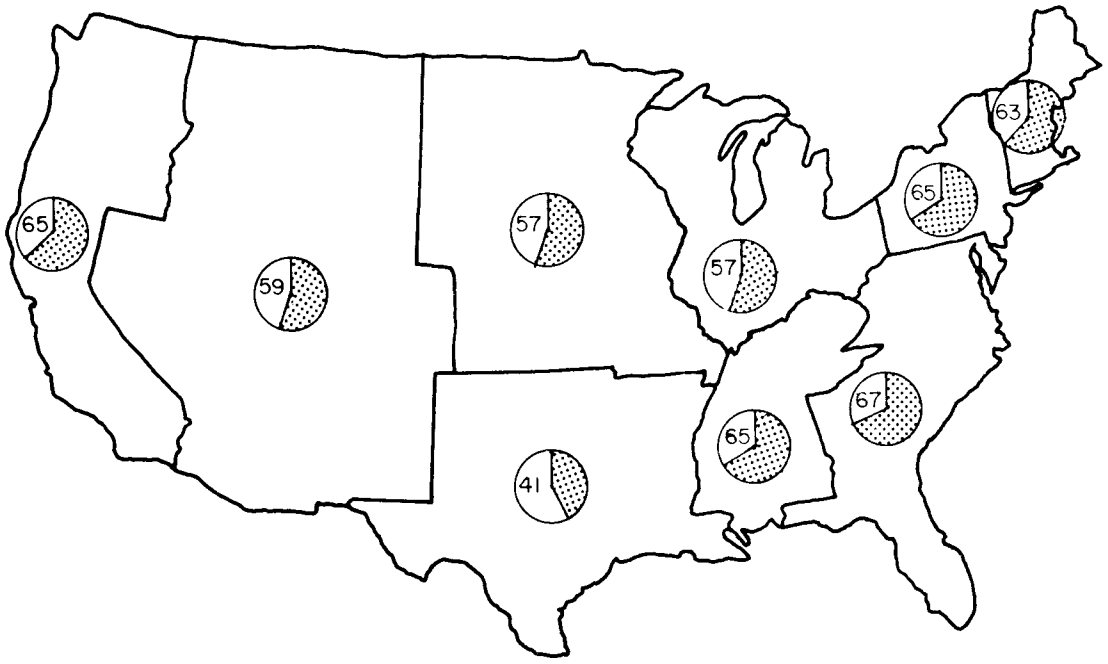
Date	Event
October 6, 1973	Arab-Israeli "Yom Kippur"War begins
October 19, 1973	Oil embargo imposed by Arab exporters
October 24, 1973	Yom Kippur war ends, Israel occupies Arab territory
November 7, 1973	President Nixon's Energy Message to the Nation asks for voluntary conservation measures
November 16, 1973	Alaska Pipeline Bill signed
November 25, 1973	President Nixon requests voluntary ban on Sunday gasoline sales
November 27, 1973	Emergency Petroleum Allocation Act passed
December 4, 1973	Federal Energy Office (FEO) established
December 23-25, 1973	Arab oil producers more than double oil price ($5.12 to $11.65 barrel)
December 27, 1973	Emergency Petroleum Allocation Act (EPAA) becomes effective - provides for mandatory allocation and price controls
January 2, 1974	Emergency Highway Energy Conservation Act passed. Speed limit set at 55 mph.
March 18, 1974	Oil embargo of U.S. supplies ends
May 7, 1974	Federal Energy Administration Act passed, FEA established
June 27, 1974	Functions of FEO transferred to FEA
December 15, 1975	Energy Policy and Conservation Act enacted outlined Federal authority to ration and impose other controls

EMBARGO

"very important" problem. In the four state Southwest region, which includes Texas, public concern was not as great (Figure III-1), since only 41 percent of those asked viewed energy as a "most important" or "very important" problem.

FIGURE III-1

HOW IMPORTANT A PROBLEM DO YOU FEEL
THE ENERGY SHORTAGE IS FOR THIS COUNTRY?



Source: National Opinion Research Center, Continuous National Survey, 1974.

The results of an identical question which was included in a North Central Texas Council of Governments Urban Panel Survey[3] of local residents conducted from January through April, 1976, indicated that a surprisingly high 78 percent of Intensive Study Area respondents

[3] North Central Texas Council of Governments, Urban Panel Project, 1976, Arlington, Texas, September, 1976.

view the energy crisis as a most or very important problem. The differences between the Urban Panel response and the National Opinion Research Center results could be a result of the high degree of urbanization in the Dallas-Fort Worth area, rising local utility bills, and the great amount of publicity given the energy issue over the years between the two surveys. In any case, these results point to the current high degree of local public awareness of the national energy problem as a consequence of the 1973-1974 embargo.

Economic Impact

The fuel shortage and petroleum price increases which resulted from the oil embargo produced severe national economic problems as well as significant changes in the life-style of many Americans. As fuel for industry was curtailed, increased unemployment and a reduced level of economic activity became serious national problems. Meanwhile, the difficulties in purchasing gasoline and the subsequent cost increases were instrumental in altering the travel habits of many individuals.

The impact on the economy was examined through a series of studies undertaken by the U. S. Department of Commerce.[4] These studies concluded that economic difficulties existing prior to the embargo, such as a weak housing market, were compounded by the embargo and produced a significant impact on economic growth, unemployment, income distribution and industrial output.

In addition, other economic indicators during the embargo time frame suggested that a delayed adverse "rippling" effect occurred in many industries. The economic slowdowns caused by the embargo produced a recessionary condition which lingered into 1975. The

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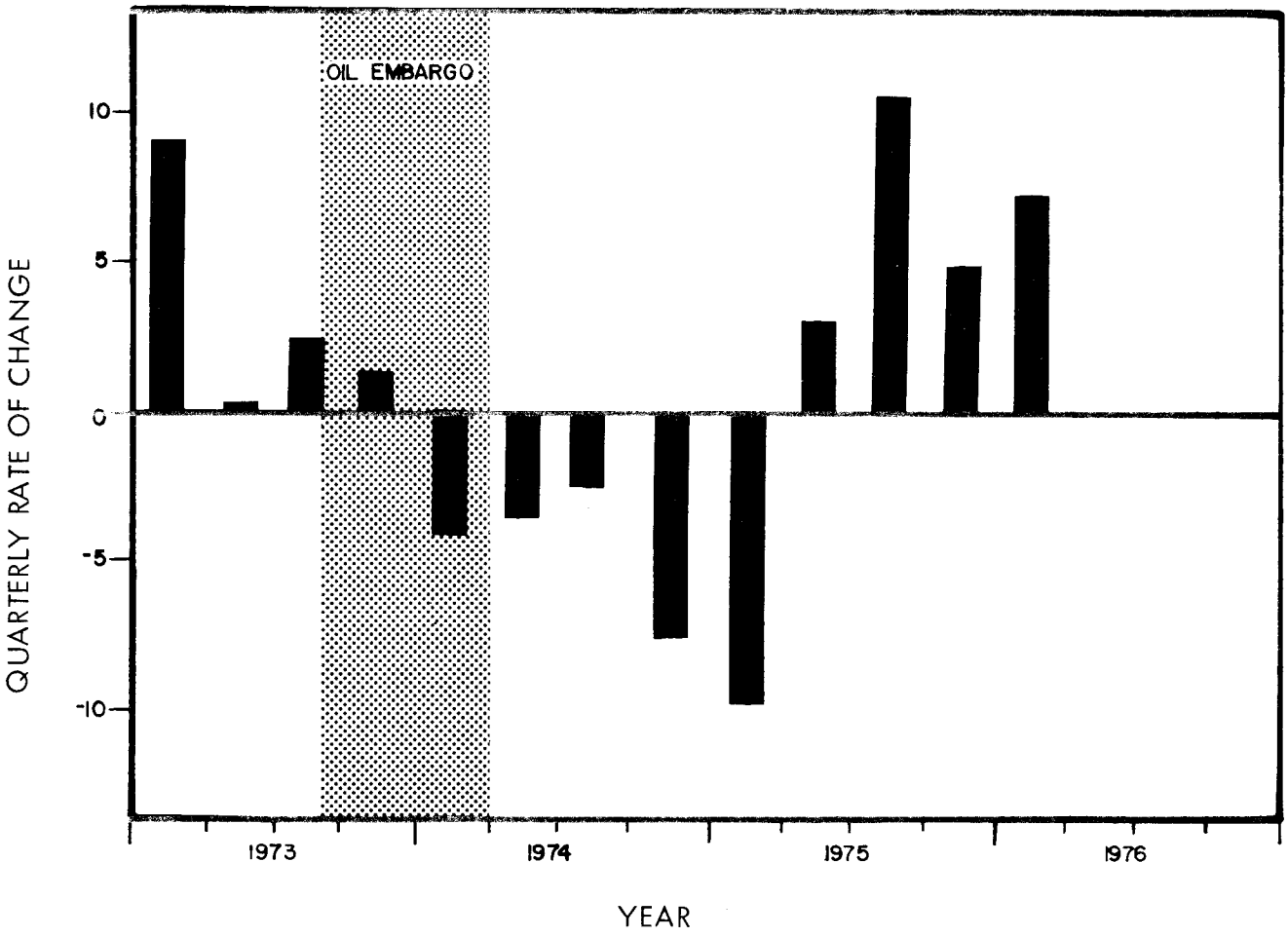
[4] These studies are summarized in: Office of Technology Assessment, U. S. Congress, Energy, the Economy and Mass Transit (Washington, D. C.: December, 1975), p. 33.

Gross National Product (Figure III-2) and industrial production indices (Figure III-3) were most affected during the latter part of 1974 and early 1975, after the embargo had been lifted.[5]

FIGURE III-2

REAL GROSS NATIONAL PRODUCT

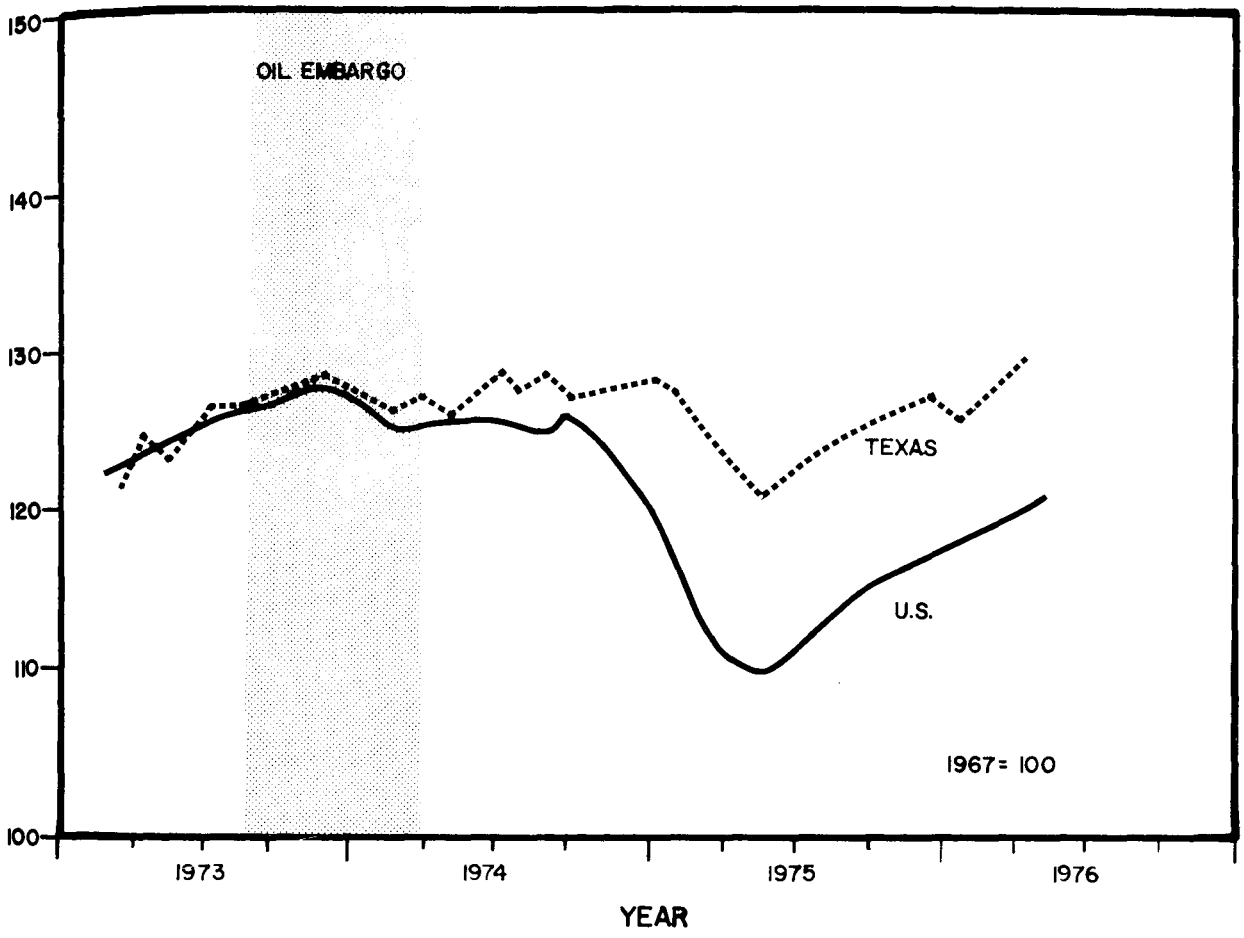


Source: First City Bancorporation of Texas, Financial Facts, April 1976.

[5]First City Bancorporation of Texas, Inc., Economics Department, Financial Facts (Houston, 1976).

FIGURE III-3

INDUSTRIAL PRODUCTION INDEX
TEXAS AND UNITED STATES



Source: First City Bancorporation of Texas, Financial Facts, April 1976.

The fuel shortage and higher pump prices produced far-reaching effects on many governmental and commercial activities in the Intensive Study Area. As could be expected, industries dealing directly with transportation-related activities, such as automobile dealers and service stations, were the most adversely affected, although nearly all economic activities felt the impact.

In many communities of the Intensive Study Area, retail sales from these auto-related businesses constitute a large proportion of total sales (Appendix A). Any slow-down in these businesses could, therefore, have a significant effect on community prosperity.

Higher transportation costs and fuel shortages also strained many local municipal government budgets to the extent that vital services were often curtailed. Because auto travel was reduced, state gasoline sales declined, and, Texas state gasoline tax revenues decreased by over four percent from 1973 to 1974 (Table III-4) . This meant that less money was available for local highway construction and maintenance.

TABLE III-4

TEXAS MOTOR FUEL TAX RECEIPTS

1970-1974

Fiscal Year	Revenue ('000's)	% Change from Previous Year
1970	$ 231,104	----
1971	$ 248,190	+ 7.4
1972	$ 262,078	+ 5.6
1973	$ 290,534	+ 10.9
1974	$ 278,359	- 4.2

Source: U.S. Department of Transportation, FHWA, Highway Statistics (Washington, D.C.: U.S. Government Printing Office, 1970-1974).

Employment

National unemployment increased significantly during and after the embargo, especially in industries which are highly dependent on petroleum. The Office of Technology Assessment of the U. S. Congress reported that:

> In terms of specific impacts, as might be expected, the repercussions were most serious on energy-dependent industries such as recreation, gasoline stations, airlines, and automobile and recreation vehicle manufacturing, etc. The Department of Labor estimated that for the period November 1973 to March 1974, 150,000 to 225,000 jobs were lost as a direct result of petroleum shortages, and an additional decline of about 310,000 jobs occured indirectly. Thus, the total short run impact of the embargo on unemployment was a loss of about 0.5 percent of the civilian labor force.[6]

Table III-5 lists the major national industries which have been identified as sensitive to the energy shortage. It should be noted that the causes for this unemployment differed for each industry: some reduced employment due to the difficulty in obtaining petroleum supplies (plastics); some were affected due to a change in consumer buying patterns which may be associated with a concern for the energy crisis (automobile, recreational vehicles) and others due to the general reduction in public travel and economic activity (hotels, air transportation). Locally, employment was not affected to any great extent directly by the energy shortage. While energy-related unemployment equalled eight to nine percent of the total national unemployment, it constituted less than one percent of the total Texas state claims.[7]

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[6] Office of Technology Assessment, U. S. Congress, Energy, The Economy and Mass Transit, p. 33.

[7] U. S. Department of Labor, Secretary of Labor's Report on the Impact of Energy Shortages on Manpower Needs, March 27, 1974.

TABLE III-5

Total Reduction of Employment
November 1973 - March 1974
in Selected Industries
Sensitive to Energy Shortages
(Seasonally adjusted)

Industry	Approx. Employment Reduction Due to All Causes	Percent Reduction in Employment
Automotive and Auto Related	237,000	9.2
Retail Gasoline Service Stations	64,000	10.3
Basic Steel Products	27,000	4.3
Hotels, Motels, and Other Lodgings	27,000	3.0
Misc. Transportation Equipment- Motorcycles, Bicycles, Trailers, Recreational Vehicles, etc.	22,000	14.5
Transportation by Air 1/	15,000	5.4
Aircraft and Parts	11,000	2.1
Special Trade Contractors	9,000	.5
Laundry and Dry Cleaning Establishments	9,000	2.2
Real Estate	7,000	.9
Misc. Plastics Products	4,000	1.1
Boat Building	No significant Change	—
Trucking	"	—

1/ This estimate excludes returning strikers.

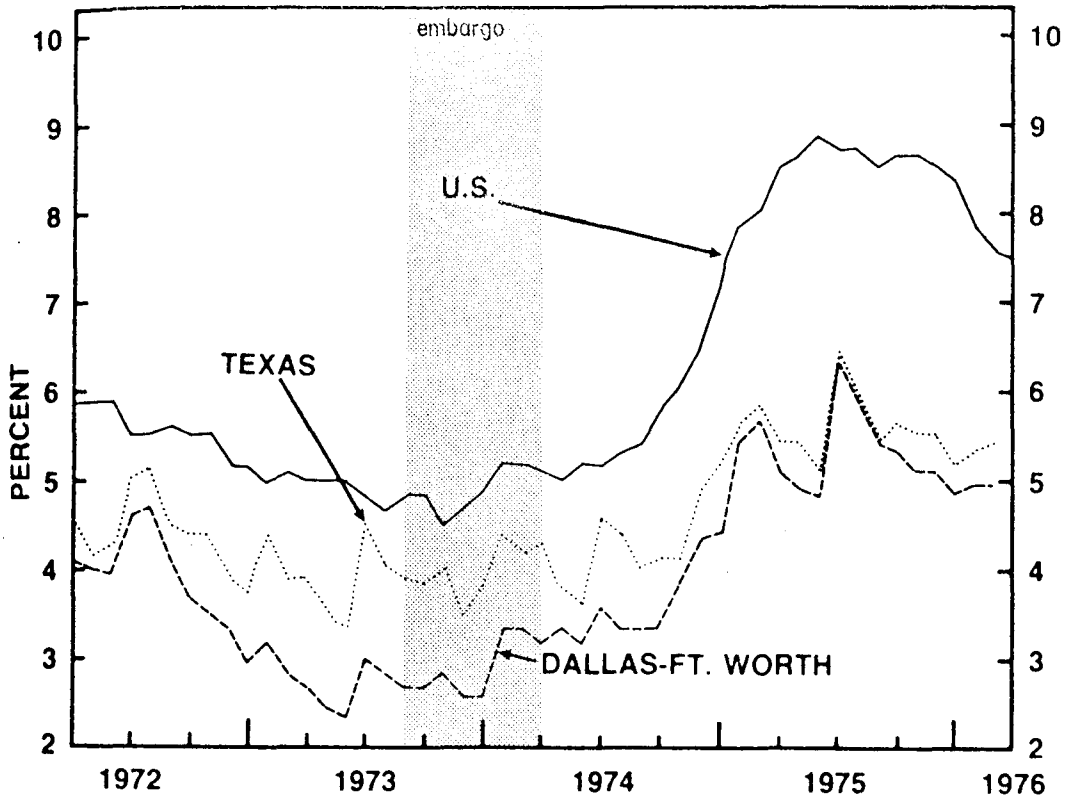
Source: Office of Economic Impact, FEA, The Economic Impact of the Oil Embargo on the American Economy, August 8, 1974.

As can be seen in Figure III-4, the unemployment rate in Dallas-Fort Worth has remained consistently below the national and state rates. During the embargo period, however, local unemployment increased by nearly one percent, an increase greater than that

experienced nationally. The delayed impact of the embargo on unemployment and the subsequent recession of 1975 can also be seen by this figure.

FIGURE III-4

UNEMPLOYMENT RATES



Source: First City Bancorporation of Texas, Financial Facts, April, 1976.

Cost of Living and Transportation

The average pump price for a gallon of regular gasoline in the Dallas-Fort Worth area rose from 35 cents in October 1973 to over 50 cents by April 1974 (Table III-6). Spurred on by these higher fuel process and more expensive petroleum-based products, the cost

of transportation rose dramatically during the crisis period (Figure III-5). The transportation price index further indicated that during this time, transportation costs increased twice as rapidly in the Intensive Study Area as in the nation on the whole (a 12 percent increase versus a 6 percent gain). Figure III-6 indicates that the previous sharp growth of consumer prices was moderated during the embargo period. In the Dallas-Fort Worth area, however, consumer prices increased at a rate greater than the national average. Although these above average rates of increase can be accounted for in part by the initial low base prices locally, they nonetheless indicate that local residents can no longer expect to experience the economical advantages once enjoyed over other urban areas.

TABLE III-6

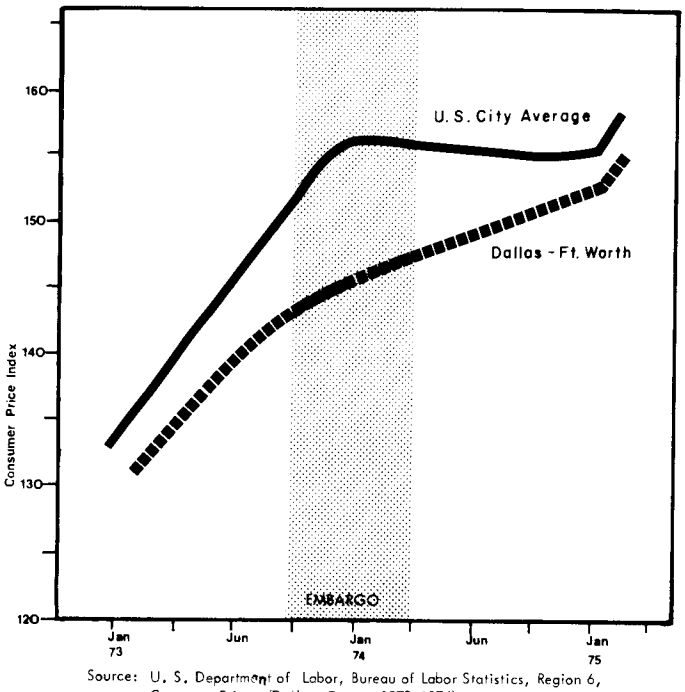
INTENSIVE STUDY AREA GASOLINE PUMP PRICES

Month		Regular Gasoline	Premium Gasoline
October, 1973	EMBARGO	$ .352	$ .389
November, 1973		.365	.400
December, 1973		.382	.420
January, 1974		.417	.452
February, 1974		.449	.484
March, 1974		.487	.524
April, 1974		.503	.537
May, 1974		.507	.540
June, 1974		.515	.547
July, 1974		.511	.548
August, 1974		.512	.550
September, 1974		.507	.546
October, 1974		.497	.536
November, 1974		.484	.523
December, 1974		.484	.524
January, 1975		.484	.527

Source: Bureau of Labor Statistics, Consumer Prices (Dallas, Texas: July 23, 1976).

FIGURE III-5

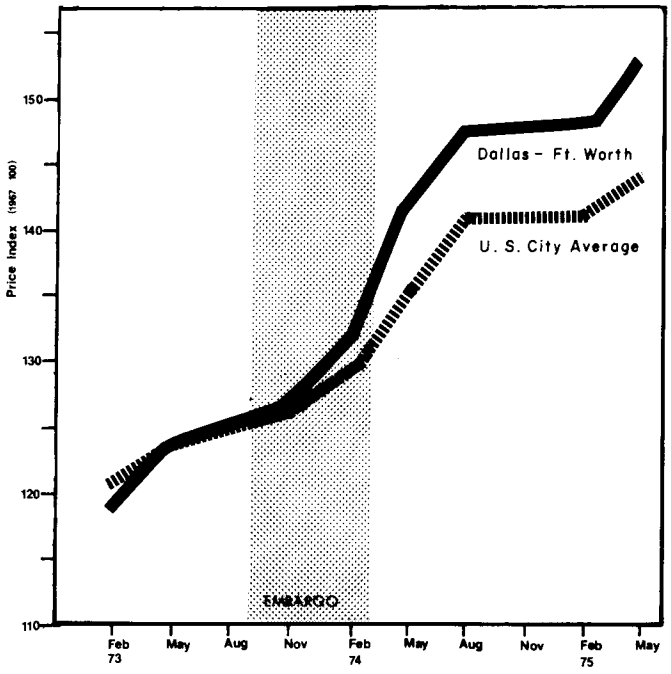
CONSUMER PRICE INDEX CHANGES



Source: U. S. Department of Labor, Bureau of Labor Statistics, Region 6, Consumer Prices (Dallas, Texas: 1973-1974).

FIGURE III-6

CONSUMER TRANSPORTATION PRICE INDEX CHANGES



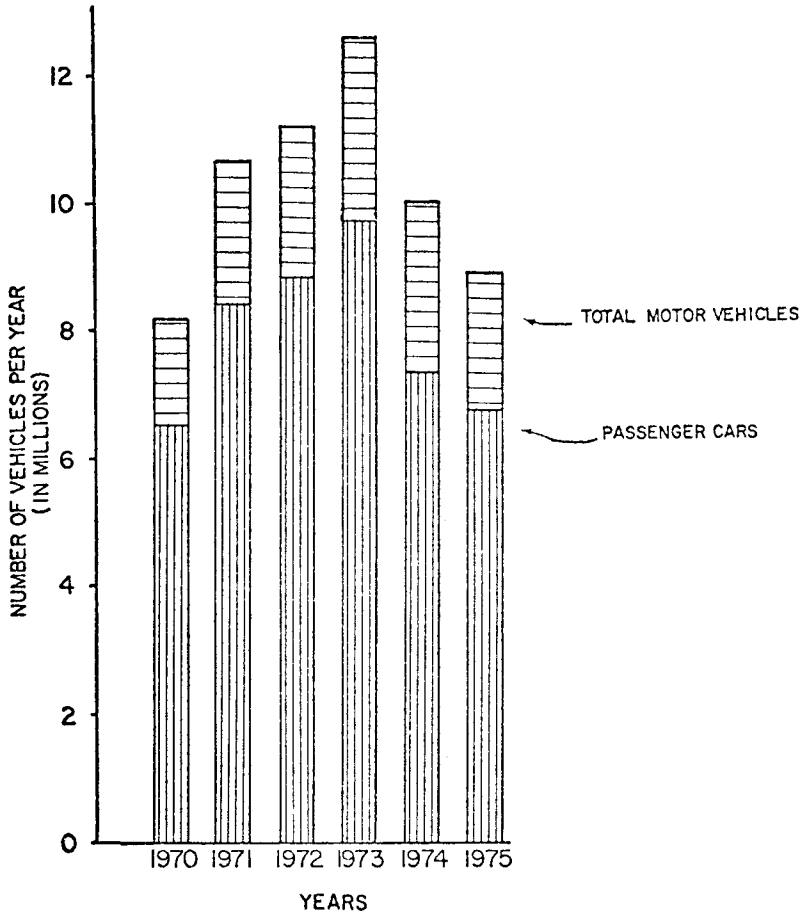
Source: U. S. Department of Labor, Bureau of Labor Statistics, Region 6, Consumer Prices (Dallas, Texas: 1973-1974).

Motor Vehicle Production and Sales

The embargo had a major indirect effect on the motor vehicle manufacturing industry because the energy shortage affected consumer demand for new cars. On a yearly basis, new motor vehicle sales in 1974 were over 20 percent lower than in 1973, during which time a record 12,637,335 new vehicles were sold (Figure III-7). Moreover, 237,000 workers or 30 percent of the industries' total labor force was laid off on a temporary or permanent basis.[7]

FIGURE III-7

ANNUAL U.S. MOTOR VEHICLE FACTORY SALES



SOURCE: MOTOR VEHICLE MANUFACTURING ASSOC., MOTOR VEHICLE FACTS & FIGURES '76.

[7] Office of Technology Assessment, The Economic Impact, p. 20.

Locally, the number of automobiles assembled at the General Motors Assembly plant in Arlington dropped over 17 percent from 1973 to 1974. In addition, employment at the factory decreased 4.8 percent during this period (Table III-7).[8]

TABLE III-7

AUTOMOBILE ASSEMBLIES AND EMPLOYMENT
GENERAL MOTORS ASSEMBLY DIVISION
ARLINGTON, TEXAS

Year	Number of Autos Assembled	Percent Change from 1973	Number of Employees	Percent Change from 1973
1973	241,762	-	4,200	-
1974	198,900	-17.7	4,000	-4.8
1975	209,500	-13.3	4,100	-2.4
1976	260,859	+ 7.9	4,220	+0.5

Source: General Motors Public Relations Department, Dallas, March, 1977.

[8] General Motors Public Relations Department, Dallas, March, 1977.

One of the most significant impacts on the sales, production, and earnings of the motor vehicle industry was felt in the passenger car segment. Consumer preferences shifted toward smaller cars, both domestic and imported. While compacts and sub-compacts increased their share of the market by over 20 percent, the standard size cars share declined by an equal percent (Table III-8).[9]

TABLE III-8

NEW CAR SALES -- 1973 versus 1974

Auto Class	1973 Sales (Millions)	Per Change in Market Penetration March '73 - March '74
Low Specialty	0.7	62.4
Compact	1.6	28.5
Subcompact	1.1	6.5
Luxury	0.3	-1.6
Intermediate	2.2	-3.6
Standard	1.8	-20.6
High Specialty	0.4	-22.5
Medium	1.5	-31.7

Source: Federal Energy Administration, Office of Economic Impact, The Economic Impact of the Oil Embargo, p. 20.

9. Office of Technology Assessment, The Economic Impact, p. 20.

While there were economic losses and inventory problems, the national auto dealership failure rate was low: 102 dealerships out of approximately 26,000 failed in the first quarter of 1974. While this is comparatively small percentage (0.39%) it should be noted that only 14 failed during the first quarter of 1973.[10]

Locally, new 1974 motor vehicle (automobiles, motorcycles, trucks, motor homes) sales declined by over 20 percent from 1973 (Table III-9). The early months of 1974 experienced especially large decreases of over 30 percent as shown by the Dallas County breakdown in Table III-10.[11]

TABLE III-9

MOTOR VEHICLE SALES*

Year	County		Total	Change
	Dallas	Tarrant		
1973	123,824	56,906	180,730	
1974	96,133	46,878	143,011	-20.9%
1975	98,664	47,816	146,080	+ 2.2

*Includes automobiles, motorcycles, motor homes, trucks, buses

Source: The Freeman Auto Report (Freeman Publishers: Dallas, 1973-1975).

10. Ibid, p. 21.

11. The Freeman Auto Report (Dallas, Texas: Freeman Publishers, 1973-1975).

TABLE III-10

MONTHLY MOTOR VEHICLE SALES
DALLAS COUNTY
(1973-1974)

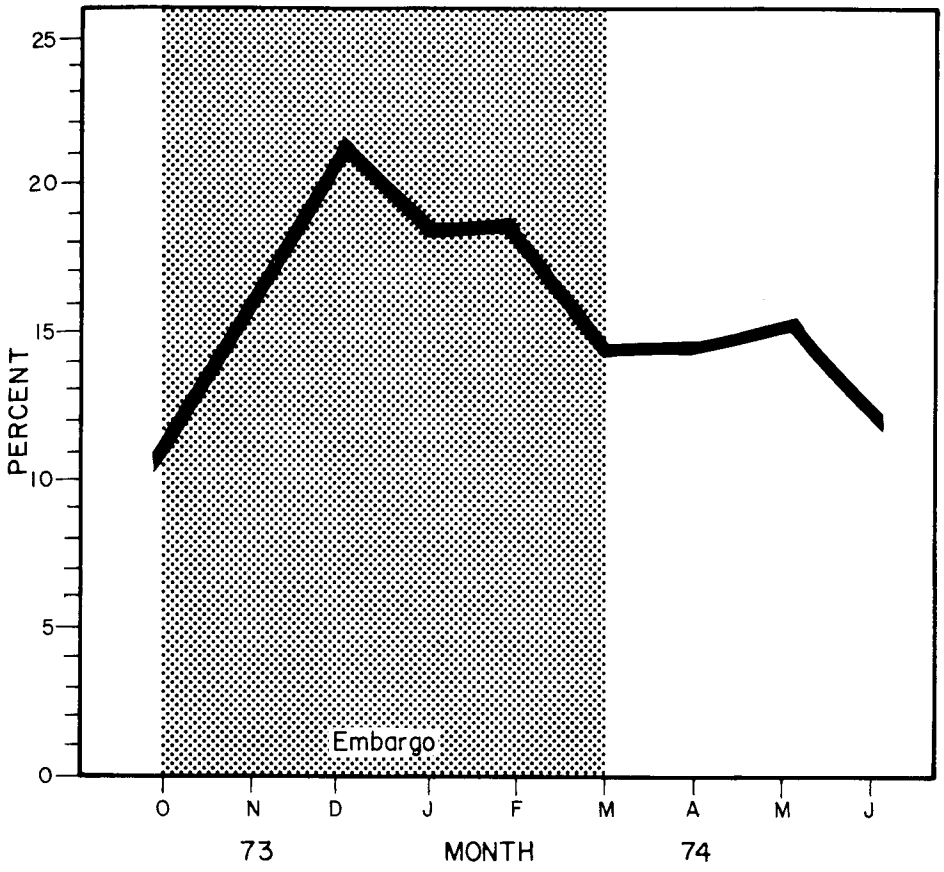
Month	1973	1974	Percent Change
January	7520	5262	-30.0
February	8413	5535	-34.2
March	9158	6952	-26.2
April	8583	6753	-21.3
May	10436	7645	-26.7
June	9066	7488	-17.4

Source: The Freeman Auto Report (Freeman Publishers: Dallas, 1973-1975).

During this period, foreign car sales represented an increasingly larger share of the auto market, from 10 percent prior to the embargo to over 20 percent of the market by December, 1973 (Figure III-8). This figure also indicates that, by the summer of 1974, foreign car sales declined to a pre-embargo share of the local automobile market.

FIGURE III-8

FOREIGN CAR SALES AS A PERCENT OF TOTAL
(DALLAS-TARRANT COUNTIES)



Source: The Freeman Auto Report Monthly Recapitulation, Freeman Publishers 1973-1974, Dallas, Texas.

Sales of the smaller model domestic cars also increased as more customers demanded better gasoline mileage to cope with increasing fuel costs. As Table III-11 indicates, sales of compact cars in Dallas and Tarrant Counties have increased since the embargo period.

TABLE III-11

SELECTED COMPACT VERSUS STANDARD SIZED AUTO SALES DALLAS AND TARRANT COUNTIES

(1973, 1975)

Model	Pre-Crisis Sales (%)* (1973)	Post-Crisis (%) (1975)
Buick Standard	61.7	54.0
Buick Compact	38.7	46.0
Dodge Standard	64.0	59.6
Dodge Compact	36.0	40.4
Mercury Standard	53.6	51.1
Mercury Compact	46.4	48.9
Oldsmobile Standard	45.4	45.7
Oldsmobile Compact	54.6	54.3
Plymouth Standard	57.7	47.7
Plymouth Compact	42.3	52.3
Pontiac Standard	68.4	49.6
Pontiac Compact	31.6	50.4
Total Standard	57.7	50.1
Total Compact	42.3	49.9

Source: The Freeman Auto Report (Freeman Publishers: Dallas, 1973, 1975).

*Percent of total sales for each model.

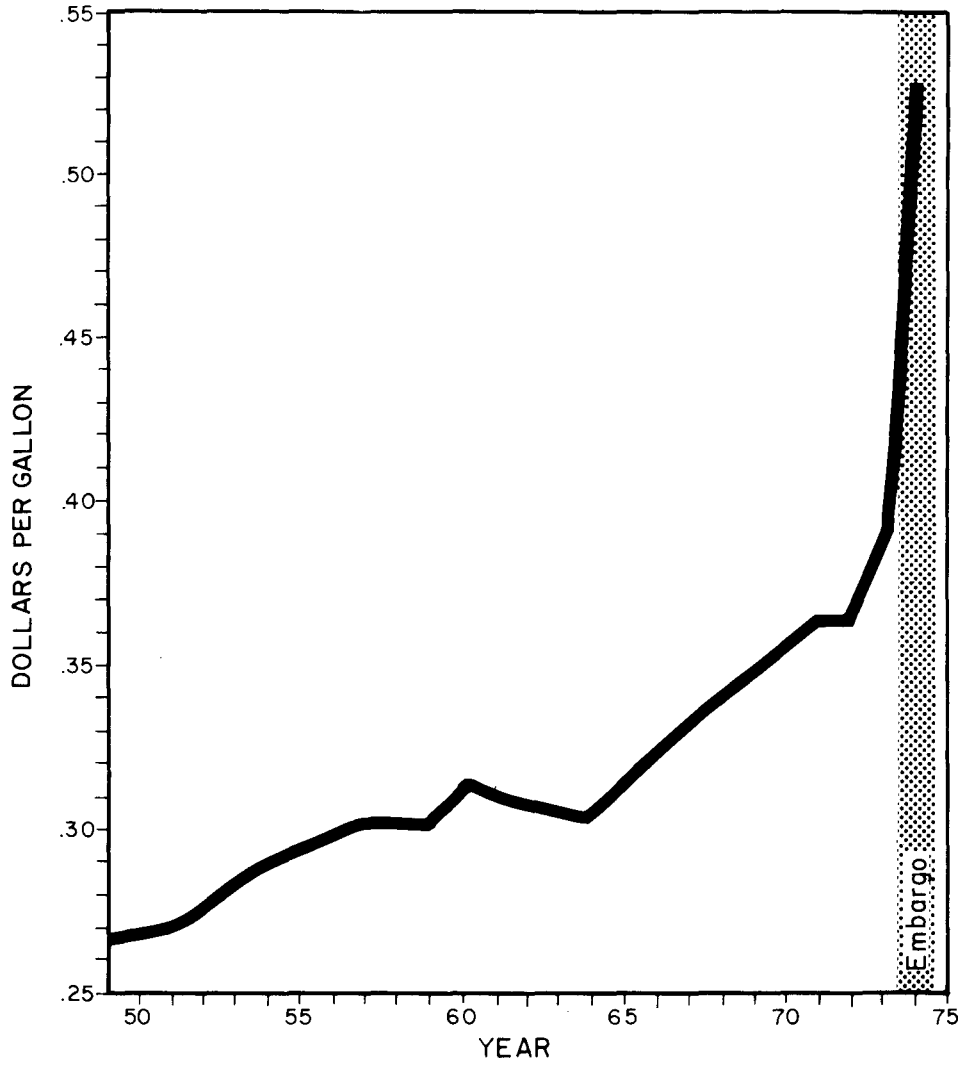
Service Station Sales

Nationally, the embargo-induced impact on gasoline service stations resulted in long lines, limited fuel supplies, short operating hours, and higher prices. During this period, the retailer's average markup increased from 8 cents to 11 cents per gallon while the average pump price (regular gas) rose dramatically from a 1972 average of 36 cents per gallon to 55 cents per gallon in March, 1974 (Figure III-9). Although sales volume declined, the average dealer experienced higher earnings on gasoline sales. Difficulty in obtaining stocks however, especially for independent dealers,

led to many permanent station closings. In 1973, as many as 60,000 or 25 percent of the 225,000 gasoline service stations closed down or changed owners for various reasons.[12]

FIGURE III-9

AVERAGE NATIONAL GASOLINE PRICES



Source: A. S. Loebl, et al., Transportation Energy Conservation Data Book (Oak Ridge, Tennessee: Oak Ridge National Laboratory, October, 1976) p. 165.

12 Office of Technology Assessment, The Economic Impact, p. 20.

The problems of obtaining sufficient fuel supplies and the resulting losses of revenue were directly responsible for the permanent closing of numerous area service stations during this period. A count of local service stations before and after the energy crisis indicates a loss of approximately 12 percent of all stations by the end of 1974 (Table III-12).

TABLE III-12

CHANGES IN NUMBER OF SERVICE STATIONS

(1973-1974)

County	1973	1974	Percent Change
Dallas	1309	1194	-8.80
Tarrant	997	821	-17.65
Total	2306	2015	-12.62%

Source: Dallas and Fort Worth Telephone directory Yellow Pages for indicated years.

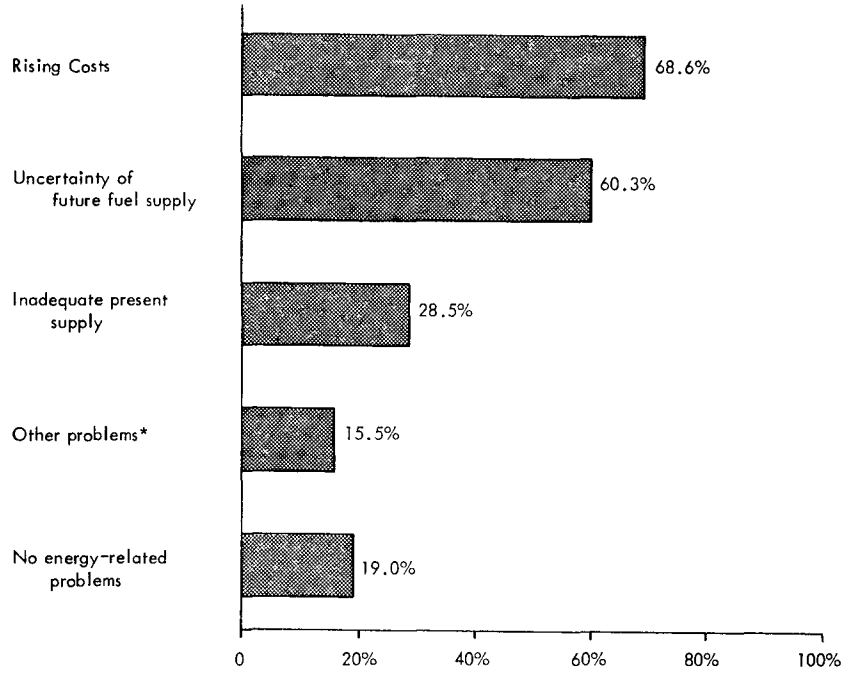
Impact on Local Government Operations

The inflationary outgrowth of the energy crisis had a detrimental effect on transportation-related operations in many local communities. A survey[13] of Texas municipalities in 1974 identified rising fuel costs as a major problem of local governments and pointed out that many areas also experienced a severe fuel supply problem (Figure III-10). It was additionally discovered that urban areas had greater energy-related difficulties than their rural counterparts (Figure III-11).

[13] C. Calderon and D. MacKenna, Energy and Local Government (Arlington, Texas: Institute of Urban Affairs, The University of Texas at Arlington, September, 1974).

FIGURE III-10

SPECIFIC ENERGY-RELATED PROBLEMS OF
RESPONDING LOCAL GOVERNMENTS, BY PERCENT

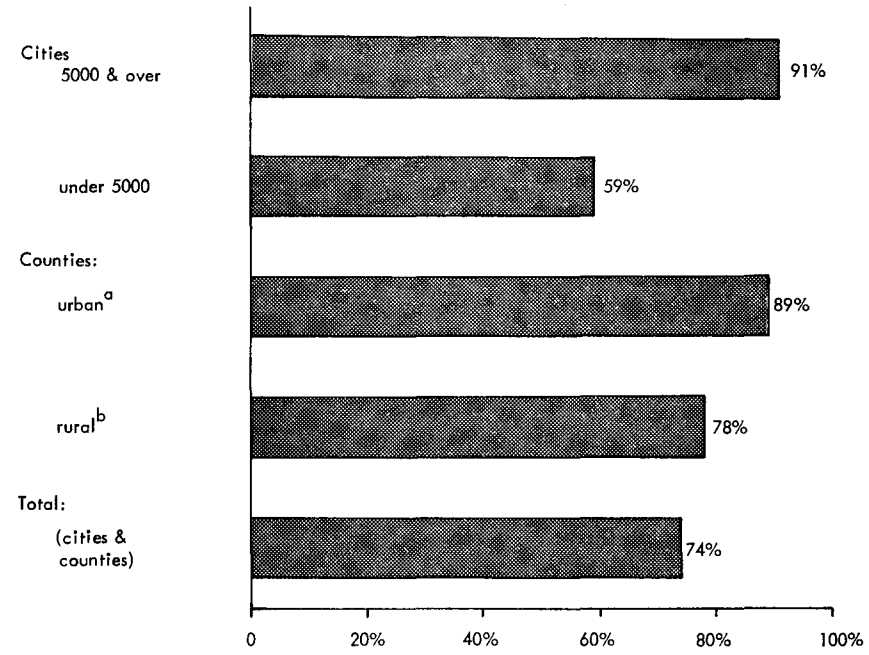


* storage, distribution, conversion

Source: Calderan and MacKenna, Energy and Local Governments, 1974.

FIGURE III-11

PERCENT OF URBAN AND RURAL LOCAL GOVERNMENTS
REPORTING ENERGY-RELATED PROBLEMS



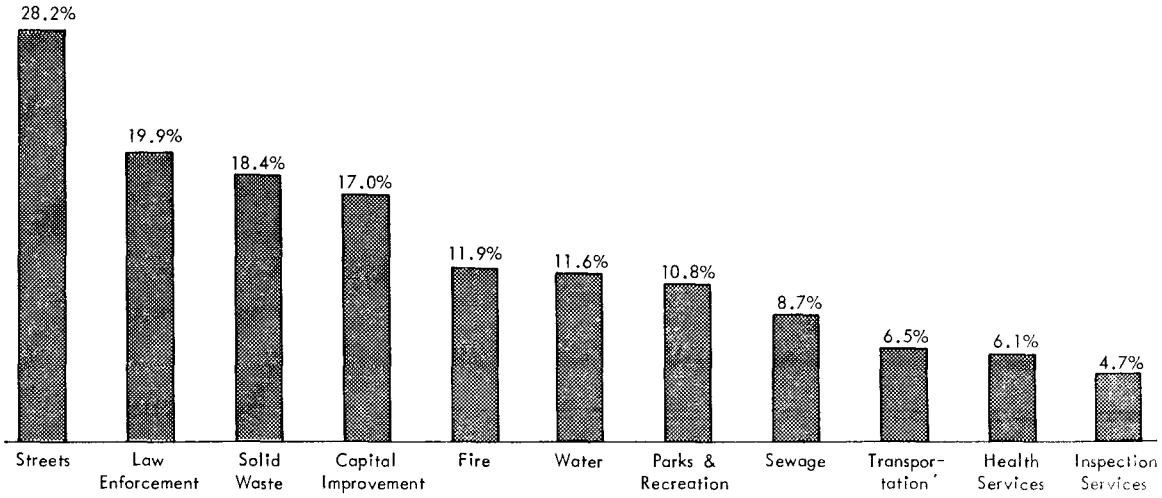
a 50% or more of the population living in urban areas.
b exclusively rural - no urban areas.

Source: Energy and Local Governments, 1974.

The immediate effect of the financial difficulties was the curtailment of municipal services. The survey indicated that street maintenance was the most often curtailed service followed by law enforcement and solid waste collection (Figure III-12). The fuel shortage and rising gasoline costs were major reasons in limiting such activities as police patrol and garbage pick-up. Appendix B lists other cities around the nation which implemented transportation-related actions to reduce costs and conserve municipal gasoline supply during the 1973-1974 embargo.

FIGURE III-12

PERCENT OF RESPONDENTS REPORTING LOCAL GOVERNMENTAL SERVICES ADVERSELY AFFECTED BY THE ENERGY CRISIS



Source: Energy and Local Governments, 1974.

Thus, the impact of the embargo was felt in nearly all sectors of the American economy and its recessionary effects lingered long after it had been lifted. The following presents a more specific discussion of this impact on the transportation system of North Central Texas.

Transportation Impact

The initial impact of the "energy crisis" produced a relatively mild reaction in the North Central Texas region when compared to that in many other areas of the nation. There was no significant change in local fuel supplies during the embargo months of 1973 and the mandatory federal gasoline allocation and price controls did not affect Texas oil supplies until January 1974.

By the end of January, however, many local service stations were beginning to feel the oil shortage when they received their first reduction in gasoline supplies under the nationwide allocation system. Throughout the embargo period, however, Texas received 95 to 100 percent of its fuel needs.[14] Thus, many of the severe problems experienced in the Northeast and other parts of the nation were not major concerns locally. Even so, this mild reaction brought about noticeable changes in the area's travel patterns.

Many of the transportation changes which occurred during this time were a result of a change in public opinion as well as in the reality of long lines and higher prices at service stations. Knowledge of national and local public reaction to this situation is helpful in explaining many of the travel changes during this period. Table III-13 compares some of these national reactions with those identified by the local Urban Panel Project. These surveys indicate that automobile travel was undoubtedly altered (as will be supported in the following sections), but significant changes also occurred in the transit

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[14] Federal Energy Administration, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, Economic Impact Analysis (Washington, D. C.: FEA, September, 1976), p. 23.

and taxicab industries, as well as in nearly all other transportation-related activities. Overall the effect of the energy shortage on transportation resulted in two major changes.

- A general reduction in travel, especially for discretionary automobile trips.
- A relatively small, but noticeable shift in modal usage from private autos to transit, carpools, bicycling and walking.

TABLE III-13

CHANGES IN TRAVEL HABITS DUE TO THE 1973-1974 OIL EMBARGO

Travel Change	Percent National* Respondents (N = 2245)	Percent Local** Respondents (N = 2000)
Tried to use less gasoline	78%	86%
Traveled less	55	41
Drove Slower	52	38
Bought/used more efficient auto	13	10
Carpooled	8	10
Used public transportation more	3	4
Other actions (bicycled, walked)	17	14

*National Opinion Research Center, The Impact of the 1973-1974 Oil Embargo on the American Household, Chicago, Illinois, December, 1974.

**North Central Texas Council of Governments, Urban Panel Project 1976, Arlington, Texas, September, 1976.

Automobile Travel

As Table III-14 shows, most modes of highway travel, except for transit, experienced a decline in national VMT (vehicle miles traveled) from 1973 to 1974. Passenger car/taxi VMT declined by over two percent. Locally, highway VMT estimates in both Dallas and Tarrant Counties indicated a decline from 1973 to 1974. As Table III-15 indicates, VMT in Tarrant County decreased by over twice the rate of Dallas County and VMT in urban areas decreased more than that in rural areas. In the rural areas of Dallas County, VMT actually increased from 1973 to 1974.[15]

TABLE III-14

CHANGES IN NATIONAL VMT
BY MODE OF TRAVEL
1973-1974

Mode	1973 VMT (in millions)	1974 VMT (in millions)	Percent Change
Passenger Car/Taxi	1,016,861	995,544	- 2.1
Truck	267,147	266,694	- 0.2
Intercity Bus	1,178	1,188	+ 0.8
School Bus	2,412	2,450	+ 1.6
Local Transit	1,835	1,907	+ 3.9
Passenger Train (excludes AMTRAK)	33	34	+ 3.0
AMTRAK	27	30	+11.1
Freight Train	469	469	0.0
Domestic Air Carrier	2,132	1,969	- 7.6
General Aviation	3,729	4,043	+ 8.4

Source: U. S. Department of Transportation, Summary of National Transportation Statistics (Washington, D. C.: U. S. Government Printing Office, June, 1976), p. 50.

[15] Data from State Department of Highways and Public Transportation, January, 1977.

TABLE III-15

CHANGES IN LOCAL DAILY VMT
DALLAS - TARRANT COUNTIES
1973-1974

	Dallas County			Tarrant County		
	1973	1974	Percent Change	1973	1974	Percent Change
Urban VMT	19,582,000	19,276,000	- 1.6	12,304,000	11,841,000	- 3.8
Rural VMT	349,000	357,000	+ 2.3	414,000	412,000	- 0.5
Total VMT	19,931,000	19,633,000	- 1.5	12,718,000	12,253,000	- 3.7

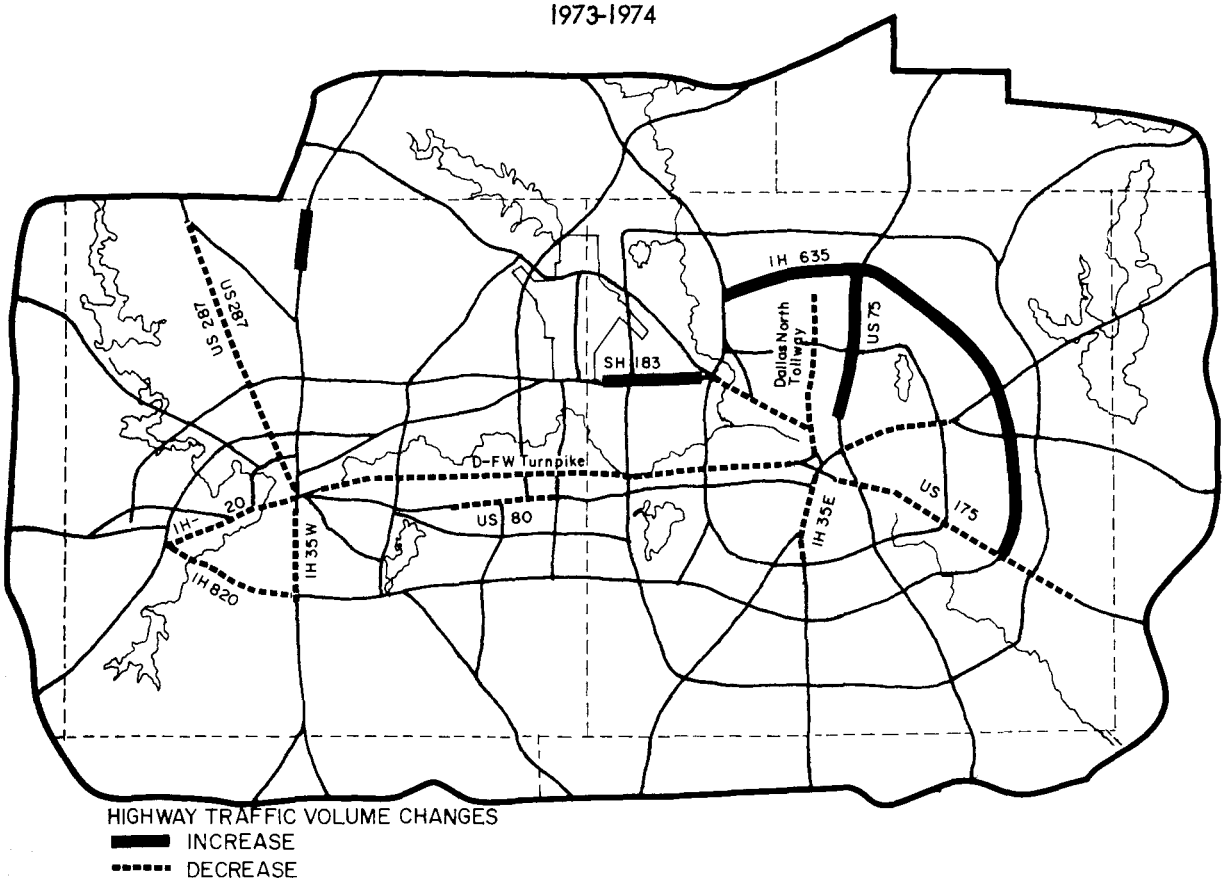
Source: State Department of Highways and Public Transportation, January, 1977.

In addition, an analysis of the permanent traffic recorder stations (which count the number of vehicles) throughout this region implies a similar local reaction. The sum of traffic records volume counts taken from these traffic records indicates that, while highway traffic in the Dallas-Fort Worth Metropolitan area increased an average of five percent each year from 1960 to 1973,[16] the growth rate abruptly slowed to less than one percent in 1974 and traffic on some individual highways declined by over 10 percent. The only highways showing increases in traffic were those which experienced rapid population growth and development, and, even in these areas the traffic growth rate slowed. North Central Expressway and I. H. 635 in North Dallas were such highways (Figure III- 13).

[16] State Department of Highways and Public Transportation, Permanent Traffic Recorder Stations, 1973, 1974.

FIGURE III-13

CHANGES IN HIGHWAY TRAFFIC VOLUME
1973-1974



Source: SDHPT, Permanent Traffic Recorder Stations, 1973-1974

Traffic in non-urban areas of the Intensive Study Area experienced traffic declines during 1974. Recorders located in rural areas surrounding Dallas and Tarrant Counties indicated that vehicle traffic decreased there by over five percent from 1973 to 1974.[17] The following analysis further examines changes on the permanent traffic recorders located within the Intensive Study Area.

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[17] State Department of Highways and Public Transportation, Permanent Traffic Recorder Stations, 1973, 1974.

Highway traffic volume changes in Dallas County differed slightly from those in Tarrant County. Due to rapid commercial and residential development in the northern part of Dallas County, overall traffic continued to increase throughout the crisis, but at a much slower rate than prior to the embargo. Traffic in other parts of the county, however, decreased by up to three percent.

Tarrant County experienced a greater decrease in highway traffic than Dallas County. By May, 1974, Tarrant County traffic on recorded highways was five percent below that of the previous year. Figure III-14 also indicates that traffic in Tarrant County did not rebound as immediately after the embargo as it did in Dallas County. By June, 1974, traffic in Dallas County was once again increasing at normal rates. At this time in Tarrant County, however, highway traffic was still below normal. The energy shortage thus appeared to have restricted travel in Tarrant County more severely and for a longer period of time than in Dallas County.

The analysis of individual recorder stations also indicates that travel volume changes varied on certain days of the week (Figure III-15). Generally, Saturday and Sunday traffic showed the greatest decline (over three percent), most likely due to the public's effort to limit unnecessary recreational auto trips and the general difficulty in buying gasoline during these days due to widespread Sunday service station closings. Weekday traffic volumes experienced a smaller decrease with the least impact during the midweek. Higher Monday and Friday auto travel levels could possibly reflect shifts in travel which would have normally taken place on Saturdays and Sundays or of trip purposes such as business travel, too important to be greatly affected by the embargo. The The decrease in weekday traffic could be accounted for by a greater utilization of transit and carpools for work trips as well as a decrease in general weekday nonwork trips.[18]

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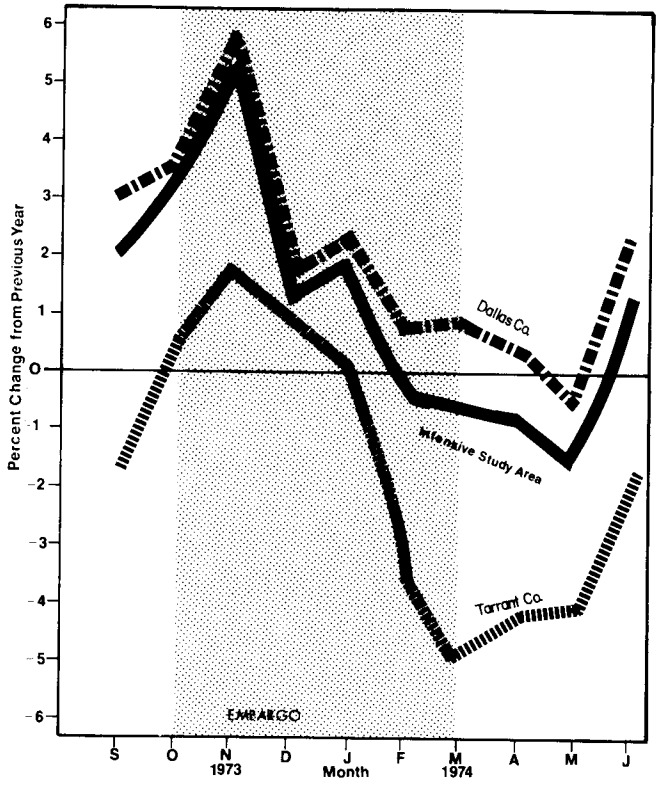
[18] Other studies indicate this general trend towards a reduction in nonwork trips. See for example: Keck, Carol, et al., Changes in Individual Travel Behavior During the Energy Crisis, 1973-74 (Albany, N. Y.: New York State Department of Transportation, August, 1974).

FIGURE III-14

CHANGES IN HIGHWAY TRAFFIC VOLUME: INTENSIVE STUDY AREA

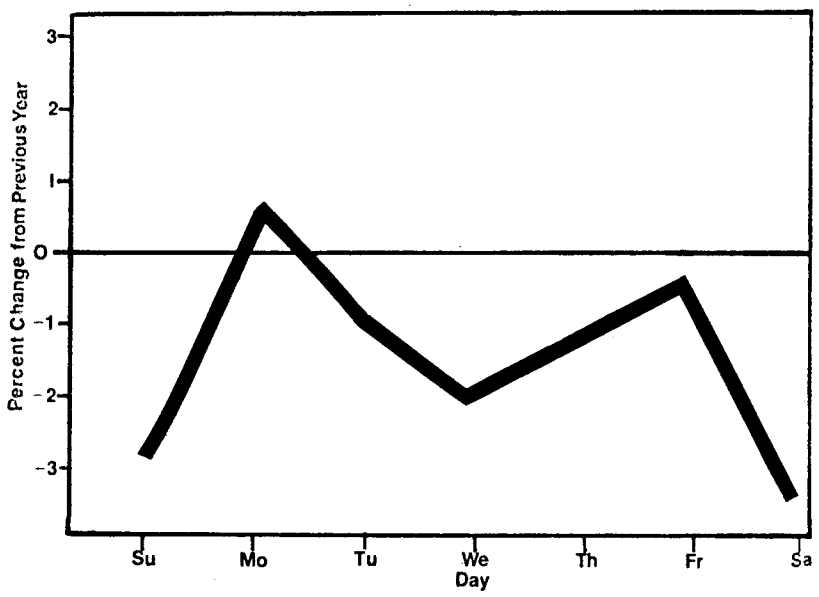


Source: SDHPT, Permanent Traffic Recorder Stations, 1973-1974

FIGURE III-15

TRAFFIC VOLUME CHANGES BY DAY OF WEEK

INTENSIVE STUDY AREA



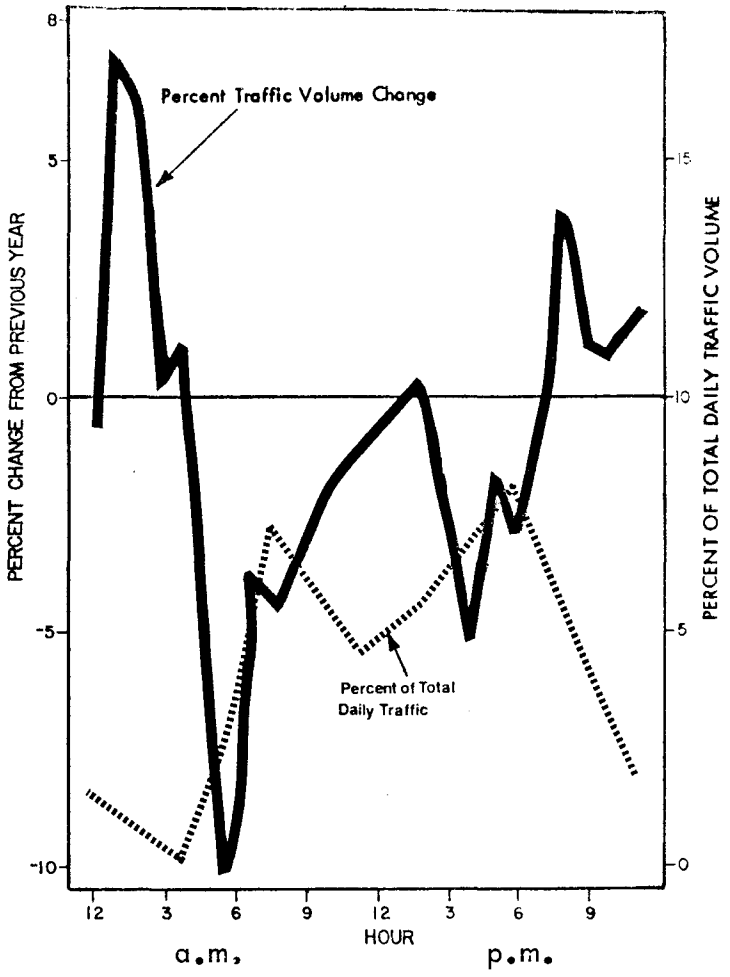
Source: SDHPT, Traffic Recorders 1973-1974

A closer examination of hourly highway traffic volume levels provides interesting information on the embargo period travel patterns.[19] The greatest decrease of weekday travel occured during the morning and the evening peak rush hours (Figure III-16) possibly indicating that workers may have utilized transit or carpooled more during these times. This may also be due to the impact of the embargo on employment. Early morning and night periods, however, during which time shifting to alternate modes of travel is not possible or convenient, showed normal increases in highway traffic.

FIGURE III-16

TRAFFIC VOLUME CHANGES BY TIME OF DAY

(1973-1974)



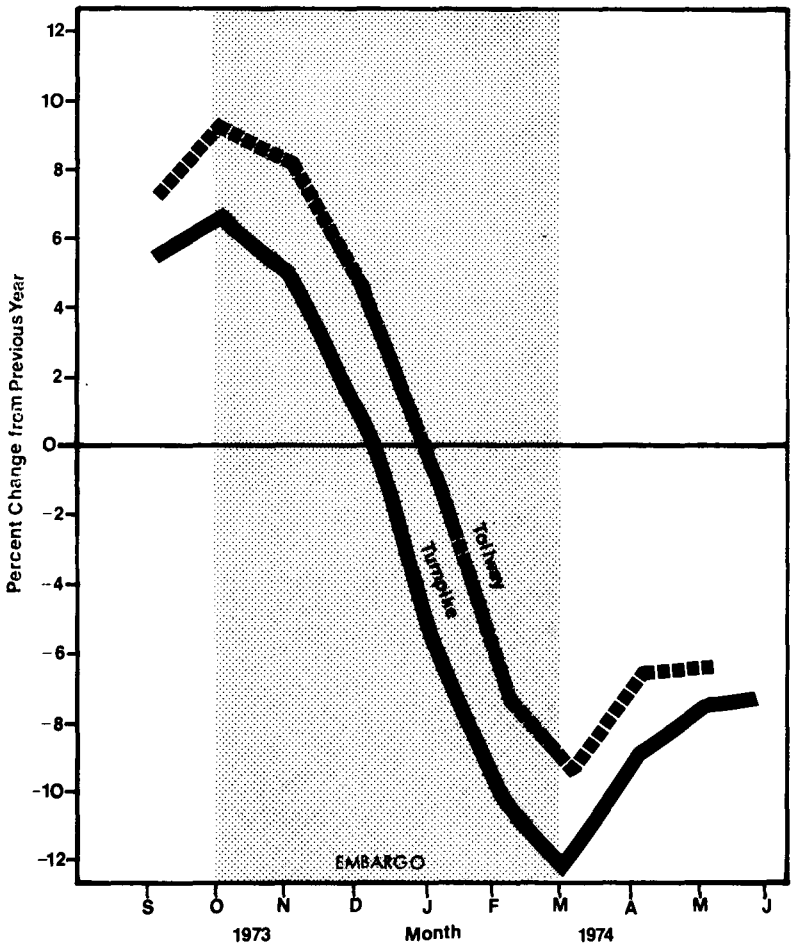
Source: SDHPT, Permanent Automatic Traffic Recorders 1973-1974

[19] State Department of Highways and Public Transportation, Permanent Traffic Recorder Stations.

Since accurate daily vehicle counts are kept on the Dallas-Fort Worth Turnpike and the Dallas North Tollway, this data is useful in analyzing the effect of the energy shortage on traffic volumes along these highways. When compared to the previous year, both highways experienced similar traffic changes during the embargo period. After the embargo was imposed in October, 1973, traffic continued to increase, but at a slower rate until January, 1974. It then declined sharply until March, 1974, when a maximum 12 percent traffic decrease was experienced on the turnpike and a 10 percent reduction occurred on the tollway (Figure III-17).

FIGURE III-17

CHANGES IN TOLLWAY AND DALLAS-FORT WORTH TURNPIKE TRAFFIC (FROM PREVIOUS YEAR)



Source: Texas Turnpike Authority, Annual Report, 1974-1975

It should be noted that the traffic decline on these toll roads was greater than that on most other non-toll highway. Possible explanations could be that 1) more commuters utilized transit service which exists along these corridors, 2) intercity traffic declined, especially along the Turnpike, 3) and, other non-energy related factors, especially the opening of Dallas-Fort Worth Airport in January 1974, caused a general reduction of travel along these highways.[20]

Auto Travel Reduction by Purpose

The reduction in auto travel during the embargo period varied by trip purpose. Nondiscretionary travel (largely work trips) appeared to be the least affected purpose since few options existed to reduce these trips. Discretionary travel, by contrast, was greatly affected by trip reductions. As shown in Figure III-18, social and shopping trip by auto were taken less frequently by about 70 percent of travelers in other urban areas.[21] This is further supported by a national shopping center study[22] which found a general reduction in traffic at nearly all types of shopping centers, especially at regional and community centers (Table III-16). While equivalent data for the Intensive Study Area is not available, it is expected that local travel followed a similar pattern.

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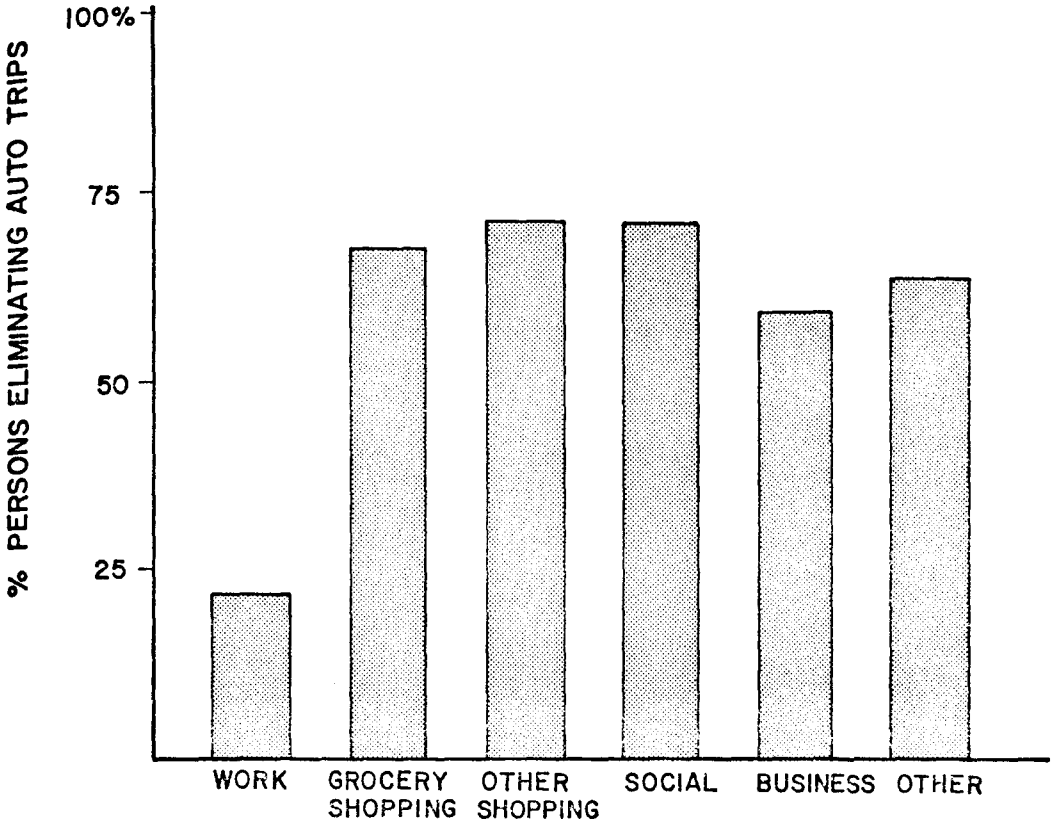
[20] Highway traffic to Love Field declined as most of the air activity was transferred to the D/FW Airport. The number of commercial vehicles on the Dallas North Tollway, for example, declined by nearly 70 percent from 1973 to 1974 while passenger vehicles decreased by six percent. Texas Turnpike Authority, Annual Report, 1973, 1974.

[21] Robert Peskin, et al., The Immediate Impact of Gasoline Shortages on Urban Travel Behavior (Washington, D. C.: U. S. D.O.T., FHWA, April 1975).

[22] International Council of Shopping Centers, ICSC Newsletter, April, 1974.

FIGURE III-18

AUTO USE REDUCTION BY TRIP PURPOSE



Source: Robert Peskin, Joseph Schofer, Peter Stopher, The Immediate Impact of Gasoline on Urban Travel Behavior (Washington D. C.: U. S. DOT, FHWA, April, 1975), p. 98.

TABLE III-16

IMPACT ON SHOPPING CENTERS IN GASOLINE TROUBLED TRADE AREAS

	% REPORTED REDUCED TRAFFIC	% REPORTED REDUCED TRAFFIC & SALES
REGIONAL CENTERS	75%	50%
COMMUNITY CENTERS	80%	40%
NEIGHBORHOOD CENTERS	60%	24%

Source: ICSC Newsletter, April, 1974.

Automobile Gasoline Supply

As national gasoline supplies dwindled and the allocation program became effective, an increasing number of local service stations were allotted insufficient amounts of fuel to meet all customer demands. By January, 1974, many stations in the area experienced some degree of difficulty in supplying their customers with requested fuel supplies and services. Fuel allotments, however, varied with each supplier.

A 1976 survey [23] of service stations operators in the Intensive Study Area indicated that over 70 percent of local stations ran out of gasoline at least once during the crisis period (Table III-17). Most stations were allocated fuel in amounts up to 50 percent lower than the previous year. As a result, supply deficits were managed by placing a gallon sales limit on customers (60% of the stations) and by reducing the hours of operation (70%). In addition, most stations (71%) remained closed on Sundays not only in response to the President's request but also to prolong their own fuel supplies.

TABLE III-17

DALLAS-TARRANT COUNTY SERVICE STATION POLL*

	Total (n=93)	Dallas County (n=60)	Tarrant County (n=33)	Major oil Companies (n=63)	Independents (n=30)
Limited Customer Fuel Sales	61%	60%	62%	66%	50%
Reduced Hours of Operation	72%	70%	75%	83%	46%
Closed on Sundays	71%	68%	75%	78%	53%
Longer Than Usual Lines	77%	80%	72%	86%	63%
Gas Sales Decreased	61%	61%	60%	68%	44%
Ran Out of Gasoline	70%	66%	78%	82%	50%
Curtailed Complimentary Customer Service	29%	35%	14%	22%	61%
Started Self-Service Pumps	9%	11%	5%	7%	23%

*Percent answering Yes

Source: North Central Texas Council of Governments, "Service Station Survey (Arlington, Texas: Transportation Department, June, 1976).

[23] North Central Texas Council of Governments, "Service Station Survey," unpublished, June, 1976.

The limited number of operating stations and hours available for customer gasoline purchases resulted in longer queues at those pumps which remained open. The service station survey indicated that most stations (77%) experienced longer than usual lines of customers during the crisis period. The lines, however, were not particularly long (two to three cars was the most frequent response) when compared to those reported in Eastern cities (a line of over 50 cars occurred in Washington, D. C., for example)[24] and usually developed only during heavy traffic periods (7-9:00 a.m. and 4-6:00 p.m.). One major result of the longer lines was the curtailment of the usual courtesy services by pump attendants. Nearly one-third of the local stations stopped performing such services when lines developed at their pumps.

Thus, many Intensive Study Area service stations, caught in a squeeze between smaller fuel allotments and greater customer demands on remaining stations with fuel, were greatly affected by the crisis. Moreover, much of the reduction in fuel use appears to have been a result of the difficulty and uncertainty in obtaining gasoline, rather than the price increase. Although economists generally agree that the price elasticity of gasoline consumption is about -0.1 (meaning that for every ten percent increase in price there will be a one percent decrease in consumption),[25] this, however, cannot account for the actual consumption decrease experienced during this period. While the local gasoline price increased about 40 percent at the time, the actual decrease in gasoline consumption from 1973 to 1974 in Texas was greater than ten percent,[26] much more than the four percent decrease expected from the price increase alone.

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[24] Federal Energy Administration, "The Energy Crisis: How Did It Happen?", Energy Reporter, December, 1976/January, 1977, p. 1.

[25] Robert McGillivray, "Gasoline Use by Automobiles," Transportation Energy Conservation and Demand, Transportation Research Record #561, 1976, pp. 45-55.

[26] U. S. Department of Transportation, Federal Highway Administration, Highway Statistics (Washington, D. C.: U. S. Government Printing Office, 1973, 1974), Table MF-21.

Transit

Perhaps the most noticeable modal shift during this period occurred on the transit systems. Nationally, the total number of transit revenue passengers on all forms of transit increased six percent[27] from 1973 to 1974, an increase of over 300 million passengers (Table III-18). Increases in bus ridership accounted for most of this gain. This rise was moreover quite significant considering the fact that transit patronage had declined an average of 2.6 percent every year since 1945. Ridership for 1974 therefore averaged over eight percent higher than might have been expected.

TABLE III-18

Trend of Revenue Passengers

CALENDAR YEAR	RAILWAY			TROLLEY COACH	MOTOR BUS	TOTAL REVENUE PASSENGERS
	LIGHT RAIL	HEAVY RAIL	TOTAL RAIL			
	(MILLIONS)	(MILLIONS)	(MILLIONS)	(MILLIONS)	(MILLIONS)	(MILLIONS)
1940	4,182.5	2,281.9	5,464.4	419.2	3,620.1	10,503.7
1945	7,080.9	2,555.1	9,636.0	1,001.2	8,344.7	18,981.9
1950	2,790.0	2,113.0	4,903.0	1,261.0	7,681.0	13,845.0
1955	845.0	1,741.0	2,586.0	869.0	5,734.0	9,189.0
1956	625.0	1,749.0	2,374.0	814.0	5,568.0	8,756.0
1957	491.0	1,706.0	2,197.0	703.0	5,438.0	8,338.0
1958	415.0	1,635.0	2,050.0	593.0	5,135.0	7,778.0
1959	378.0	1,647.0	2,025.0	517.0	5,108.0	7,650.0
1960	335.0	1,670.0	2,005.0	447.0	5,069.0	7,521.0
1961	323.0	1,680.0	2,003.0	405.0	4,834.0	7,242.0
1962	284.0	1,704.0	1,983.0	361.0	4,773.0	7,122.0
1963	238.0	1,661.0	1,899.0	264.0	4,752.0	6,915.0
1964	213.0	1,698.0	1,911.0	214.0	4,729.0	6,854.0
1965	204.0	1,678.0	1,882.0	186.0	4,730.0	6,798.0
1966	211.0	1,584.0	1,795.0	174.0	4,702.0	6,671.0
1967	196.0	1,632.0	1,828.0	155.0	4,633.0	6,616.0
1968	187.3	1,627.0	1,814.3	152.2	4,524.5	6,491.0
1969	183.4	1,656.3	1,839.7	135.3	4,335.3	6,310.3
1970	172.4	1,573.5	1,745.9	127.5	4,058.3	5,931.7
1971	155.1	1,494.0	1,649.1	113.1	3,734.8	5,497.0
1972	147.3	1,445.7	1,593.0	99.5	3,560.8	5,253.3
1973	143.5	1,423.7	1,567.2	73.6	3,652.8	5,293.9
1974	113.7	1,435.1	1,548.8	59.5	3,997.6	5,605.9
P 1975	93.7	1,384.7	1,489.1 (a)	55.8	4,080.9	5,625.8

P = Preliminary
(a) Includes cable car and inclined plane

Source: American Public Transit Association, 75-76 Transit Fact Book, March, 1976, p. 33.

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[27] American Public Transit Association, Transit Fact Book, 1975-1976 Edition (Washington, D. C.: March, 1976), p. 33.

During the peak month of the oil shortage (April, 1974), national transit ridership increased by over 10 percent (Table III-19). In some areas of the country, the influx of new passengers was even more dramatic. In the Dutch Fork area of Columbia, South Carolina, for example, bus ridership more than doubled within a two week period in

TABLE III-19

INCREASES IN NATIONAL TRANSIT RIDERSHIP DURING THE 1973-74 FUEL CRISIS AND ADJACENT MONTHS

Month	Percent Change Over Same Month in Prior Year	Months Directly Affected By Embargo
September 1973	- 3.81	
October		+ 1.77
November*		+ 0.86
December		+ 0.47
January 1974*		+ 5.41
February*		+ 8.41
March		+ 3.68
April		+10.55
May*	+ 6.02	
June	+ 5.54	
July	+12.30	
August	+ 6.76	
September	+ 7.87	
October*	+ 9.11	
November	+ 1.04	
December	+ 5.44	
January 1975*	+ 0.62	
February*	- 1.25	
March*	- 0.98	
April*	0.00	
May	- 1.24	
June	+ 1.07	
July*	+ 0.54	

* Same number of working days in months compared.

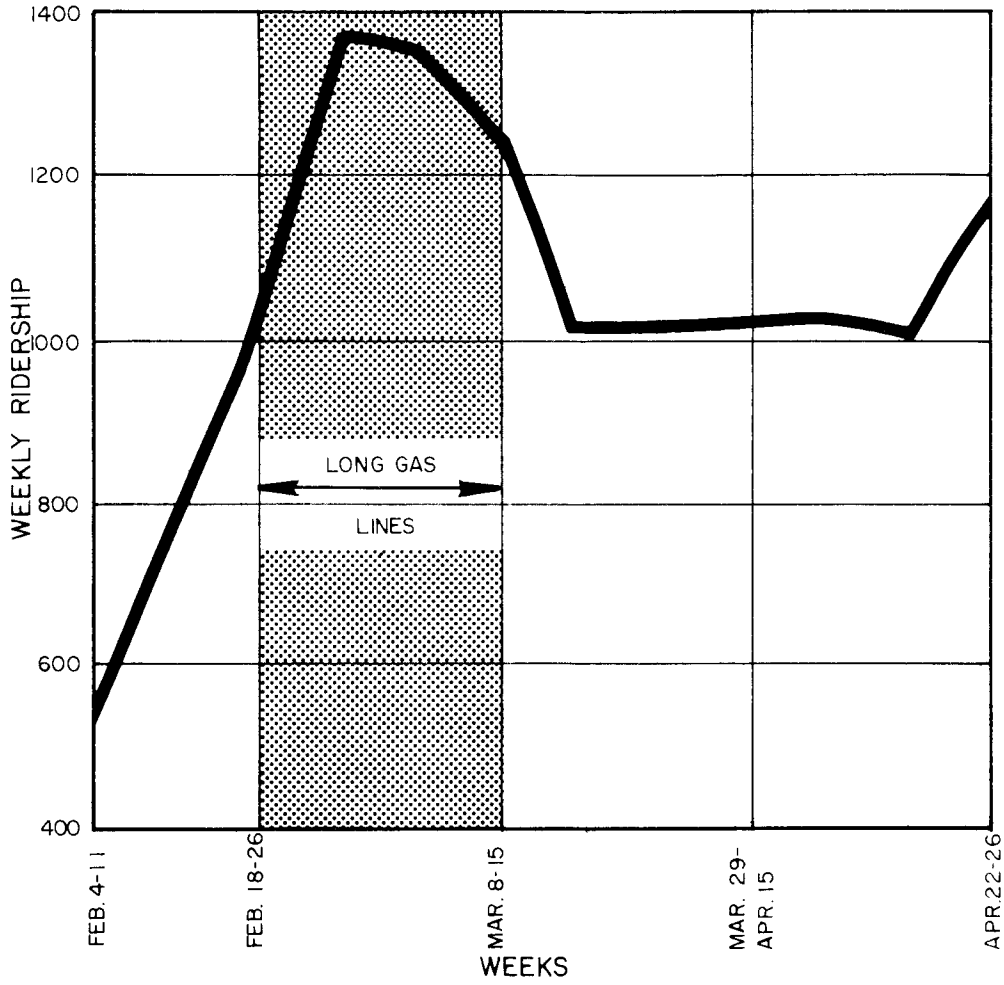
Note: These ratios are not based on data normalized for changes in the number of Saturdays, Sundays, holidays and work-days in the same month from year to year. Normalized data were used in the regression analyses reported in Chapter V and Appendix A.

Source: United States Congress, Office of Technology Assessment, Energy, The Economy and Mass Transit (Washington, D. C.: U. S. Government Printing Office, December, 1975), p. 61.

February, 1974. This coincided with the time when local gasoline supplies were at their lowest and when long lines formed at gasoline stations (Figure III-19).[28] In addition, data from Seattle suggests that most of this increased ridership occurred during peak travel hours (Figure III-20), although differences were noted from line to line.

FIGURE III-19

RIDERSHIP BY WEEK
DUTCH FORK AREA TRANSIT STUDY
COLUMBIA, SOUTH CAROLINA

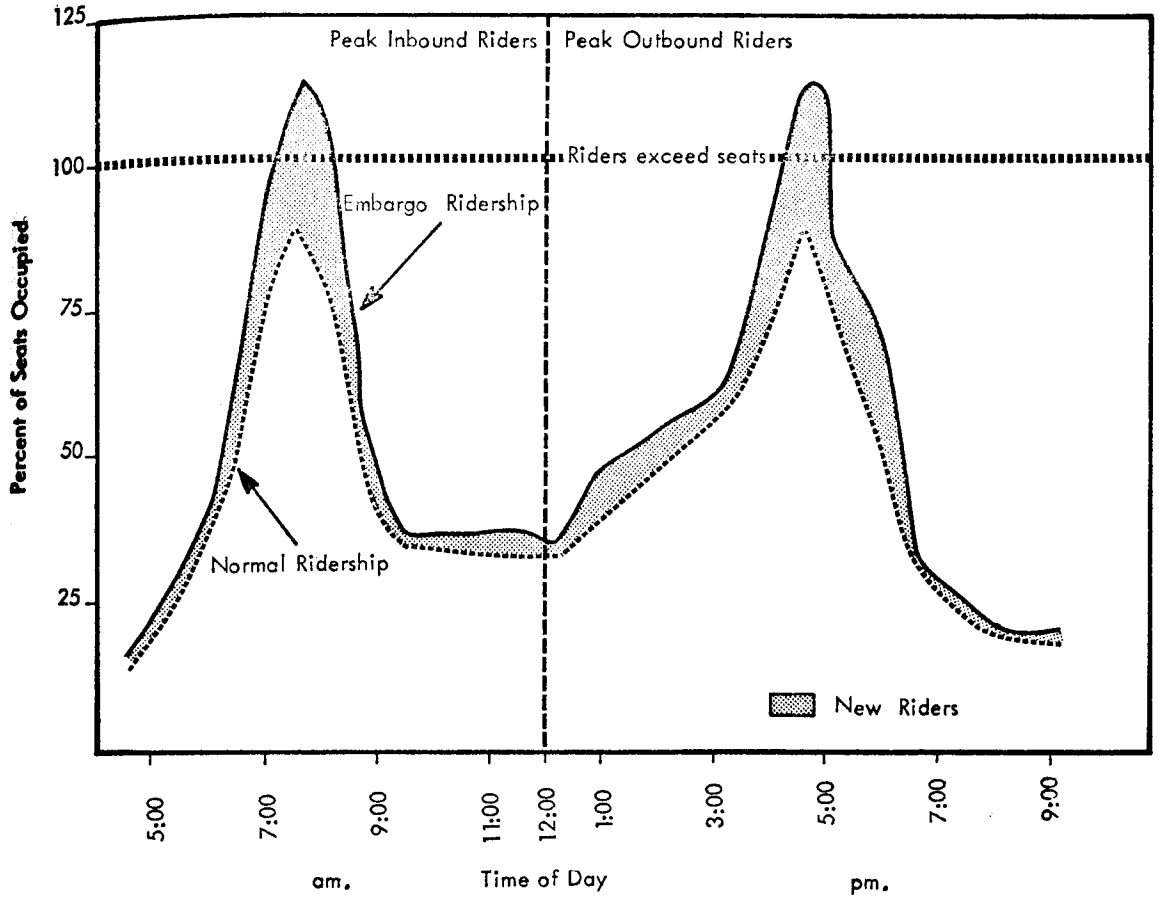


Source: Energy, The Economy and Mass Transit, p. 67.

[28] Energy, The Economy and Mass Transit, p. 67.

FIGURE III-20

THE EFFECT OF THE ENERGY SHORTAGE ON PEAK HOUR TRANSIT RIDERSHIP



Source: Seattle Metro Council, An Energy Crisis Contingency Plan for Metro Transit, November, 1975, p. 32.

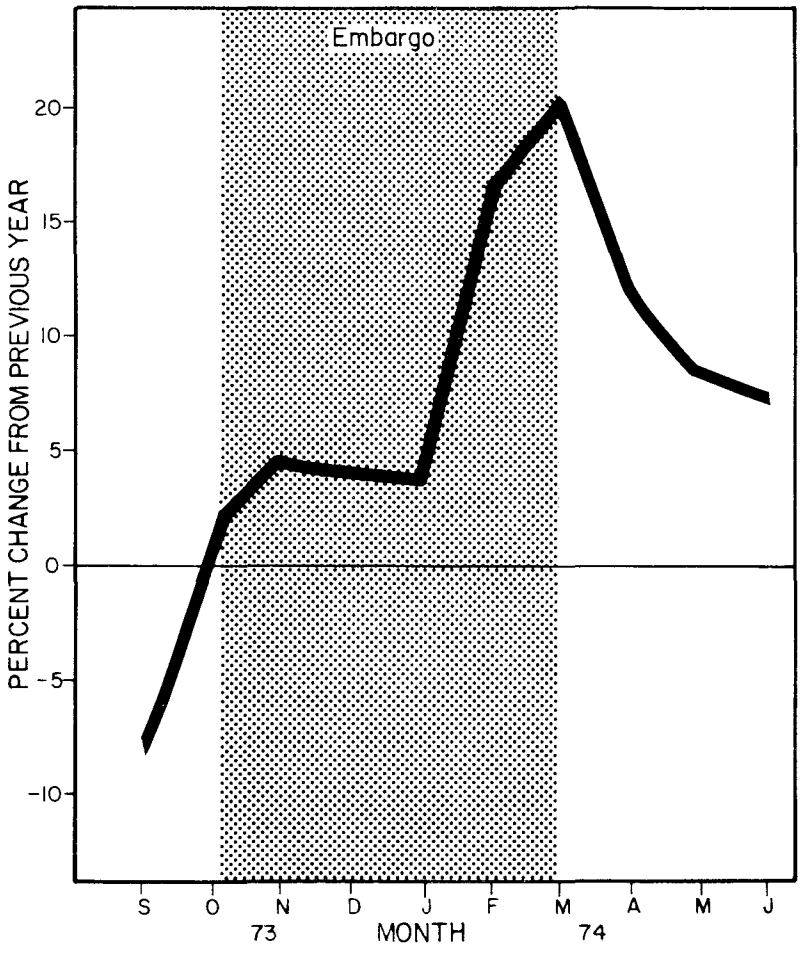
Locally, transit ridership also increased significantly during the embargo period. The Urban Panel survey indicated that, in the cities which provide intra-city bus service, Dallas and Fort Worth, 4.4 percent and 7 percent respectively of the residents used the bus service more frequently.[29]

[29] North Central Texas Council of Governments, Urban Panel Project 1976, Appendix B.

Monthly ridership levels on the Dallas Transit System (DTS) increased significantly during the embargo period (Figure III-21).[30] Prior to the embargo, monthly revenue passenger levels were five to ten percent below that of the previous year. By October, 1973, however, the ridership began to increase and experienced its most dramatic rise during the early months of 1974. By March, 1974, ridership was 20 percent higher than it had been during the same month in the previous year.

FIGURE III-21

RIDERSHIP CHANGE: DALLAS TRANSIT SYSTEM



Source: DTS

[30] Dallas Transit System, July, 1976.

The Dallas Transit System's number of scheduled bus miles and hours of operating service declined steadily up until 1973.[31] During fiscal year 1974, however, the upsurge in demand for the transit service resulted in a substantial increase in the number of bus miles and hours of service provided (Table III-20). By 1975, however, as many of the embargo period patrons returned to using their automobiles, the level of transit service was reduced.

TABLE III-20

CHANGES IN OPERATING STATISTICS
DALLAS TRANSIT SYSTEM

Year*	Route Miles	Scheduled Miles	Scheduled Hours
1971	372.6	13,007	980
1972	375.5	12,928	963
1973	377.4	12,630	942
1974	460.7	13,570	993
1975	450.6	13,578	971

*Fiscal Year - October 1 to September 30

Source: 1976 Transportation Program, p. V-15.

The increase in transit ridership during and immediately after the crisis resulted in a slight (1.8 percent) rise in operating revenue for fiscal year 1974 over the 1973 level (Table III-21). At the same time, the system experienced a dramatic (17 percent) rise in operating expenses. The cost of fuel, which nearly doubled from 1973 to 1974,

[31] 1976 Transportation Program, p. V-15.

was the major contributor to this rise. In 1973, fuel accounted for four percent of operating expenses, for 1974 it equalled 7.8 percent.[32] The system, therefore, did not benefit from the additional revenues since they were offset by the spiraling operating expenses.

TABLE III-21

TRENDS IN REVENUES AND EXPENSES
DALLAS TRANSIT SYSTEM

Year *	Operating Revenue (000)	Operating Expense (000)	Revenue Per Scheduled Hour	Cost per scheduled Hour
1971	$ 11,225	$ 11,209	$ 11.45	$ 11.44
1972	11,737	11,838	12.19	12.29
1973	11,217	12,426	11.91	13.19
1974	11,414	14,496	11.49	14.60
1975	10,601	15,447	10.92	15.91

*Fiscal Year - October 1 to September 30.

Source: 1976 Transportation Program, pg. V-28

[32] 1976 Transportation Program, p. V-15.

Perhaps the major impact of the energy crisis on the Dallas Transit System, as well as on many other transit systems, was the realization that a significant market of high-income, surburban automobile users were willing to utilize transit given certain incentives (e.g., high gasoline prices, difficulty in getting gasoline, desire to conserve fuel) and reasonable service. A number of service improvement plans, such as those involving the development of park-and-ride facilities and express bus service, were given added priority due to the impact of the embargo.

One such improvement in service was the establishment of the first DTS park-and-ride facility (located near the North Central Expressway) with express bus service to the Central Business District, which was initiated on November 27, 1973. At that time, approximately 900 riders utilized this service each way per weekday and about 600 autos were parked at the facility parking lot.[33] Two additional park-and-ride lots were subsequently developed by the end of 1974 (Figure III-22) to serve outer city commuters in the southern and southeastern sections of the city. The Dallas Transit System, in cooperation with the City of Garland, now operates two park-and-ride facilities from that city and plans have been made to begin a new operation from Irving in the near future.

The Fort Worth City Transit System, CITRAN was also affected by the energy crisis. The system experienced a slight (0.5 percent) decrease in ridership (revenue passengers) from fiscal year 1973 to 1974 (Table III-22). This, however, was a considerable increase from the average seven percent annual decrease experienced during the previous 10 years. As is shown in Figure III-23, the largest ridership increases occurred during the months immediately following the embargo. Service improvements and a CITRAN marketing campaign could also be partly accountable for the ridership changes.

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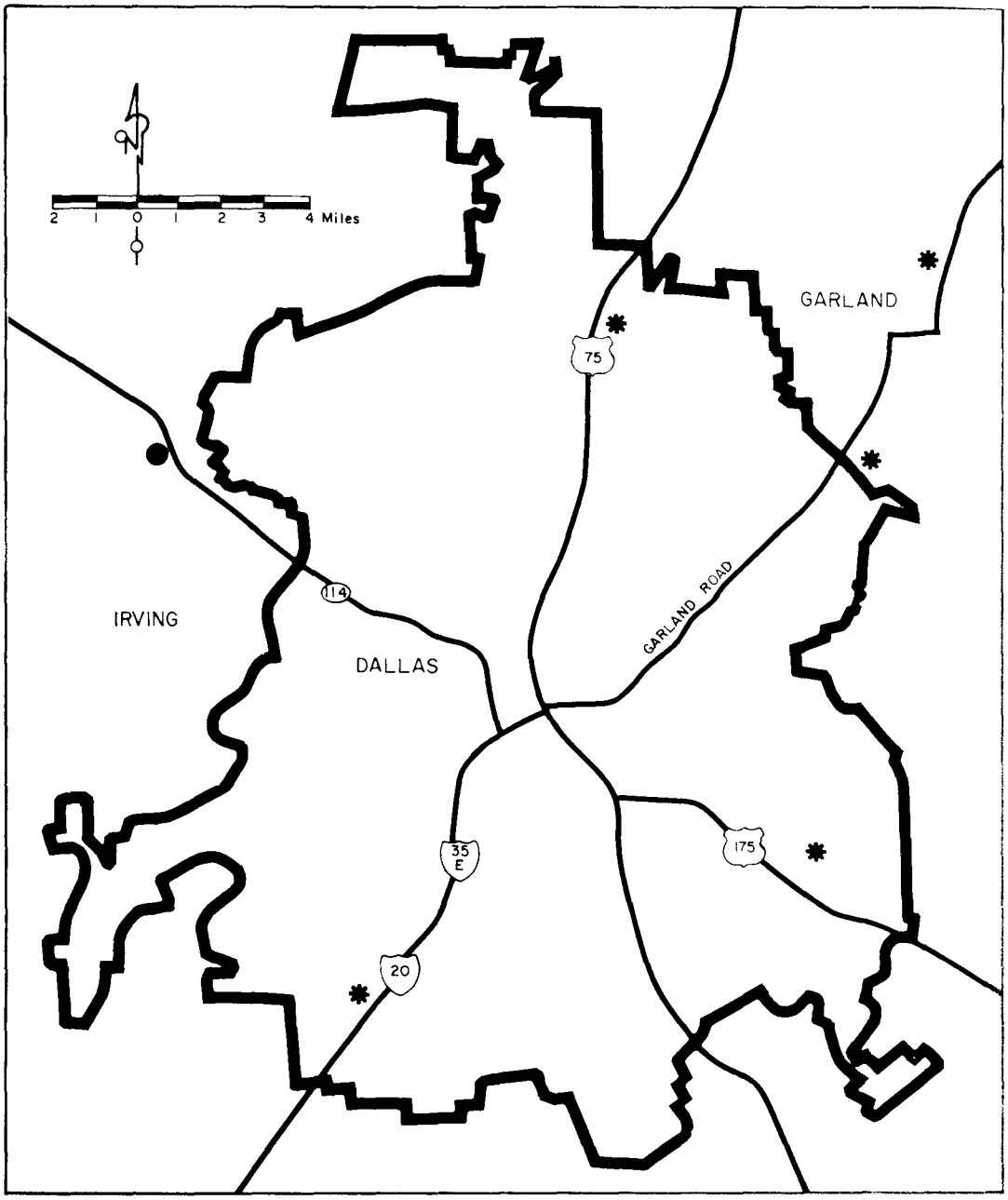
[33] 1976 Transportation Program, p. VI-28.

FIGURE III-22

EXISTING AND PROPOSED PARK AND RIDE TERMINAL LOCATIONS
IN DALLAS COUNTY



Source: 1976 Transportation Program, p. II-29, Fig. III-14.

LEGEND

✱ Park and Ride Facility in Operation

● Park and Ride Site Specified

TABLE III-22

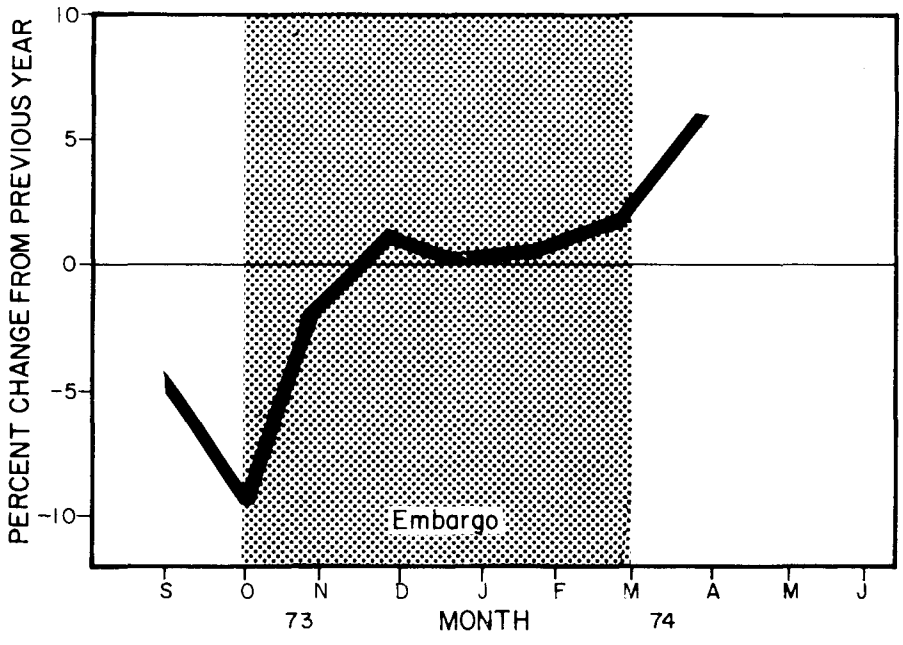
FORT WORTH TRANSIT RIDERSHIP TRENDS

Year	Revenue Passengers	Percent Change
1965	7,455,965	-7.1
1966	7,860,593	+5.4
1967	7,738,573	-1.6
1968	7, 649,636	-1.2
1969	6,846,147	-10.5
1970	5,892,223	-13.9
1971	5,107,847	-13.3
1972	4,628,874	-9.4
1973	4,498,324	-2.8
1974	4,473,689	-0.5
1975	4,170,146	-6.8

Source: 1976 Transportation Program, p. V-38.

FIGURE III-23

RIDERSHIP CHANGES CITRAN



Source: CITRAN

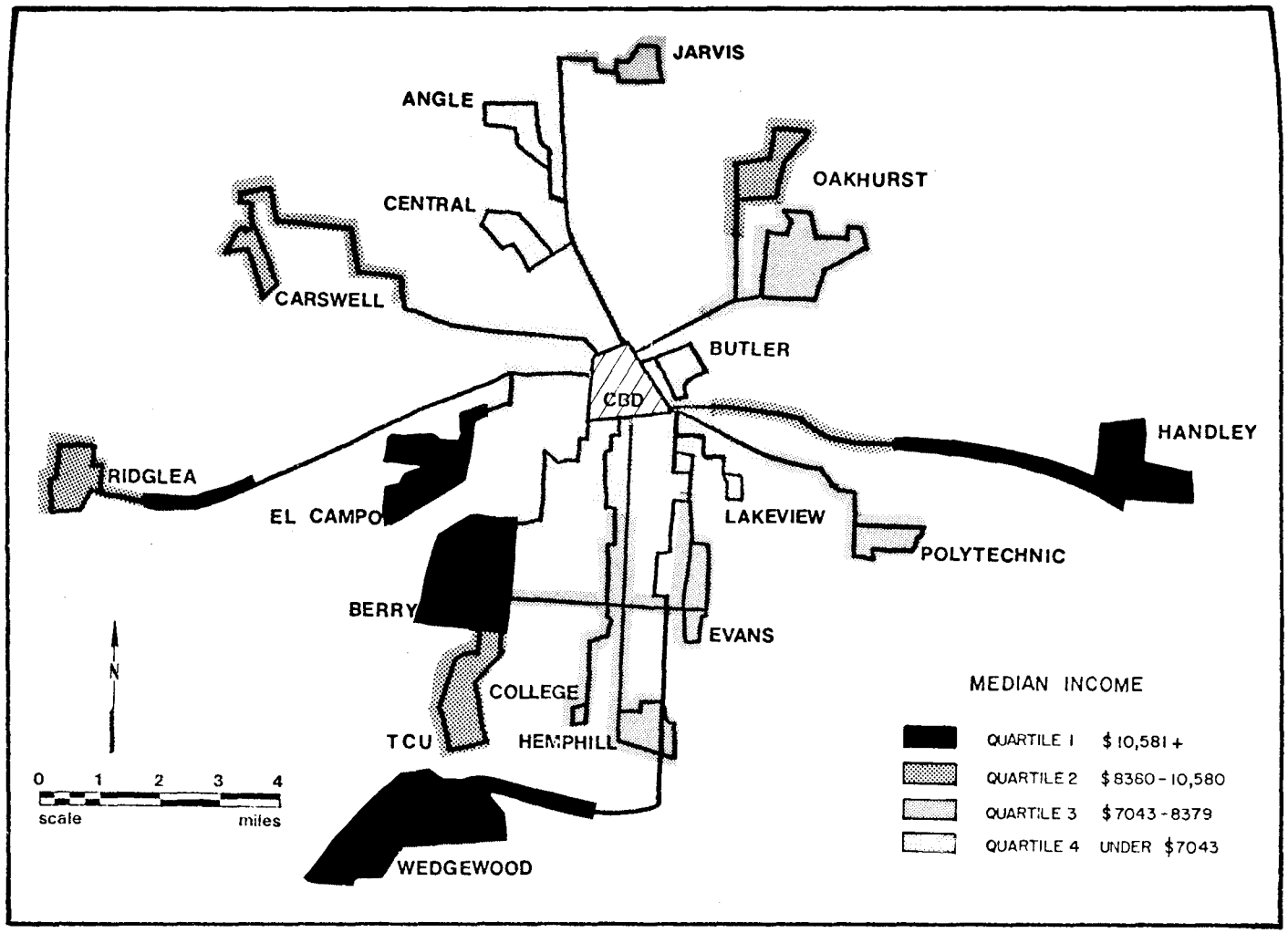
A closer analysis of CITRAN line data indicates that all city bus lines were not affected equally. The lines which experienced the largest gains during the crisis period were those routes which traversed affluent residential areas with large numbers of workers who normally utilize automobiles for their work trip (Table III-23). The suburban Ridglea and Wedgewood Express lines, which increased ridership by up to 100%, were such routes (Figure III-24). At the same time, other routes, especially those through low-income areas where ridership was already at a high level, experienced little or no increase. Ridership on the Butler Housing line, for example, actually decreased by five percent from the previous year. Although these differences have not been fully analyzed, they may reflect relative differences of the economic impact, especially unemployment, of the embargo on various income groups.

TABLE III-23

RIDERSHIP CHANGES ON SELECTED CITRAN LINES

Line	Revenue Passengers March, 1973	Revenue Passengers March, 1974	Percent Change	Average Neighborhood Income
Wedgewood Express	2938	4169	+41.9	$ 13,538
Ridglea Express	7766	15536	+100.0	10,938
Carswell	17045	17623	+3.4	7,066
Butler Housing	6805	6431	-5.5	3,100
Poly-Como	18104	17007	-6.0	6,300

Source: CITRAN



CITRAN BUS LINE SERVICE AREA INCOME
(1970)

FIGURE III-24

The changes in CITRAN ridership during the embargo remained at levels that could be accommodated by existing services. The system, therefore, allowed the reserve seating capacity to fill instead of increasing the scheduled service. There was, however, one major addition to the system during this period. This was the initiation of a subscription bus service to the Bell Helicopter factory in January, 1974, which now carries from 200 to 250 passengers each day.[34]

Although ridership remained steady during fiscal year 1974, line service revenues decreased during this time. Changes in the fare structure during 1974, which included a change in special fares for elderly riders and the implementation of downtown free bus service, probably account for this revenue drop and also a portion of the ridership increases. Operation costs for CITRAN, as in the case of DTS, rose sharply (17 percent) due to the increased price of fuel and other petroleum products.

The surge in transit usage during the crisis period encouraged the development of new transit services within the system. Beginning in April, 1974, park-and-ride service was initiated throughout the City (currently, 16 park-and-ride lots have been established) in an effort to encourage more automobile commuters to use the bus. Also, on June 3, 1974, CITRAN initiated free downtown bus service which averages 1,000 riders daily.[35]

While Dallas and Fort Worth city transit systems experienced significant ridership gains during the energy crisis, the private transit lines connecting suburban communities with these major cities experienced large ridership increases as well. Texas Motor Coaches, which provides commuter bus service between Dallas and Fort Worth as well as limited local service through Arlington and Grand Prairie, experienced monthly gains of up to

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[34] CITRAN

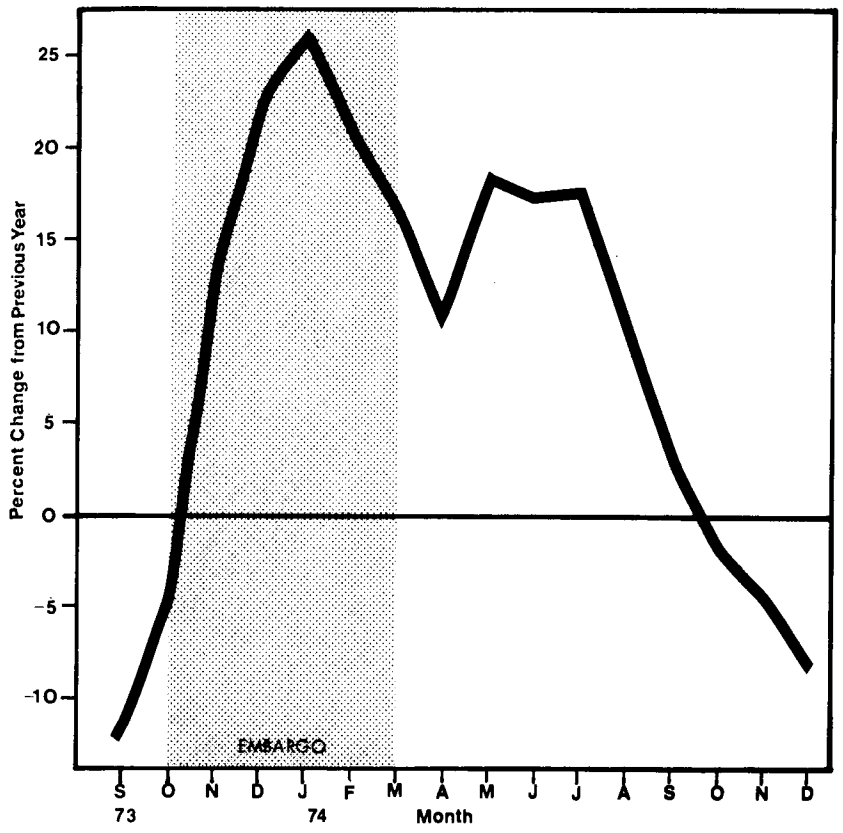
[35] 1977 Transportation Program for North Central Texas, p. VI-20.

percent during the crisis period (Figure III-25). Ridership, however, fell off to pre-crisis levels soon after the embargo was lifted.[36]

FIGURE III-25

RIDERSHIP CHANGES

TEXAS MOTOR COACHES



Source: Texas Motor Coaches

Ridership levels on the Dallas-Irving, Dallas-Garland, and Dallas-Denton routes run by Continental Trailways experienced even more dramatic ridership rises. Ridership on the Dallas-Irving route, for example, more than doubled during the crisis but quickly

[36] Data from Texas Motor Coaches, June, 1976.

dropped to normal levels after the embargo was lifted in March (Table III-24). The Garland route showed gains of approximately 10 percent while the Denton route increased about 50 percent.

TABLE III-24

INTER-CITY RIDERSHIP CHANGES
CONTINENTAL TRAILWAYS

Dallas to:	Crisis Ridership (March, 1974)	Post-Crisis Ridership (February, 1975)	Percent Change
Irving	4,470	1,450	-67.6
Garland	1,401	1,274	-9.0
Denton	960	646	-32.7

Source: General Manager, Continental Trailways, Dallas, March, 1975.

Other, less extensive inter-city transit service also underwent substantial ridership increases. The Texas Electric Bus Line, which operates between Dallas-Waco and the communities in-between, experienced a 10 percent increase. A small transit line from Azle to Fort Worth, the Jack Lambert Bus Line, initiated subscription bus service for commuters during this period.

While none of the local area transit systems reported any special difficulty in obtaining fuel supplies during the embargo period, had the embargo continued much longer, their fuel supplies probably would have been limited. The State Allocation Office reported that the Houston Transit System did have trouble obtaining all its needed fuel and was forced to apply for additional allotments from this State office.[37]

[37] Mr. J. Ventura, Texas State Allocation Office, telephone conversation, November, 1976.

Paratransit

The increased fuel costs undoubtedly placed additional financial burden on the area's social service transportation providers as well as on local taxicab companies. Due to higher gasoline costs, both the Dallas and Fort Worth taxi systems increased fares from 50¢/mile in 1973 to 60¢/mile in 1974. As a result of this fare increase and tighter household budgets, the number of taxicab passengers declined from 203,000 in 1973 to 192,000 in 1974, a five percent decrease.[38]

Another of the apparent results of the energy crisis was the greater utilization of carpools for area work trips. Although it is not known exactly how many area residents began carpooling as a result of the crisis, the Urban Panel poll indicated that 10 percent of its respondents carpooled more frequently as a direct response to the energy situation.

By the end of the crisis, the Cities of Dallas and Fort Worth, in cooperation with the Federal Highway Administration and State Department of Highways and Public Transportation, had initiated carpool demonstration programs. These programs and their accompanying publicity campaigns were undoubtedly responsible for encouraging the formation of new carpools in the Dallas-Fort Worth area. While the exact number of carpools begun as a result of these programs has not been determined, a survey of carpoolers in Fort Worth indicated that at least one-third of those currently carpooling are doing so as a direct result of the Fort Worth carpool demonstration program.[39]

These formal, as well as an unknown number of informal carpool arrangements were likely the cause of increases in the auto occupancy rates recorded on many local highways. The State Department of Highways and Public Transportation vehicle occupancy

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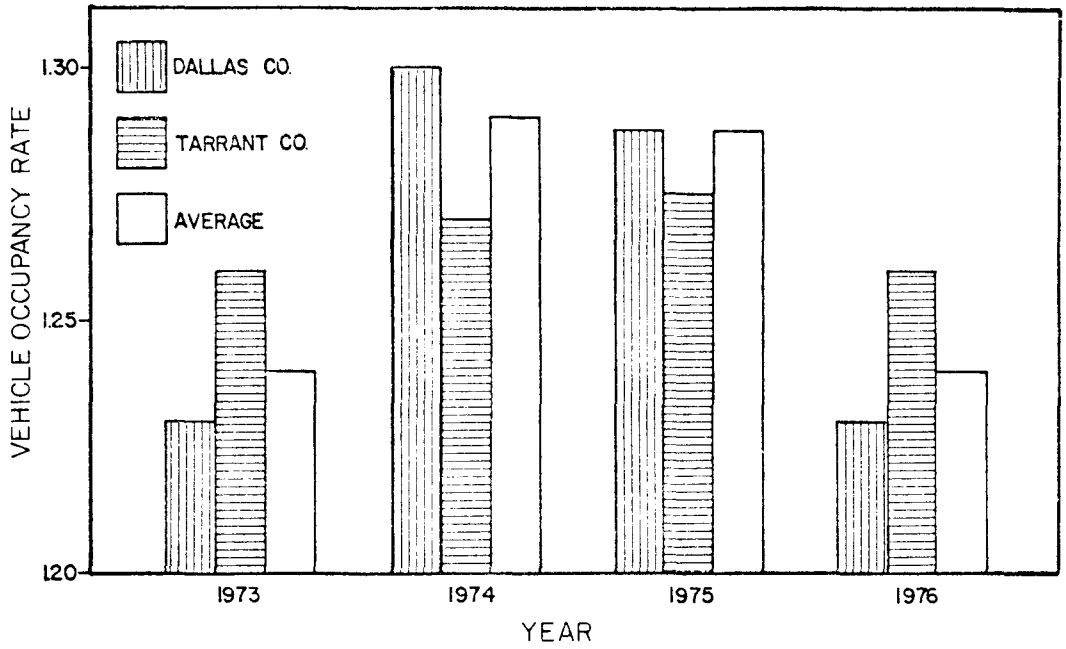
[38] Totals for Fort Worth Cab & Baggage and Yellow Cab of Dallas. Figures exclude service to Love Field.

[39] Traffic Engineering Department, City of Fort Worth, "Evaluation: Metropolitan Fort Worth Carpool Program Demonstration Project M-9009-(14)," (Fort Worth, Texas: January, 1976).

study indicated that average occupancy rates in the Intensive Study Area rose from 1.24 persons per vehicle in 1973 to 1.29 in 1974, an increase of four percent.[40] Dallas County rates increased the greatest (six percent) while those in Tarrant County increased less than one percent (Figure III-26).[41]

FIGURE III-26

INTENSIVE STUDY AREA
VEHICLE OCCUPANCY RATE



Source: SDHPT, Vehicle Occupancy Study, 1973, 1974.

[40] Based on an average of 2.5 persons per carpool, this indicates that the number of carpools increased by over 20 percent.

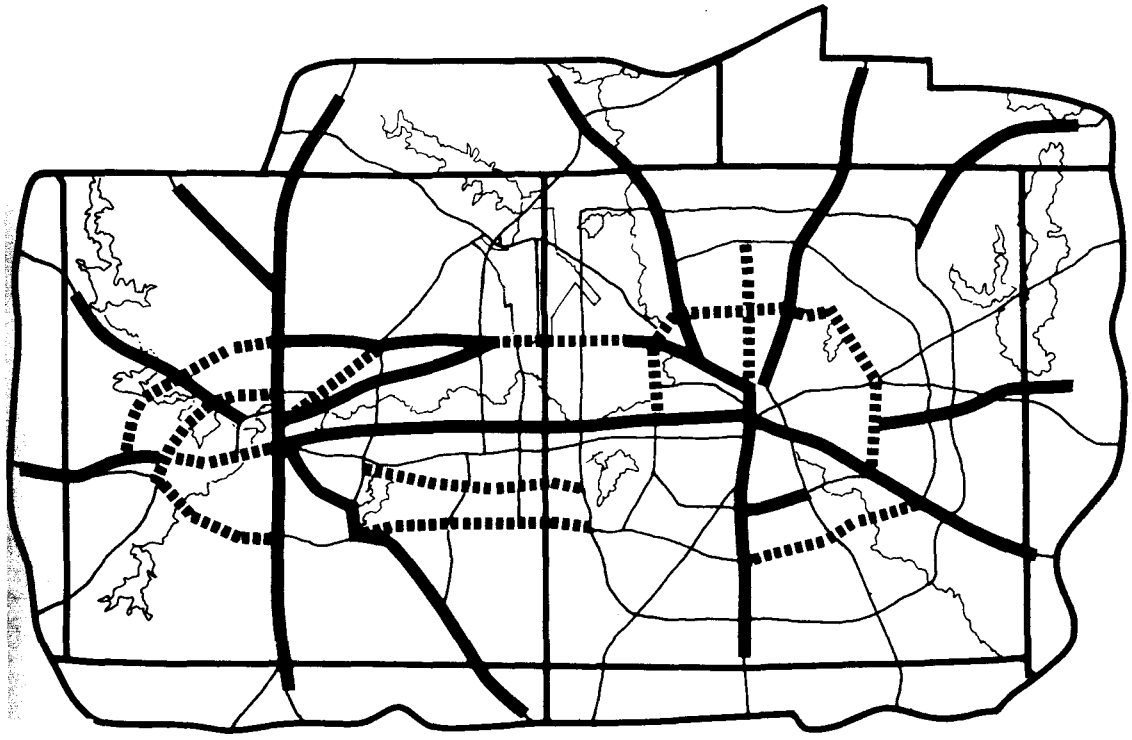
[41] North Central Texas Council of Governments, 1976 Transportation Program, (Arlington, Texas: NCTCOG, 1975), p. V-2.

In 1974, the highways which had traffic with the highest occupancy rates were those intercity routes between the Cities of Dallas and Fort Worth and surrounding urban areas. The Dallas-Fort Worth Turnpike and SH 183 between Fort Worth and Weatherford were among those routes which carried traffic with above average occupancy rates (Figure III-27). The survey also indicated that, prior to the embargo, the average occupancy rate for morning outbound traffic was higher than for inbound automobiles. By 1974, however, inbound traffic registered a higher auto occupancy rate increase and nearly equaled that for outbound traffic. This possibly indicates the formation of more carpools by employees going to work in the Central Business District.

FIGURE III-27

AUTO OCCUPANCY COUNTS

1974



ABOVE AVERAGE

BELOW AVERAGE

1974 AVERAGE = 1.29

Source: SDHPT, Vehicle Occupancy Study, 1973, 1974.

Summary of Local Impact

To summarize, the major effects of the embargo on transportation in the Dallas-Fort Wor metropolitan area include the following:

- Retail gasoline stations received insufficient allotments to meet customer demands. This resulted in public confusion and uncertainty in obtaining fuel supplies.
- Transit ridership increased noticeably, especially during peak commuter hours in middle and upper income areas, and over inter-city routes. As buses became overcrowded, additional service was needed in some areas.
- Reduced fuel supplies for municipal operations resulted in significant service cutbacks.
- While local transit systems did not experience difficulty obtaining fuel, had the embargo continued much longer, they undoubtedly would also have been affected.
- Increased petroleum product costs affected not only public transit systems, but led to taxicab fare increases.
- An increased interest in carpooling, either through private arrangements or area carpool programs (Dallas and Fort Worth), resulted in a greater utilization of this travel mode.
- There was a general increase in public awareness of the energy situation and support for energy conservation measures.

Placing the local impact in its proper perspective, the reader should be aware that most of these changes were mild when compared to those in many other regions of the nation due to relatively moderate reduction in fuel supplies in the area. With the implementatio of the present federal fuel allocation and rationing programs during future shortages, how ever, any fuel shortage is expected to affect all regions of the nation equally. The following chapter examines the major characteristics of these proposed allocation and rationing programs.

IV. Allocation and Rationing: The Alternate Energy Scenarios

he energy shortage brought about by the Arab oil embargo of 1973-1974 generated much iscussion and debate on possible short-term energy conservation measures. If there hould happen to be another sudden, severe energy shortage, there is little doubt that he federal government would initiate large-scale national conservation measures which ould have a profound effect on the Intensive Study Area.

he U. S. Congress has recognized this energy problem and has enacted the Energy Policy nd Conservation Act of 1975 to begin preparations to deal with future oil shortages. he responsible administrative agency for this Act, the Federal Energy Administration, tates in the Federal Register[1] that:

> . . . . There are two principal emergency supply distribution mechanisms contemplated by the EPCA (Energy Policy and Conservation Act); allocation and rationing. In a shortage, FEA would either continue or, if they had been phased out, reimpose its Mandatory Petroleum and Price Regulations. In the specific case of gasoline and diesel fuel, the allocation program would continue substantially the same as at present so far as distribution to all consumers and not just to bulk purchasers as under the current allocation program.

igure IV-1 shows the proposed federal actions to be taken in the event of another oil mbargo. Allocation would be one of the first actions to be implemented, while rationg would not be used unless preceding measures fail to accommodate the fuel shortall. Since both of these measures could precipitate confusion and adverse effects on

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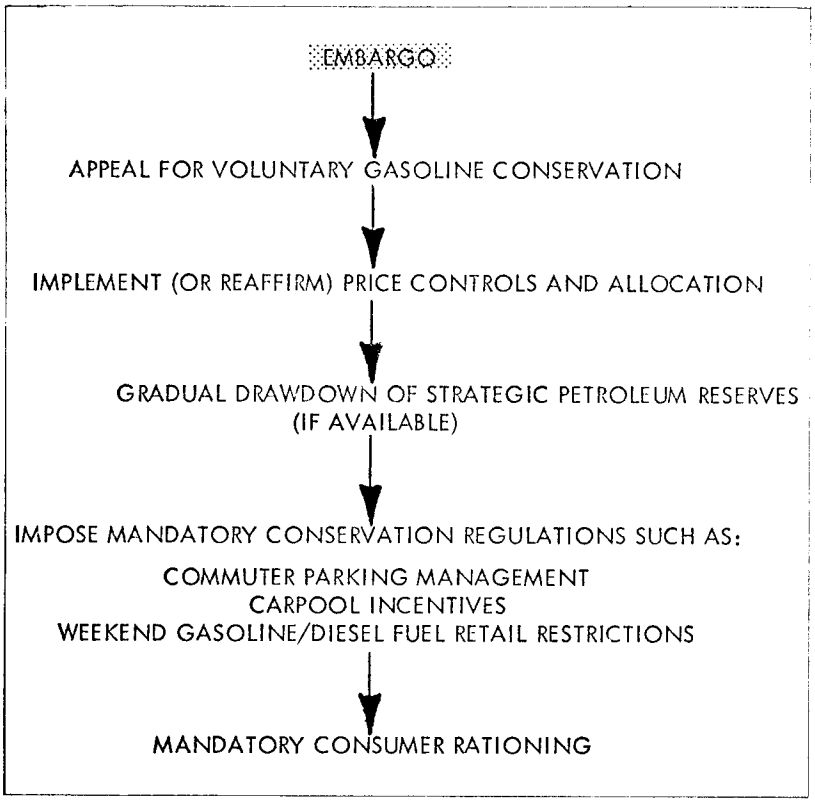
Federal Register (Washington, D. C.: May 28, 1976), Vol. 41, No. 105.

the local economy (not to mention those caused by the energy shortage itself), it is quite important that these programs and their implications be understood and anticipated.

FIGURE IV-1

FEDERAL ACTIONS TO CONTEND
WITH A FUTURE OIL EMBARGO



Source: Federal Energy Administration, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, Environmental Impact Assessment, 1976, p. 20.

Table IV-1 outlines the principal features of each program as they are currently stated. It should be noted, however, that these regulations are presently being reviewed and are subject to change. The following presents a more detailed discussion on the allocation program as it now exists and the rationing program as currently proposed by the FEA.

TABLE IV-1

PRINCIPAL CHARACTERISTICS OF

FUEL ALLOCATION AND RATIONING PROGRAM

	ALLOCATION	RATIONING
Fuel Distribution Mechanism	Gasoline station allotments	Consumer coupons/ration checks
Maximum Period of Implementation	Indefinite	9 months
Priority Allotments (100% of needs)	U.S. Department of Defense Food production	Department of Defense Food production Emergency municipal services Passenger surface transport systems (excludes water, rail, vehicles seating 10 or fewer persons)
Price of Gasoline	Fixed	Fixed, but market determines coupon price
Effect on Obtaining Fuel Supplies	Difficulty in obtaining fuel supplies	Fuel supplies easily obtainable if expense of extra coupons can be met

SOURCES: FEA, Economic Impact Analysis, September, 1976.

FEA, Allocation and Price Controls as a Solution to the Energy Problem, February, 1975.

The Allocation Scenario

If less drastic governmental conservation programs, such as voluntary conservation actions, fail to meet the petroleum shortfall, the federal government is likely to impose, or, if it has been discontinued, reimpose a program of fuel allocation. Simply stated, the allocation of fuel supplies is one method of distributing the petroleum shortfall throughout the U. S. economy on a more or less equitable basis. It does not by itself reduce demand, but merely provides a set of rules and mechanisms to distribute whatever quantity of petroleum supplies are available. Price controls must also be

incorporated with the allocation process in order to regulate any price increases which might occur during such a supply deficit.

Present Allocation Program

In response to the Arab oil embargo and in an effort to ensure equal distribution of existing oil supplies, Congress passed, and the President signed, the Emergency Allocation Act of 1973. This legislation gave certain industries and uses a priority supply of fuel (specifically defense and agricultural uses) and attempted to restrict public consumption by limiting retail outlet provisions.

The Act also provides for price controls which are regulated by FEA and set at the producer, refiner, reseller, and retailer levels of marketing. At the producer level, "old oil" (crude oil produced in amounts up to February, 1976, levels from a particular property) is priced at an average of $5.25 per barrel. Free market prices apply to oil produced in excess of February, 1976, levels and to oil from a property which produces less than 10 barrels per well per day.[2] Imported oil prices are also uncontrolled and the average free market selling of this oil was $11.28 per barrel in January, 1977.

At the refiner level, increased crude oil costs and limited non-product cost increases may be passed along. However, the profit margins of refiners generally cannot be increased. These basic rules apply down the marketing chain to wholesaler and retailer. The regulations of the Allocation Act also provide for a crude oil supply program for small and independent refiners under which the 15 major oil corporations are required to sell certain volumes of crude oil to the small and independent refiners. A supplier must continue to supply the same customers he serviced during the "base period" (currently 1972).

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[2]Federal Energy Administration, Federal Energy News (Washington, D. C.: November 11, 1976).

Regulations[3] now state that each supplier of gasoline shall provide all wholesale purchasers with an allocation fraction which is to be determined by base period volumes as adjusted by the gasoline shortfall. If, for example, the nation experiences a 10 percent deficit in gasoline supply, a retail gasoline outlet might be allocated new supplies equal to about 90 percent of those it received during the base year (this, of course, assumes that its supplier can provide only 90 percent of its previous sales). It is the supplier, however, which determines the allocation ratio and, therefore, the ultimate gasoline supplies given to each retail outlet. Inequities may develop among gasoline outlets with different suppliers. Thus, service station A may receive 90 percent of its previous supplies while service station B, with a different supplier, may receive only 80 percent.

Advantages and Disadvantages of the Allocation Program

A number of positive and negative aspects of the allocation program can be identified (Table IV-2). One of the positive accomplishments of the allocation/price control mechanism is that increases in the consumer price index are minimized since prices can be kept from rising. The allocation program also spreads petroleum shortages nationwide, thus lessening the regional impacts of such a program. The supply allocation system is also fairly easily administered since firms, rather than individuals, are involved in the reporting schemes. Another positive aspect of the allocation program is that it can be implemented together with other actions, such as rationing, to reduce fuel consumption.

On the negative side, since the allocation program may result in retailers being supplied with insufficient amounts of fuel to satisfy customer demands, reduced hours of operation at retail outlets may result in long waiting lines at gas pumps and inconvenient hours of business for customers. This not only brings about unproductive time losses, but also

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[3] Federal Energy Administration, Allocation and Price Controls as a Solution to the Energy Problem (Washington, D. C.: February 4, 1975), p. 2.

creates hazards to traffic and gas station operators due to crowding conditions. Since there is no priority given to transit or any other fuel users (only the Defense Department and agricultural production are assured 100 percent of fuel needs), all transportation users may experience reduced supplies. Insufficient allocation in an area may also result in drivers using additional gasoline by searching for gas and idling their auto engines while waiting in long lines at gasoline stations. In addition, the allocation program adversely affects those areas which have experienced rapid population growth and widespread gasoline station closings since there may be insufficient upward adjustments in fuel allotments.

TABLE IV-2

ADVANTAGES AND DISADVANTAGES OF
THE ALLOCATION PROGRAM

ADVANTAGES	DISADVANTAGES
• Price increases minimized	• Insufficient allotments to outlets
• Petroleum shortage spread equally over entire nation	• Confusion and long lines develop at service stations
• Easy administration by gasoline outlets	• No priority allotments to transit services or municipal operations
• Can be implemented with other actions	• Wasted time and fuel in search of open station
	• Rapid growth areas may be undersupplied
	• Consumer uncertainty

Source: Federal Energy Adminisstration, "Allocation and Price Controls as a Solution to the Energy Problem," (Washington, D. C.: February 4, 1975).

The Task Force on Regulatory Review of Contingency Allocation, Final Report, Contingency Allocation Program, (Washington, D. C.: April 18, 1975).

Future Application of Allocation

Because the gasoline allocation mechanism had been instituted during the previous embargo, and is, in fact, still in effect, there is little doubt that it would become a major part of federal petroleum conservation policy in the event of another embargo.

The major uncertainty lies in the extent of severity of its fuel restrictions. Current FEA contingency scenarios assume at least a 15 percent shortfall in gasoline supply before coupon rationing would be considered.[4] It can be assumed, then, that allocation would be used to deal with shortfalls up to 15 percent and even perhaps beyond this point.

Implementation Roles and Responsibilities

Since the major responsibilities of allocation lie with the FEA and the petroleum suppliers (Table IV-3), the allocation mechanism is much less complex than that of the proposed rationing plan. If allocation is not in effect at the time of the shortfall or if certain petroleum products have been deferred from the base plan, the President, with concurrences from both houses of Congress, may reimpose the allocation plan.

The FEA is primarily responsible for implementing and regulating this program. Its most important role, however, is to establish the amount of allocable petroleum supplies for each month or allocation period. This is done by estimating the amount of gasoline available for that month (imports plus domestic production) and comparing it to the demand expected. If, as is the current case, the supplies equal or exceed the demand, 100 percent of fuel needs are allowed to be distributed by the oil suppliers. If, however, it is expected that there will be a shortfall in the oil supply due to an embargo or increased demand, FEA may require the suppliers to distribute only a certain percentage of their base supply level. The states are also given the option of distributing three percent of allocated gasoline supplies to certain users. These recipients of state controlled allocations currently include agricultural and private users rather than service stations whose allocations generally are determined by regional FEA offices.

It is the supplier's responsibility to pass this shortfall on to the wholesale and retail outlets. If, for example, an oil embargo reduces national supplies by 10 percent,

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[4] Federal Register, Vol. 41, No. 105, May 28, 1976, p. 21919.

suppliers will be given only about 90 percent of their base supplies and will then likewise assign their customers about a .9 allocation ratio (this may vary at the discretion of the supplier).

With an allocation of only 90 percent of its usual monthly needs, a gasoline outlet may try to conserve supplies to last through the month by staying open fewer hours, closing on certain days, or using its own method of allocating fuel to customers. For example, it may try to limit purchases, limit sales to certain license plate numbers or letters, etc. If, however, it sells normally, it may run out of supplies before the end of the month and be forced to cease gasoline sales until new supplies are delivered. Such was the case in many stations during the 1973 embargo, as was discussed in Chapter III.

TABLE IV-3

ROLES AND RESPONSIBILITIES DURING THE ALLOCATION PROGRAM

ACTOR	ROLES AND RESPONSIBILITIES
President	• Propose an allocation plan
Congress	• Vote on acceptance of the allocation plan
FEA	• Maintain and administer the program • Establish the amount of allocable fuel supplies available • Establish a base year • Establish allocation ratios to distributors • Review appeals for modified allotments
Fuel Supplier	• Establish an allocation ratio for each of its wholesale and retail outlet customers
Gasoline Outlet	• Distribute monthly fuel supplies to consumers
Consumer	• Reduce fuel consumption

Source: Federal Energy Administration, State Guidance Manual for the Emergency Gasoline Rationing Program, (Washington, D. C.: April 15, 1975).

Federal Register, Vol. 42, No. 17, Wednesday, January 26, 1977, pp. 4813-4833.

Under this allocation program, the individual customer is in no way restricted (except perhaps by individual outlet policies) in the amount of gasoline which may be purchased. Since, however, numerous outlets may be limiting sales hours, open outlets may experience an increase in customers which will (as during the previous embargo) result in long lines of automobiles at these outlets. However, consumers, as a group, must reduce their total consumption of gasoline to the prescribed level.

The Rationing Scenario

Perhaps the most controversial energy conservation measure proposed during the last embargo was that of gasoline rationing to consumers. While the general public opinion was that such a severe action was not necessary at that time, the federal government pursued a policy of possible rationing implementation to the extent that an Office of Gasoline Rationing was formed and 4.8 billion ration coupons were printed and stored in five locations around the country. If, indeed, the oil embargo had continued much longer, it appears that the federal government would have been prepared to implement a policy of gasoline rationing in the United States.

Past Experience

The idea of gasoline rationing is by no means new to the nation. During World War II, a program of consumer rationing with gasoline coupons was imposed over a 3-1/2 year period.[5] At that time, owners of the nation's 25 million cars (there are over 106 million today) endured a coupon system which was based on adjudged need. The rationing program distributed "A" series coupons (good for up to four gallons a week) to people who had little need to drive; "B" or "C" coupons were issued to those who drove more; and "T" or "X" coupons were given to doctors, truckers, and others whose livelihood depended on vehicle travel.

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[5] "Rationing: Some Pros - But A Lot of Cons," Time, February 3, 1975, p. 15.

The impact of this former rationing program on the American motorist was apparently very similar to that evident during 1974.[6] During World War II, the newspapers were filled with energy conservation suggestions and appeals. The federal government encouraged voluntary conservation and attempted to involve state and local civil defense organizations in the promotion and supervision of these efforts. Besides the mandatory rationing program, the speed limit was restricted to 35 mph and a ban (later rescinded) was placed on pleasure driving.[7] Voluntary measures included the encouragement of group riding, staggered work hours, and discouraging holiday, pleasure, and convention travel. During this time, it should also be noted that transit patronage reached an all-time high. During 1945, for example, over 8.3 billion revenue passengers were carried by the nation's bus systems, more than twice the current ridership level.[8]

The results of this previous gasoline rationing program were generally mixed. While it undoubtedly succeeded in limiting gasoline consumption, it spawned considerable inequality between need and distribution which led to a booming "black market", counterfeiting operations, and considerable discontent with the system.[9]

The Pros and Cons of Rationing

The currently proposed gasoline rationing program, as published in the Federal Register,[10] would make initial gasoline allotments to each licensed driver equally, with no general regard to driving needs. The wide variation in needs of those workers who must depend

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[6]Donald Kendall, Carpooling: Status and Potential (Washington, D. C.: U. S. Department of Transportation, July, 1974), p. 5.

[7]Carpooling: Status and Potential, p. 5.

[8]American Transit Association, Transit Fact Book (Washington, D. C.: 1974), p. 8.

[9]"Rationing: Some Pros - But A Lot of Cons," p. 15.

[10]Federal Register, Vol. 41, No. 105, May 28, 1976.

n the private automobile for the home-to-work journey each weekday would be satisfied by an open "white market" for a gasoline rationing coupons. Although there are special allowances set forth to accommodate particular classes of drivers, including low-income commuters,[11] these allowances are made through an appeal process. In this respect, for instance, a family with four licensed drivers (husband, wife, and two teenagers) would receive, under the present guidelines, enough coupons to drive about 2,160 miles per month.[12] However, a family in which only one member is licensed to drive would receive only enough coupons to drive approximately 540 miles per month.

Any system of gasoline rationing that must necessarily deal with the approximately 140 million licensed drivers which will exist by 1980 will obviously be highly complex and involve burdensom administrative and distribution requirements. The current rationing program is estimated by the FEA to cost approximately $2 billion per year to administer and may add 93,000 employees to all levels of government.[13] This expense would largely be paid for through a fee on gasoline of about 2.0 to 2.3 cents per gallon. There would also be a need for an efficient audit and enforcement component in the program to discourage pilferage and counterfeiting attempts.

On the positive side, the gasoline rationing program can achieve almost any short-term level of energy consumption reduction necessary since the coupon exchange can be based on current energy supplies. This is an important element to be considered in the case of a severe gasoline shortage. Another important aspect is that a rationing program allows for some redistribution of wealth since the lower-income person, whose driving needs are usually less, will have an opportunity to exchange ration coupons for money needed for

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[11] Currently defined as having an annual family income below $10,000.

[12] Assuming a 10 gallon weekly allotment, the maximum now proposed by the FEA, and that the average automobile achieves 13.5 miles per gallon of gasoline.

[13] FEA, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, Economic Impact Analysis, pp. iii, 30.

other basic requirements in his budget. The gasoline rationing approach also provides for a basic gasoline ration per driver and yet permits additional gasoline to be purchased, at a premium, on the coupon market. This mechanism discourages high gasoline usage but does not prevent it.

In sum, a program of gasoline rationing would perhaps be one of the most effective and equitable short-term conservation measures possible. The administrative costs and the impact on the American life-style, however, are serious concerns associated with this approach. Table IV-4 sums these advantages and disadvantages.

TABLE IV-4

ADVANTAGES AND DISADVANTAGES OF
THE RATIONING PROGRAM

ADVANTAGES	DISADVANTAGES
• Each licensed driver entitled to an equal fuel allotment	• Does not account for differences in individual or regional needs
• Can achieve immediate short-term energy reduction	• Appeal process for additional rations may be time-consuming
• Redistributes wealth through an exchange market	• Complex administrative bureaucracy must be established
• Transit and essential municipal services receive priority rations	• High cost of initial implementation ($2 billion)
• Low income commuters may receive additional rations	

Source: Federal Energy Administration, Analysis of Gasoline Rationing, (Washington, D. C.: January 22, 1975).

"Rationing: Some Pros - But a Lot of Cons," Time, February 3, 1975, pp. 15-16.

Proposed Rationing Plan

The ultimate decision to initiate the implementation of a gasoline rationing program must be made by the President. Section 203 of the Energy Policy and Conservation Act (EPCA) requires the President to submit a rationing contingency plan (to be developed by the FEA) to Congress for their vote of approval. The current plan, developed from the recent FEA proposals, is to be submitted to the 95th Congress in 1977.[14] This plan restricts the length of any rationing period to nine months,[15] although it is likely that the plan could be reinstated by Congress if energy shortages remain severe.

The Ration Coupon

The principal mechanism in the implementation of rationing is the distribution of fuel "coupons." Physically, ration coupons will be printed as dollar-sized stamps in sheets of 16 coupons each.[16] Each coupon would be worth a certain amount of gasoline, probably five gallons. Figure IV-2 depicts a facsimile of a coupon. A different coupon series would be used each month. For example, the first month would begin using coupon series A, the second month series B, and so on. As currently proposed, once issued, a coupon could be used indefinitely unless recalled by the FEA.

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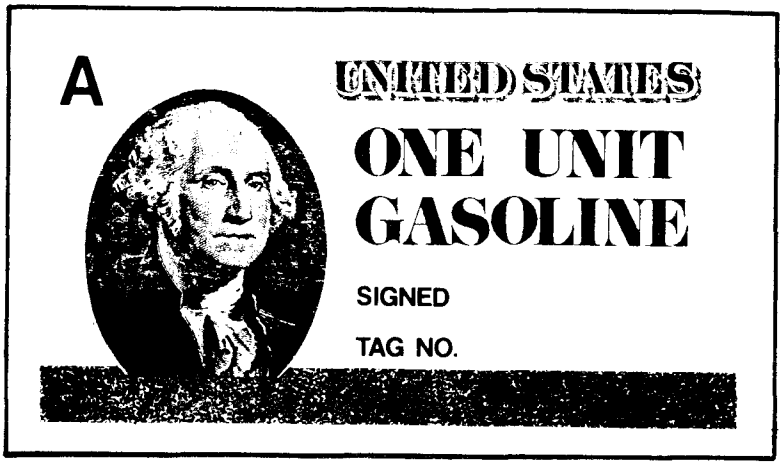
[14] Information obtained from telephone conversation with Regional FEA Office personnel.

[15] FEA, Economic Impact Analysis, p. 6.

[16] FEA, State Guidance Manual for the Emergency Gasoline Rationing Program (Washington, D. C.: Emergency Standby Capability Working Group, FEA, April, 1975), p. 2.

FIGURE IV-2

FACSIMILE OF RATION COUPON



Coupon Eligibility

Under the proposed plan, an individual eligible to receive ration coupons is a "natural person having a valid driver's permit, other than a learner's license, or any other person whom FEA designates as an eligible individual."[17] Using this definition, and considering an increase in the number of driving license applications due to the ration plan, an estimated 140 million persons would have been eligible in 1975.[18]

Coupon Distribution

Figure IV-3 provides a schematic view of the coupon distribution process. Under the proposed plan, the FEA would issue ration rights for each ration period (every four to

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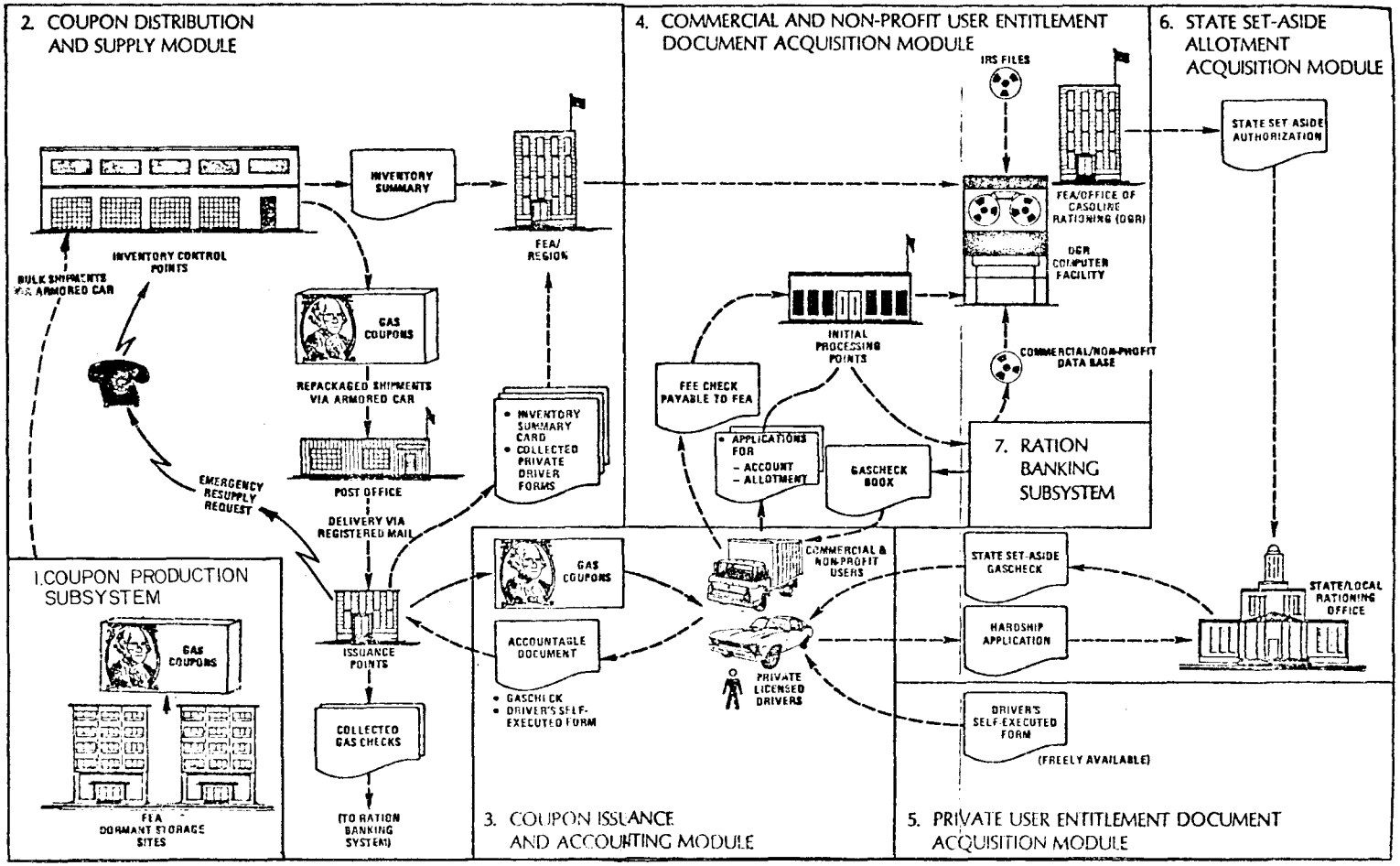
[17] Federal Register, May 28, 1976, p. 21919.

[18] U. S. Department of Transportation, FHWA, Highway Statistics, 1975.

CONCEPTUAL OVERVIEW—COUPON DISTRIBUTION SUBSYSTEM FOR THE FIRST QUARTER OF GASOLINE RATIONING



Source: FEA, State Guidance Manual for Emergency Gasoline Rationing Program, Draft, April 15, 1975.

six weeks) equal to the total estimated available supply of gasoline during that period. The FEA would then distribute these ration rights through four basic programs:

1) The FEA would provide ration coupons to all eligible individuals currently defined as "persons holding valid state driving permits."
2) The FEA would provide ration credits to all firms (defined to include individuals, government units, corporations, partnerships, etc.) which are engaged in priority activities and for which a ration credit level has been established. These credits would be in addition to any coupons received by a person as an eligible individual.
3) The FEA would distribute three percent of all ration rights to State Rationing Offices which would be authorized to distribute these rights through local boards to hardship cases.
4) The FEA would reserve one percent of the issued ration rights to distribute itself under emergency circumstances and to adjust deficiencies in the distribution of ration rights under the other three programs.

Factors Determining Distribution

Since the number of coupons distributed to licensed drivers will remain the same for each rationing period, differences in fuel supply and demand will be accounted for by altering the length of each period. The proposed procedure to determine the length of a ration period follows these four basic steps:

1) The FEA would estimate the total amount of gasoline supplies during the coming ration period.
2) Next, the FEA would compute the number of ration credits to be issued to firms entitled to a ration credit level.
3) The FEA then would decide the number of ration rights to be issued for the National Ration Reserve and the State Hardship Reserves by computing four percent of the total available supply of gasoline.
4) Finally, the total number of ration credits to be issued to firms entitled to a ration credit level and the ration rights issued to the National Ration Reserve and State Hardship Reserves would be subtracted from the total amount of gasoline supplies available during the coming ration period. The remaining gasoline would be for use

by eligible individuals. Since their basic allotment would have been set by the coupons previously (or initially) issued, the available gasoline would then be matched with the total of eligible individual allotments by adjusting the length of the ration period.

Thus, the rationing to businesses will be given priority with the remaining fuel to be distributed to the individual consumer.

Coupon Redistribution: The Ration Rights Exchange Market

Persons to whom ration rights are issued could sell, trade, or give them away. Under the proposed ration plan, any individual or organization could enter the ration rights exchange market and function as a trader or broker of ration rights following their issuance by the FEA. Thus, ration rights could be traded on a "white market" rather than a "black market." The FEA would not impose any monetary or administrative barriers to entry. Any trader or broker could open a secondary ration credit account with a participating bank to handle his or her transactions. There would also be a free market in the trading of all ration rights in the form of coupons and ration credit accounts.

Prices for ration rights would be determined by supply and demand with the account, form, and timing of payment determined by mutual agreement between the buyer and seller. The average price of these coupons has been established to be $1.20 per gallon but could, however, range from 20 cents per gallon to as high as $2.50 per gallon depending on supply-demand factors as well as the perceived transaction costs incurred by the seller.[19] The FEA does not expect to prohibit short selling, future sales, and trading in unissued series. However, such practices may be restricted if the FEA were to determine that they were harmful to the stable operations of the exchange market.

[19] Economic Impact Analysis, p. 18.

Hardship Allotments

Hardship allotments could be made by Local Rationing Boards to the following classes of individuals:

1) Handicapped persons whose gasoline needs exceed their basic allotment, if any, for reasons related to their handicaps. A handicapped person would be "any individual who, by reason of disease, injury, age, congenital malfunction, or other permanent incapacity of disability is unable without special facilities, planning, or design to utilize mass transportation vehicles, facilities and services and who has a substantial, permanent impediment to mobility."

2) Low-income, long distance commuters who, without a supplemental allotment, would be forced to spend over five percent of their adjusted gross income purchasing ration rights for travel to and from their place of employment and for whom carpooling or public transportation is not a reasonable alternative. (A table would be provided to compute the supplemental allotment according to each applicant's adjusted gross income, number of dependents, commute distance, and the prevailing price of coupons on the ration rights exchange market.) Current proposals suggest a family income below $10,000 a year and a weekly work trip VMT of at least 100 miles.

3) Migrant workers who hold a driver's license issued by a state and who own motor vehicles used for travel from one agricultural work site to another. These workers would apply for supplemental allotments according to the distance between their current work sites and their new work sites.

4) Persons engaged in household moving who are driving vehicles as part of their own household moves and who, without a hardship allotment, would be forced to use over 25 percent of their total household basic allotment for one ration period in order to complete their moving.

5) Other recurring or one-time hardship needs which a Local Rationing Board considers to be consistent with the spirit and intent of the hardship priority classification.

Ration Credit Allotments to Firms

Under the FEA's proposed ration plan, certain gasoline consumers would receive (in addition to any ration coupons issued to them as eligible individuals) ration credits based upon their being engaged in certain priority business activities. These consumers or "firms" could be individuals, corporations, trusts, government units, partnerships, etc. who normally report gasoline purchases as an expense to the Internal Revenue Service.

However, the right to receive these ration rights would depend on whether the consumer is engaged in an activity for which these ration rights could be issued.

A ration credit would be redeemable for one gallon of gasoline. Under the proposed regulations, for example, a firm with a base period of 1,000 gallons of gasoline for the calendar month of September and entitled to a ration credit level of 90 percent of its base period use would receive 900 ration credits for the month of September.

Rather than being issued ration coupons, a firm's allotment of ration credits for a calendar month would be deposited by the FEA on the first day of each month in the firm's primary ration account maintained with an FEA regional processing center. The firm could then withdraw its ration credits by issuing a ration credit check drawn on its primary ration account to the order of its gasoline supplier. The supplier would then redeem the ration credits represented by the check.

In order to receive monthly ration credits, firms entitled to a ration credit level must establish primary ration credit accounts with an FEA regional processing center. FEA would contract with local banks (defined as "participating banks") to act as the FEA's agents to accept applications for the establishment of primary ration credit accounts. The participating banks would probably be commercial banks (rather than the savings and loan associations and credit union which may serve as issuance points for distributing ration coupons to eligible individuals). A firm could qualify for one of three gasoline ration credit levels, depending on its end use of gasoline. Table IV-5 lists these users and their fuel allotments.

Appeals for temporary increases in fuel allotments may be made through the State Rationing Office. The State Rationing Office, however, cannot make an adjustment of a firm's base period allotment since the State Hardship Reserves are intended to be a means of meeting hardship needs caused by unusual circumstances. Firms which seek

permanent adjustments of their base period uses may petition the appropriate FEA regional office in accordance with instructions to be issued by the FEA.

TABLE IV-5

PROPOSED RATION CREDIT LEVELS

Ration Level	Users
100 percent of current requirements	• Department of Defense use (essential to national defense operations); • Agricultural production directly related to food production, and to to the transport, processing, and sale of perishable foods (excludes activities relating to fibers, tobacco, and timber); • Emergency services (law enforcement, fire fighting, emergency medical services, and others); • Passenger surface transportation services, including school buses, but excluding water and rail transportation and vehicles seating 10 or fewer persons.
100 percent of base period use	• Telecommunications services (repair, operations and maintenance of various communications services); • Sanitation services (water, sewer, and solid waste); • Energy production (gasoline use directly related to energy exploration, production, and distribution).
90 percent of base period use	• All other government (Federal, State, and local) uses; • All other uses by firms which report gasoline purchases as an expense; to the Internal Revenue Service (IRS); • All uses for religious, charitable, educational or other eleemosynary purposes not otherwise accorded a ration credit level.

Source: Federal Register, Vol. 41, No. 105, May 28, 1976, p. 21930.

The National Ration Reserve

A National Ration Reserve (initially one percent of estimated supply) would be established as a special allotment which could be used by the FEA to meet national disaster relief needs, or for interim replenishment of any State Hardship Reserves faced with usually heavy demand. The National Ration Reserve could also be used by the FEA to provide any special allotments deemed necessary for any reason during any ration period.

Purchase of Diesel Fuel

Diesel fuel would be rationed similarly to the gasoline plan. Eligible individuals or firms would use their allotments of ration coupons or credits for their diesel fuel requirements. This would assure equity between users of gasoline-powered and diesel-powered vehicles.

Financing the Plan

"User fees" would be collected by the FEA to recover the total cost of gasoline rationing. The following are illustrative of expected types and ranges of such fees:

1) (a) A user fee of between 1.6 cent and 1.9 cent per gallon of all gasoline supply available during a gasoline shortage, (b) the actual operating costs of rationing (other than costs to gasoline marketers), and (c) the amortization arrangements made to recover start-up costs of rationing. This fee would be collected through the same Internal Revenue Service (IRS) procedures that are used to collect the Federal excise tax on gasoline.
2) Fees to cover the cost of opening and using gasoline checking accounts.
3) In addition to the fees described above, a markup estimated to total approximately 0.4 cents per gallon of gasoline would be permitted for suppliers to recover their direct costs associated with the handling, canceling, and depositing of ration coupons, ration credit checks, and redemption checks.

The FEA would collect no gasoline taxes and the total amount of fees collected would not exceed the cost of the gasoline rationing program. However, the "fees" added would raise the price of gasoline a minimum of two or three cents per gallon.

Responsibilities of Gasoline and Diesel Fuel Suppliers and Sales Outlets

It is the responsibility of the fuel suppliers (refiners or importers) to allocate gasoline and diesel fuel to wholesale operations (based on supply obligations) according to the amount of allocable supply of fuel available. Suppliers must adjust their allocation fractions for each ration period to reflect adjustments in their supply (based on National supplies) and obligations to wholesalers. Wholesalers must present to their supplier ration redemption checks drawn upon a redemption account in amounts equal to the supplier's deliveries at least 10 days prior to delivery.

Retail gasoline/diesel fuel outlets (service stations) will receive fuel allocations based on their supplier or wholesaler obligations in monthly amounts determined by the National deficit. These outlets are required to collect and redeem ration coupons and credit checks for all gasoline sold and to deposit these redeemed coupons or checks in the supplier's redemption account. The retailer may, at his option, issue scrip for any unused value of a ration coupon which could be redeemed for gasoline at a later time.

Responsibilities of Individuals (Licensed Drivers)

For the first three ration periods, each individual desiring to obtain ration coupons must register at the predesignated issuing point (currently planned to be savings and loans or credit unions) by filling out an application form and presenting a valid driver's license for certification. The individual will then be issued the appropriate number of coupons (currently assumed to be eight coupons worth five gallons each) for that ration period. For the fourth and subsequent ration period, the individual will receive in the mail a rationing authorization card sent by the state motor vehicle department. This card will then be taken to the issuing point and surrendered when the coupons are received.

Individuals needing additional coupons due to hardship can apply to the Local Rationing Board and complete the appropriate forms (see Appendix C for example). If they are unsatisfied with the results of this application, they may appeal to the State Rationing Office for a final judgement.

Firms

It is the responsibility of each applicant who is considered to be a "firm" (this includes local transit companies, municipal governments, taxicab companies, etc.) to open a rationing rights account at the predetermined issuing point (commercial banks as now proposed) by completing an application form. Each firm must certify its base period use or estimated current requirements for gasoline for each calendar month of the year.

After the ration rights have been deposited into the firm's ration account, it may then purchase gasoline by writing a check from this account and presenting it to the gasoline supplier for the amount of fuel purchased.

If any firm's gasoline consumption for any three preceding months decreases by 25 percent or more from the corresponding period of the base year, it is required to report the amount to the FEA for readjustment of the ration allotment. If the amount of gasoline needed increases to 25 percent or more than the base period, the firm could apply to the FEA to increase the size of ration credits allotted. Firms may also purchase additional ration rights from the "white market." All organizations receiving ration credits would be required to maintain records of gasoline purchased during the program.

Role of State Governments

Even though the State of Texas currently has made no provisions to administer a rationing plan,[20] the FEA has outlined the roles and responsibilities of State governments (see Table IV-6 for a listing of major roles and responsibilities during rationing). The principal role of the State government under this plan is to administer the local hardship coupon allotments. Local rationing offices are to be formed to decide individually, through an administrative process, the eligibility of hardship applicants. The size of the State Hardship Reserve for each ration period (taken from the three percent allotted nationally) will be apportioned according to State population and "other relevant factors." The State Rationing Office could be incorporated with the existing State Energy Office.

The State Rationing Office would distribute (assumably based on population and need) its hardship allotments to Local Rationing Boards. The State Rationing Office would also hear appeals from decisions of Local Rationing Panels and would decide on hardship applications filed by firms. Records of these State transactions would be sent to and monitored by the FEA.

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[20] Information obtained through telephone conservation with Mr. J. Ventura, State Allocation Office, November, 1976.

TABLE IV-6

ROLES AND RESPONSIBILITIES DURING THE RATIONING PROGRAM

ACTOR	ROLES AND RESPONSIBILITIES
President	• Propose the rationing plan
Congress	• Vote on acceptance of the plan
FEA	• Submit plan to President • Regulate and monitor the plan • Establish the length of each ration period • Review appeals to modify ration allotments
State Governments	• Administer local hardship ration allotments • Establish local rationing boards • Issue rationing authorization cards (based on drivers licenses) • Conduct public information program and distribute FEA materials
Local Governments	• Choose local rationing panel to hear appeals
Savings and Loan Associations/ Credit Unions	• Act as coupon issuing point to individuals
Commercial Banks	• Act to maintain ration credit accounts for firms
Gasoline Sales Outlets	• Collect ration coupons and checks • Redeem coupons and checks for next fuel allotment • Issue scrip for unused value of coupon (if desirable)
Consumers	• Obtain coupons from local savings and loan associations upon presentation of operators license and application form • Apply to local rationing board if coupon adjustments are desired - may appeal to state rationing office • May sell, loan, or give away coupons • May purchase additional coupons on the "white market" • Must surrender coupons to service stations upon purchase of fuel
Firms	• Apply to qualify for ration rights at commercial bank • Write check(s) and present them to gasoline supplier for purchase • May apply for readjustment of rations throught local FEA office • May purchase additional coupons or ration rights on the open market • Maintain records of gasoline/diesel fuel purchased

Source: Federal Energy Administration, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, September 1976.

Another responsibility of the State is to issue rationing authorization cards. These cards, which will take the place of driving licenses for identification for coupon rationing purposes, must be issued by the fourth ration period under the auspices of the State Department of Motor Vehicles.

In addition, the States would be asked to conduct an ongoing public information program to fully inform citizens about the rationing procedures, distribute certain FEA materials, and respond (through Local Rationing Boards) to public inquiries concerning the system.

Local Government

Local governments (by city or county council meeting, town meeting, etc.) would be allowed to choose a volunteer Local Rationing Panel to head the Local Rationing Board which will make decisions concerning hardship cases. In accordance with FEA guidelines, this panel must reflect the community as a whole. A paid Local Rationing Board Manager (appointed by the Chief Executive of the State) would primarily responsible for carrying out the day-to-day operations of the board along with a paid administrative staff whose covered through the fees previously discussed.

Since the State of Texas has not yet considered the rationing mechanism, the exact structure on the local level is not known. Such a program might be locally administered through County Commissioners, the Department of Public Safety (which currently administers Civil Defense), or the County Agricultural Offices (during the 1973-1974 embargo, these Agricultural Offices reviewed allocation requests in most Texas counties).[21]

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[21] Telephone conversation with Mr. J. Ventura, State Allocation Office, November, 1976.

Conclusions

Due to the inherent differences between the allocation and the rationing programs, transportation problems will vary under each senario. Under allocation, for example, transit operations could receive fuel supplies reduced by perhaps up to 25 percent while, under rationing, 100 percent of fuel needs for these users would be assured. Chapter V will examine these specific problems as well as those resulting from a general fuel shortage caused by an interruption in supplies. Note that, although the analysis and recommendations contained in subsequent chapters are based on scenarios representing current federal rationing and allocation regulations, it is felt that the problems of increased fuel prices and/or limited fuel availability will be characteristic of any future energy scenario. Thus, the approach employed here addresses both the specific problems of rationing and allocation as well as the more general problems assocaited with diminishing petroleum supplies.

V. Problem Analysis

Under the basic assumptions that the impact of a sudden severe oil shortage in the near future will affect the nation in ways similar to that of the 1973-1974 oil embargo, that the shortages will be equally distributed throughout the United States, and that the federal government will implement a policy of fuel allocation and/or rationing, local transportation problems likely to develop during this scenario can be identified. These basic problems appear to be:

- Obtaining sufficient fuel supplies to operate public transportation
- Coping with mass transit ridership increases
- Providing transportation alternatives in suburban areas
- Reducing inequities and uncertainties associated with gasoline rationing and allocation

The following discussion analyzes these difficulties and suggests actions which, it is felt, will meet the major criteria of maintaining the work trip and maximizing the availability of public transportation under the anticipated conditions.

Insufficient Fuel Supplies for Public Transportation

A basic difficulty to be encountered during a period of fuel allocation or rationing would be one of obtaining sufficient gasoline or diesel fuel supplies to maintain normal public transportation services throughout the area. While most of the vital public transportation services (transit, school buses, emergency services), would be guaranteed 100 percent of their fuel needs under a rationing scenario (Table V-1), current State and federal regulations do not assure similar considerations under an allocation contingency. As can

also be seen in Table V-1, taxicabs and social service transportation services will receive only 90 percent of their base period use under the rationing program. In addition, it is conceivable that spot fuel shortages may develop locally. Therefore, the problem of securing adequate fuel supplies during a sudden oil shortage could produce severe hardships on the local transportation system if adequate measures are not taken to prepare for the situation. Possible short-term solutions to this problem would be to:

- Modify allocation regulations to assure priority treatment of transit and emergency transportation services
- Include taxicabs in preferential treatment under the rationing program
- Expand or establish in-house fuel supplies
- Reduce fuel consumption

TABLE V-1

GASOLINE/DIESEL FUEL ALLOTMENT CONTINGENCIES

USE	UNDER ALLOCATION	UNDER RATIONING
AUTO	NO LIMIT AT RETAIL	7.2-9.2 GALLONS/WK
TRANSIT	ALLOCATION RATIO (10-25% DEFICIT)	100% OF NEEDS
SCHOOL BUSES	ALLOCATION RATIO	100% OF NEEDS
TAXICABS	ALLOCATION RATIO - NO LIMIT AT RETAIL	90% OF BASE PERIOD
SOCIAL SERVICE	RATIO - NO LIMIT AT RETAIL	90% OF BASE PERIOD
SANITATION SERVICES	ALLOCATION RATIO	100% OF BASE PERIOD
EMERGENCY SERVICES (POLICE, MEDICAL, FIRE)	ALLOCATION RATIO	100% OF NEEDS

Source: Based on FEA information.

Modify Allocation/Rationing Regulations

Changes in the fuel allotment regulations at either the federal or state level to assure priority fuel supply considerations for transit and paratransit services would relieve much of the uncertainty currently associated with these regulations. As mentioned in Chapter IV, federal allocation regulations currently assure 100 percent of fuel requirements only to the Department of Defense and for agricultural food production. If, however, these federal allocation regulations were modified to assure transit and paratransit users with 100 percent of their fuel needs, much of the uncertainty of accommodating or expanding service demands could be avoided.

Modifications of fuel allocation regulations currently administered by the State could also result in more fuel reserves being made available for these users. Currently, the Federal Energy Administration requires that three percent of the gasoline/diesel fuel supply entering each state be set aside for distribution by the State Allocation Office. In Texas, this amounts to 16 to 18 million gallons of fuel per month.[1] The State office may allocate this fuel to anyone loosely defined as a "wholesale purchaser consumer" (such as a large business or trucking company) or an "end user" (farmers, transit operations). While transit systems and emergency services may be prime recipients of these allotments (during the 1973-1974 embargo, for example, the Houston Transit System received additional fuel in this manner), they are not assured special considerations over other applicants. If, however, a priority list which guaranteed transportation providers first priority for these supplies was established by the State, much of the uncertainty associated with this fuel source could be ended.

A change in the federal rationing regulations would also be desirable to assure supplies to paratransit users, especially for taxicab operations which would be given 90 percent

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[1] Information obtained during a telephone conversation with Mr. Joseph Ventura, Texas State Allocation Office, Austin, November, 1976.

of other base period consumption. The FEA expects the 10 percent fuel supply reduction to be accommodated through taxi conservation measures such as "reduced cruising, increased use of taxi stands, and greater use of radio call equipment."[2] Since, however, these measures are currently being followed by most local taxicab companies, (Fort Worth, for example, has an ordinance against taxicab cruising), the rationing regulations would place an unfair burden on taxicab operations in the Dallas-Fort Worth Metropolitan area.

The solution to this problem would be to modify these federal rationing regulations to include paratransit users, or specifically taxicab operations, under the priority list of those receiving 100 percent of their fuel needs. It should also be noted that the federal rationing regulations are currently only proposed plans and are in a stage or restatement by the FEA. Thus, the opportunity exists for this position to be modified to include paratransit as a priority fuel user before the regulations are finalized.

Expand or Establish In-House Fuel Reserves

Another possible solution to a fuel shortfall would be to use stored in-house diesel/gasoline reserves. If a fuel user has established its own reserves of stored gasoline or diesel fuel prior to the shortage, it may be unnecessary to search for outside allotments during a time when normal supplies are reduced by federal actions or spot shortages. A similar policy on the national level is, in fact, in the process of being implemented by the federal government with regard to crude oil supplies. The Strategic Petroleum Reserve (SPR) program plans to eventually stockpile one billion barrels of crude petroleum. By 1980, 325 million barrels are to be stored throughout the nation (mostly in underground salt domes), a reserve sufficient to account for a 45 percent loss of imports for up to four months.[3]

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[2] Federal Register, Vol. 42, No. 17, Wednesday, January 26, 1977, p. 4815.

[3] Federal Energy Administration, "Strategic Petroleum Reserve Plan Goes to Congress," Energy Reporter, December, 1976/January, 1977, p. 3.

A similar strategy at the local level could likewise be an effective hedge against short-term fuel reductions, particularly since the federal reserves may encounter difficulties in implementation. While the desired size of the reserve supply could vary depending upon the duration and extent of the oil embargo, a one month's reserve (based on normal consumption) appears to be a worthy goal. By drawing from such a reserve to make up for fuel shortages, the user could maintain normal transportation operations of four to ten months depending on the severity of the shortage. This time period could be used to prepare additional contingency plans to cope with the shortfall once the reserves are depleted. On the other hand, if sufficient fuel is available to maintain normal operations, this reserve supply will allow for some expansion of service if desired.

Differences in fuel use and storage capacity between the Dallas Transit System and CITRAN (Table V-2), for example, may not make this alternative equally attractive to both bus systems. As can be seen in the table, CITRAN's current diesel fuel storage capacity is already near to a one month's supply while that for DTS is equivalent to less than a week's normal consumption. Therefore, the cost to develop a 30 day storage capacity in the case of CITRAN (an estimated $10,000 - $20,000) would require a much smaller investment than that for DTS, where approximately $210,000 - $300,000 would be needed.[4]

TABLE V-2

CURRENT FUEL CONSUMPTION AND STORAGE CAPACITY

DTS AND CITRAN

	DTS	CITRAN
Average Monthly Diesel Fuel Consumption	350-375,000 gallons	60-70,000 gallons
Current Diesel Fuel Reserves	60,000 gallons	50,760 gallons
Days Supply at Current Consumption	5 days	24 days

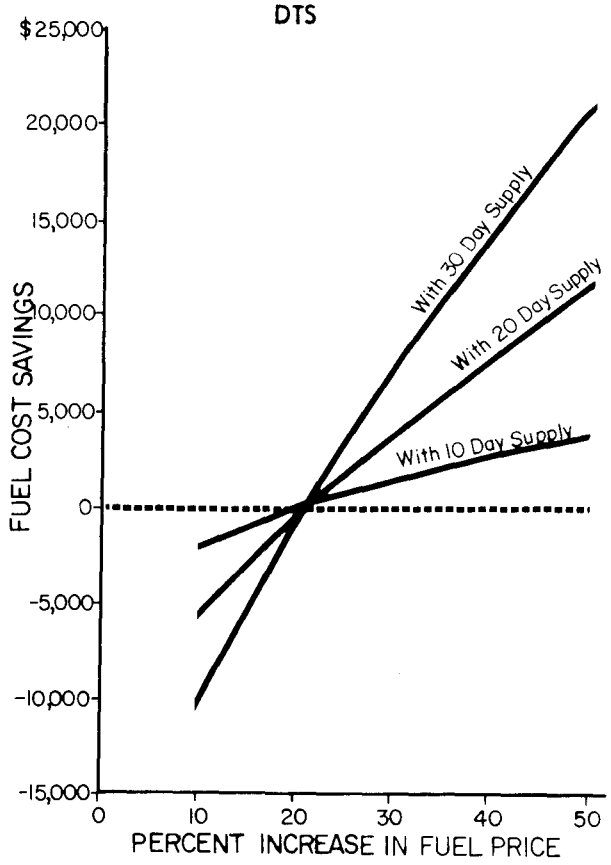
Source: Dallas Transit System and CITRAN, January 1977.

[4] The installed cost of a fully equipped 10,000 gallon storage tank ranges from $7,000 to $10,000 depending on the type of tank (steel, fiberglass). Source: Dallas Pump Service, 1977.

These investments in fuel reserves, however, could be financially profitable, especially if the price of fuel rises after the stocks had been established. Current FEA projections suggest that, if a rationing program were initiated in 1977, the cost of fuel would rise 21.33 percent.[5] The local share by DTS and the City of Dallas, for example, to develop this capacity would amount to approximately $20,000.[6] If the price of fuel were to rise by 22 percent, however, the savings in fuel costs will offset the cost of the storage facility (Figure V-1). In addition, other financial savings of a large storage supply could be realized by decreasing truck deliveries and thus reducing the number of DTS man-hours involved in the administrative process as well as fuel transportation costs.

FIGURE V-1

THE EFFECT OF FUEL PRICE INCREASES ON STORED FUEL SUPPLY VALUE DTS



[5] FEA, Economic Impact Analysis, p. 75.

[6] Local cost would be seven percent of the total cost of the storage facility. This figure excludes the cost of the fuel itself.

The major disadvantages of this solution, however, are: 1) a large initial investment would be needed to purchase fuel to fill the tanks; 2) the large storage facility may be difficult fo find; and 3) safety problems may arise from storing such a large quantity of fuel. It is also conceivable that this same strategy could be applied to expanding or establishing fuel storage facilities for other municipal operations and private transportation operations.

Reduce Fuel Consumption

The third alternative to coping with a fuel shortfall would be to reduce the amount of fuel consumed by 1) reducing or eliminating service and 2) operating the service more efficiently. If additional fuel supplies cannot be obtained, transit systems may find it necessary to reduce their service in order to save fuel. Such measures, besides inconveniencing patrons, could also mean eliminating or reducing the number of bus operation personnel, thus aggravating the local unemployment situation.

Through a detailed analysis of hourly bus line ridership, each transit system should be able to identify the lines and times for which service could be curtailed if fuel reductions make this necessary. Indeed, a readjustment of bus schedules may be necessary anyway to meet anticipated changes in rider demands. A contingency plan of this type has been developed by Seattle's Metro bus system based on an analysis of how the 1973-1974 oil embargo affected each line.[7] This information was then used to develop three alternate levels of service reductions based on the severity of the fuel shortage. The first level reduced or eliminated service on certain lightly patronized routes and was designed to save about seven percent of the systems fuel supply. The second level reduced or eliminated service during non-peak (afternoon, late night, weekend) hours, and would save up to 33 percent

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[7] The Municipality of Metropolitan Seattle, An Energy Crisis Contingency Plan for Metro Transit (Seattle, Washington: November, 1975).

of its fuel. The third level of service reduction would reduce or totally eliminate even peak hour bus service, however, the transit system's electric trolley would remain in service.[8]

The first level reduction would affect 29 routes and would be accomplished by service changes which would:

- Totally eliminate some routes
- Provide peak service only along certain routes
- Lengthen headways
- Eliminate weekend service
- Modify service to shuttle to other routes

Locally, DTS and CITRAN could choose actions similar to those proposed in Seattle for reducing fuel consumption. A system of priorities would have to be established by both systems to determine which types of cutbacks would occur, at what times, and on which lines. In addition, an examination of line changes during the past embargo (as discussed in Chapter III) will provide additional insight on what types of changes can be expected on the various lines.

A number of strategies to increase the efficiency of current transit operations could also be utilized during a fuel shortage. These include actions which:

- Reduce the number of bus stops
- Change some local to express service
- Improve the flow of buses in traffic
- Decrease the number of "deadhead" bus miles

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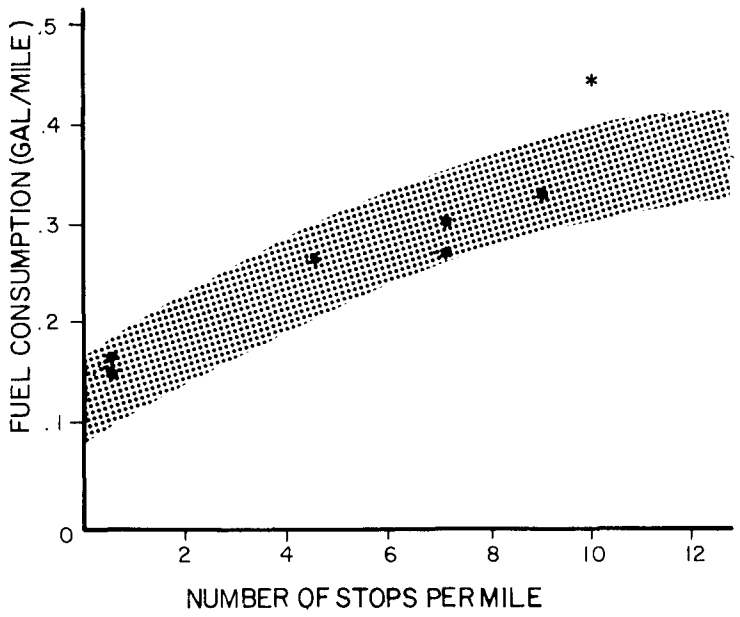
[8] Ibid, pp. 60-63.

Figure V-2 shows that, as the number of bus stops increases, the fuel efficiency of a bus decreases. Therefore, if the number of stops is cut in half, say from four stops per mile (about average for local transit service) to two stops per mile, fuel consumption could be reduced by about 25 percent.

FIGURE V-2

BUS FUEL CONSUMPTION
AND BUS STOP FREQUENCY



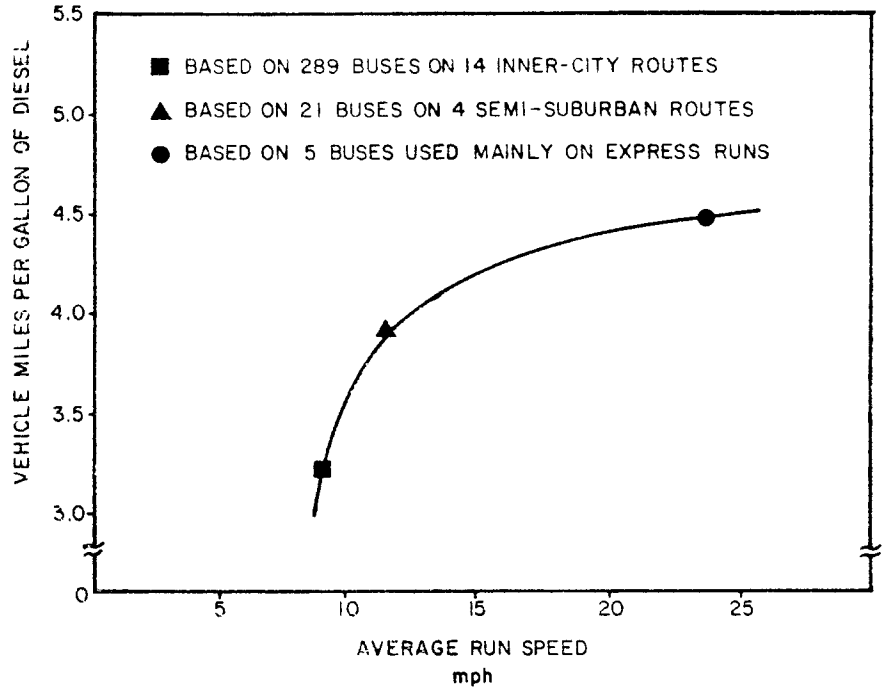
Source: DeLeuw, Cather, and Co., Case Studies of Transit Energy and Air Pollution Impacts, Prepared for the Environmental Protection Agency, June 1975.

Another possible way to save fuel would be to shift some existing service from local to express-type operations. This would have the effect of increasing the bus speed, and thus saving fuel. As can be seen by Figure V-3, bus fuel economy increases with speed. The average speed of local service DTS buses is currently 12-14 miles per hour and for CITRAN 11-13 miles per hour. Express bus service in these cities, however averages

over 20 miles per hour.[9] Thus, each local bus that could raise its average speed to express levels could travel approximately 12 percent farther on the same amount of fuel.

FIGURE V-3

DIESEL BUS FUEL UTILIZATION VS. SPEED



Source: Martin J. Bemard III, and Sarah LaBelle, Energy Conservation in Urban Transit System, Presented at Energy Conservation: A National Forum, Ft. Lauderdale, Florida, December 1-3, 1975.

The major disadvantage of strategies such as those which reduce the number of bus stops or change local to express operations, is that the level of service to bus patrons is reduced below normal levels, thereby inconveniencing passengers and discouraging transit use. If, however, sufficient fuel supplies cannot be obtained, reductions in service may be unavoidable.

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[9] North Central Texas Council of Governments, Transit Development Program for the North Central Texas Region (Arlington, Texas: June, 1973), p. 39

The vehicle speed and hence fuel efficiency, could also be increased by implementing preferential bus treatment actions which would increase the bus flow through traffic. Such measures include:

- Bus activated signals
- Reserved bus lanes

The utilization of bus-activated signals would tend to speed the flow of buses through congested intersections. Such a system is currently being developed in Dallas which would provide bus signal preemption at 42 intersections.[10] These measures, however, require considerable time and expense to develop and cannot be considered as short-term strategies unless they have been implemented prior to the energy shortage. Their effect on fuel reduction, however, could be considerable since time delays due to the traffic signals account for 10 to 20 percent of overall trip time.[11] A possible alternative to expensive signal equipment could be to manually direct traffic at major intersections to provide the priority movement of transit vehicles. Such traffic direction is currently used in downtown Dallas during peak hours.

Reserved bus lanes provide a greater potential as a short-term action to increase bus speed. Bus lanes in existence in other cities (e.g. Washington, D. C., Atlanta, Chicago, Toronto, London and Paris) have resulted in bus speed increases generally ranging from one to five percent.[12] Dallas and Fort Worth currently provide reserved bus lanes in downtown

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[10] City of Dallas, Application for a Section 5 Capital Assistance Grant for a Bus Priority System, April, 1975, p. 70.

[11] U. S. Department of Transportation, State-of-the-Art Bus and Carpool Priorities, Presented at the Workshop on Priority Techniques for High Occupancy Vehicles, Miami, April 29, 1975.

[12] Wilbur Smith and Associates, Inc., Bus Rapid Transit Options for Densely Developed Areas, Prepared for U. S. Department of Transportation, February, 1975, p. 104.

areas, and Dallas has established two experimental reserved lanes and arterial bus routes, one along Harry Hines Boulevard and another along Fort Worth Avenue.[13] While most of these were relatively expensive long-range projects, it would be necessary to establish temporary lanes inexpensively on a short-term basis during an energy crisis. Reserved curb lanes along highways with three or more one-way lanes are prime targets for such a bus strategy. Bus lanes could be established in such areas relatively easily by placing traffic signs, painting lane stripes or using other traffic markers to indicate their exclusive use. Moreover, due to the anticipated decrease in traffic volume, the use of one lane for high-occupancy vehicles may not even increase traffic congestion on the other lanes. However, unless adequately supervised, legal enforcement of such exclusive lanes may become a problem.

A number of potential locations for short-term bus lanes in Dallas and Fort Worth have been identified.[14] These are shown in Figures V-4 and V-5.

In addition to bus lanes, other preferential traffic actions, such as reserved bus ramps on freeways or reserved turning lanes could also expedite the flow of buses. The sum of these actions could be an effective means of increasing the bus flow thereby decreasing its fuel consumption.

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[13] City of Dallas, Department of Traffic Central, Report on Effect on Traffic Operations When Bus Lanes are Reserved on Major Thoroughfares, September, 1975.

[14] City of Fort Worth, Exclusive Bus/Carpool Lanes for the Fort Worth Metropolitan Area, February, 1974.

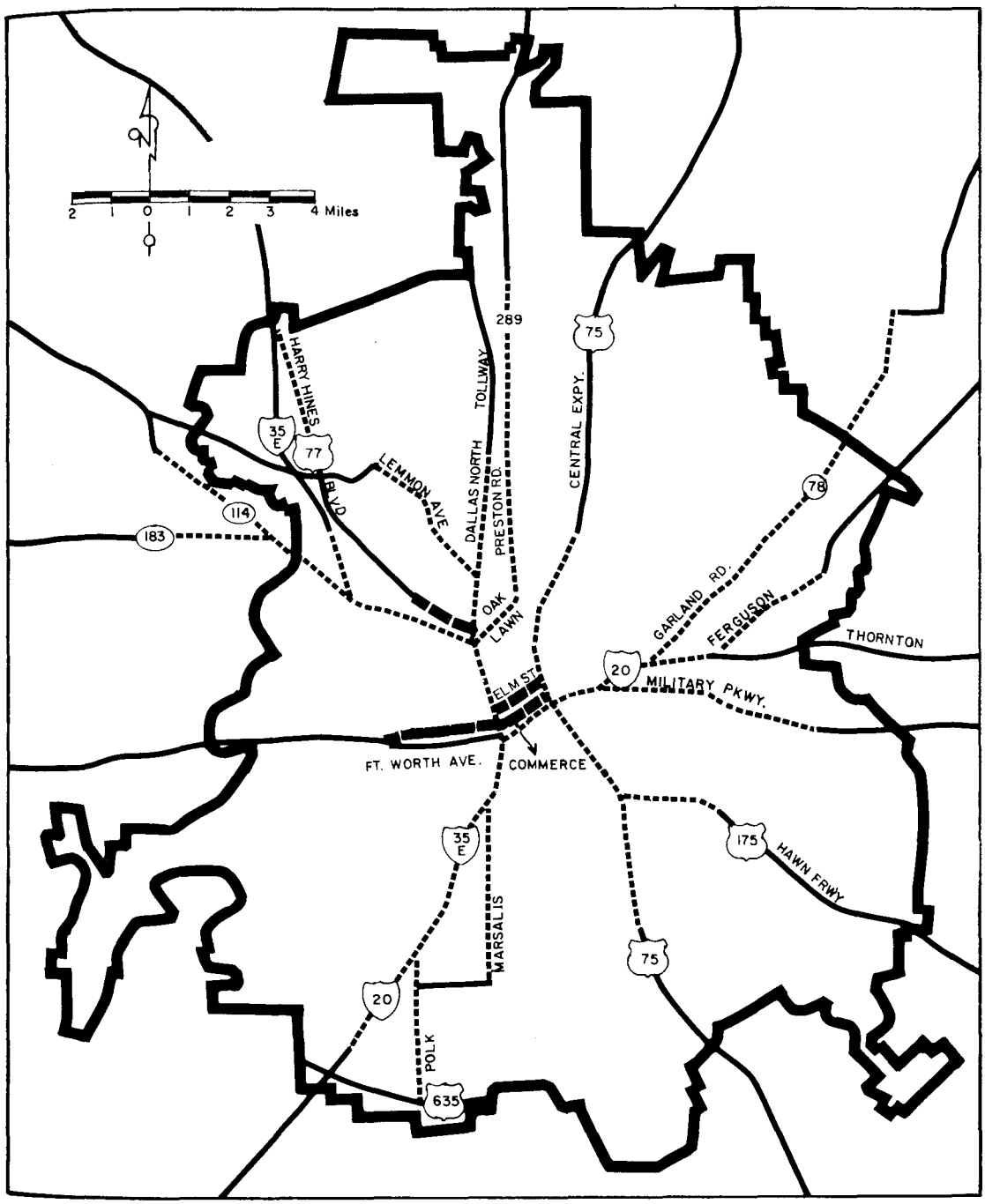
Barton-Aschman Associates, Inc., Dallas Urban Area Public Transportation Plan, Dallas Subregional Public Transportation Study, November, 1975.

Dallas Transit System.

FIGURE V-4

POTENTIAL BUS LANE LOCATIONS FOR EXISTING BUS ROUTES

DTS



Potential Bus Lane

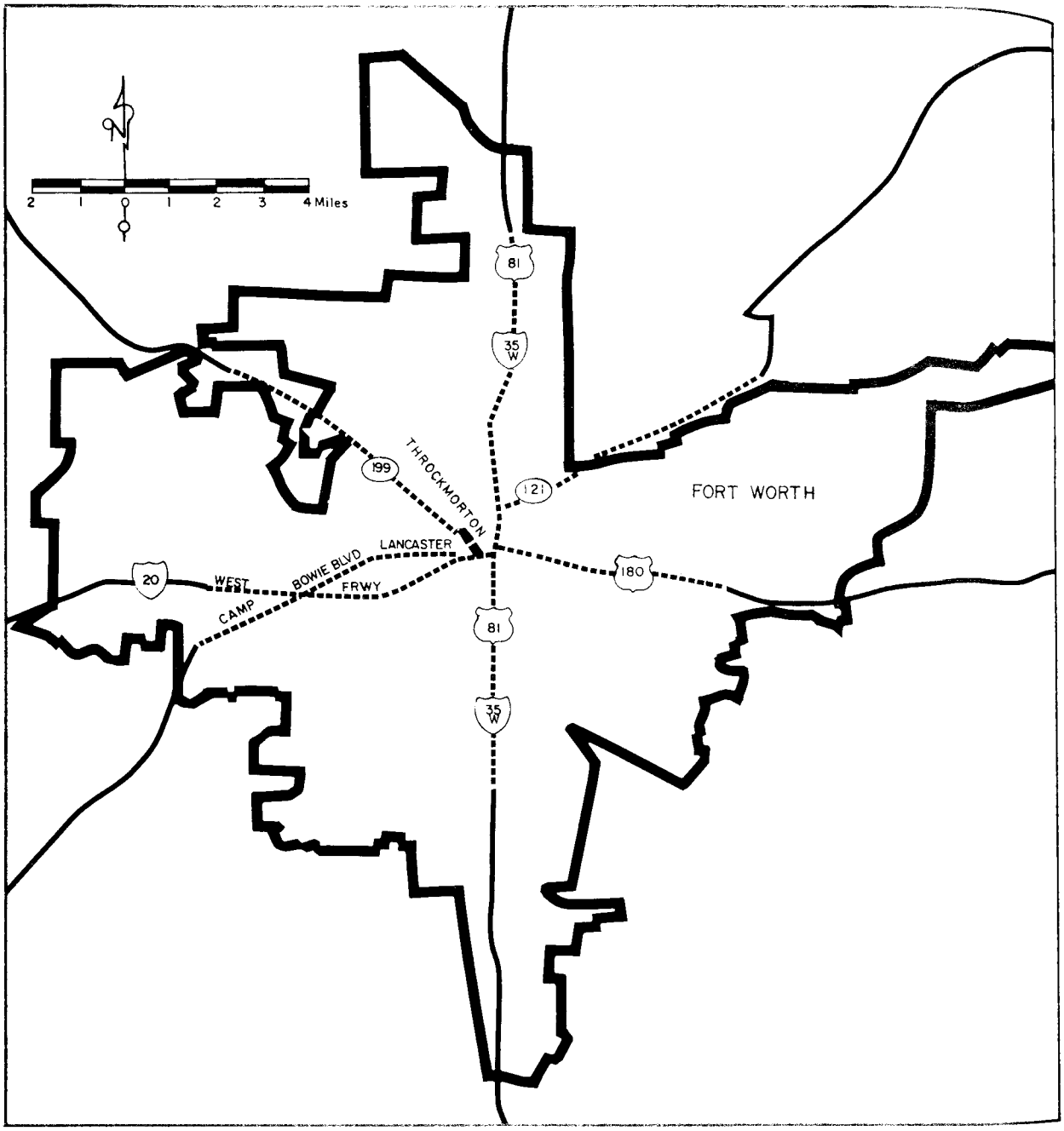
Existing Bus Lane

Source: Dallas Transit System, North Central Texas Council of Governments

FIGURE V-5

POTENTIAL BUS LANE LOCATIONS FOR EXISTING BUS ROUTES

CITRAN



Source: City of Fort Worth, Traffic Engineering Department, Exclusive Bus/Carpool Lanes for the Fort Worth Metropolitan Area, February, 1974.

Another possible method of decreasing bus fuel consumption would be to reduce the numbers of "deadhead" miles (i.e. miles to garages or other destinations when the bus is not in service). Unlike the automobile, not every bus vehicle mile produces passenger miles. This is due to unbalanced loading on different portions of some routes and the need to return vehicles to yards or garages between peak periods.

A strategy to reduce these "deadhead" bus miles could be to lease land for bus parking near or in the Central Business Districts. Here, buses which are used only during peak service could be parked during the midday rather than running them empty back to their respective garages. A single bus from each remote lot could be used to shuttle the drivers to and from the main bus garage. A study of the Chicago Transit Authority has estimated that approximately one percent of its fuel could be conserved by this strategy.[15]

Such a storage facility would need to accommodate 237 buses in Dallas and 45 in Fort Worth during the current off-peak hours[16] and could result in an estimated one to four percent fuel savings. The major disadvantages, however, are the additional expenses of leasing the downtown lots and of providing security for the buses. Even so, the money saved by using less fuel could make up much of this added expense.

Table V-3 lists these strategies which would reduce fuel consumption by eliminating service and by increasing the system's fuel efficiency. The table also indicates the approximate fuel saving which could be realized by DTS and CITRAN through each action and the impact of each on ridership. The total savings from implementing all the actions listed would, of course be less than the sum of the percentages indicated.

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[15] Martin J. Bernard III, and Sarah Labelle, "Energy Conservation in Urban Transit Systems," presented at Energy Conservation: A National Forum, Ft. Lauderdale, Florida, December 1-3, 1975, p. 5.

[16] Dallas Transit System and CITRAN, 1977.

TABLE V-3

TRANSIT STRATEGIES TO REDUCE FUEL CONSUMPTION

Strategy	Percent Fuel Savings DTS	Percent Fuel Savings CITRAN	Impact on Ridership DTS	Impact on Ridership CITRAN	Impact on Annual Operating Costs DTS	Impact on Annual Operating Costs CITRAN
Eliminate night service	8-12%	3- 6%	-12.5%	- 3.0%	$1,640,000 Savings	$149,000 Savings
Eliminate weekend service	16-20%	8-10%	-10.0%	- 9.0%	$2,952,000 Savings	$298,000 Savings
Eliminate midday service	20-25%	20-24%	-21.0%	-27.0%	$3,690,000 Savings	$729,000 Savings
Increase bus headways (by 10-25 percent)	10-25%	10-25%	- 5% to - 10%		$2,870,000 Savings	$580,000 Savings
Reduce number of bus stops (by 20-50 percent)	10-25%	10-25%	- 20% to - 40%		$ 196,000 Savings	$ 49,000 Savings
Modify local to express service (10 percent of local)	8-10%	8-10%	Uncertain		$ 100,000 Savings	$ 25,000 Savings
Increase bus flow by: 1) Bus lanes	1- 5%	1- 5%	+ 2.5%	+ 2.5%	$ 28,000 Savings	$ 8,400 Savings
2) Other preferential traffic treatment	1- 2%	2- 4%	+ 0.5%	+ 0.5%	$ 17,000 Savings	$ 8,400 Savings
Decrease "deadhead" bus miles	1- 2%	2- 4%	No effect		$ 17,000* Savings	$ 8,400* Savings

* does not include security costs

Source: Based on information provided by DTS and CITRAN.

UMTA, Guidelines to Reduce Energy Consumption Through Transportation Actions, May, 1974.

U. S. Department of Transportation, Priority Techniques for High Occupancy Vehicles, November, 1975.

Alan M. Voorhees and Associates, Handbook for the Development of Transportation System Management Plans, work draft, prepared for the North Central Texas Council of Governments, March, 1977.

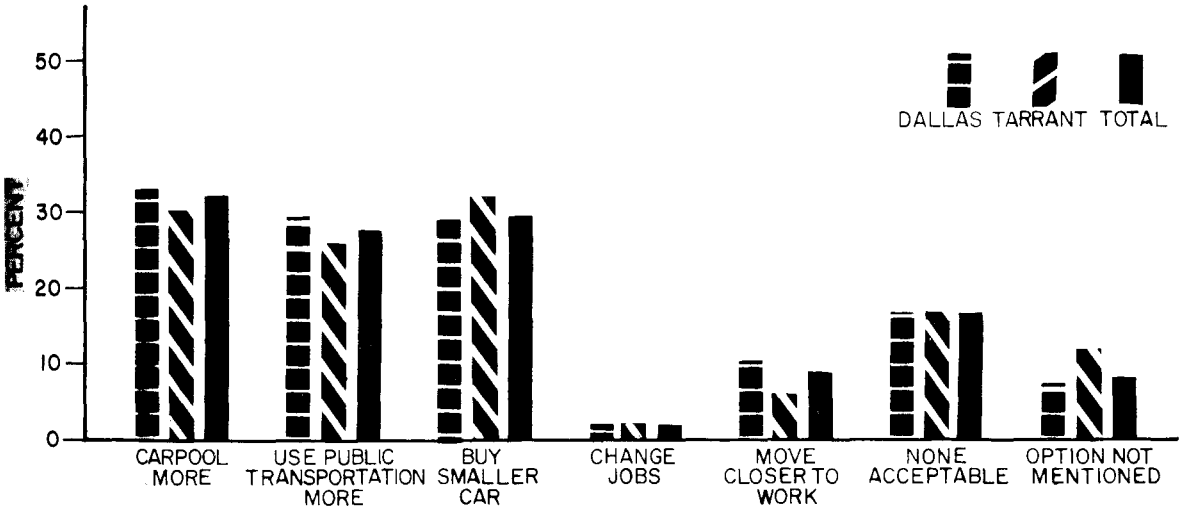
Paratransit services have limited opportunities to benefit from similar reductions. Local taxicabs could possibly attempt to save fuel by encouraging travel during off-peak hours rather than during congested peak hours or along congested routes. This could be done by adding a fare surcharge during peak travel periods. Taxis could also benefit from using bus lanes where they have been established. To save fuel, some transportation dependent municipal services could be curtailed, as during the last embargo period. While such municipal activities as street sweeping, solid waste disposal, police patrol, and inspections could be reduced, it would not be feasible to reduce emergency ambulance or fire fighting services. And finally, reductions in elderly and handicapped operations may be possible through better coordination of these services.

oping With Mass Transit Ridership Increases

s mentioned in Chapter III, area mass transit systems experienced increases in ridership uring the 1973-1974 oil embargo, and it is reasonable to assume that similar changes ould occur during a future embargo. In addition, the Urban Panel Survey[17] has explored ikely local public reaction to higher gasoline prices by asking respondents how they would hange their travel habits in the event of a large increase (to one dollar or more) in the rice of gasoline. A common public response (28%) to this scenario was the greater use of ublic transportation (Figure V-6).[18] The impact of potentially large increases in the

FIGURE V-6

PUBLIC REACTION TO SEVERE GASOLINE COST SCENARIO



Question: Suppose the price of gasoline were to move to one dollar or more. Which one or more of these options would be attractive to you?

Source: North Central Texas Council of Governments, Urban Panel Project, Macro-Level Data Analysis (Arlington, Texas: September, 1976).

Urban Panel Project, 1976, Macro-Level Data Analysis, p. VIII-8.

Care should be taken in assuming that people will do what they say they will do. Past experience has shown that forecasts based on this type of questioning are typically inflated by a factor of ten or more.

demand for public transportation will present a dilemma for transit operations: how can service be maintained or increased at a time when fuel supplies and rolling stock are limited? The following discussion will examine this impact on existing transit systems and the demand for transit and paratransit services in areas currently not served by mass transit.

Estimating Ridership Increases

Transit systems within the Intensive Study Area experienced significant increases in ridership during the energy shortage with the greatest monthly increases[19] occurring in either March or April: Dallas Transit System increased a maximum of 20% (March, 1974), CITRAN 5% (April, 1974) and Texas Motor Coaches 26% (March, 1974). Since this occurred from public reaction to a relatively mild reduction in the area's fuel supply, a projected 10-25 percent shortfall by 1980 would likely produce an even greater demand.

The impact of a 10-25 percent shortage on transit ridership has been examined by the United States Congress, Office of Technology Assessment (OTA).[20] This study concludes that, depending upon the severity and extent of an oil shortage, near-term national transit ridership would increase by approximately 10 percent to 40 percent (from 1974 levels) (Figure V-7). Since the oil shortage is expected to be spread through the nation by the federal programs, these national ridership increases can be reasonably expected to occur within the Intensive Study Area.

The OTA study also cautions that the mild consumer reaction to the previous embargo appeared to be based on the judgement that it was only a temporary situation. Future travel modifications will likewise depend upon whether the shortage is perceived as a temporary or long-term phenomenon. In the latter case, the 40 percent increase in

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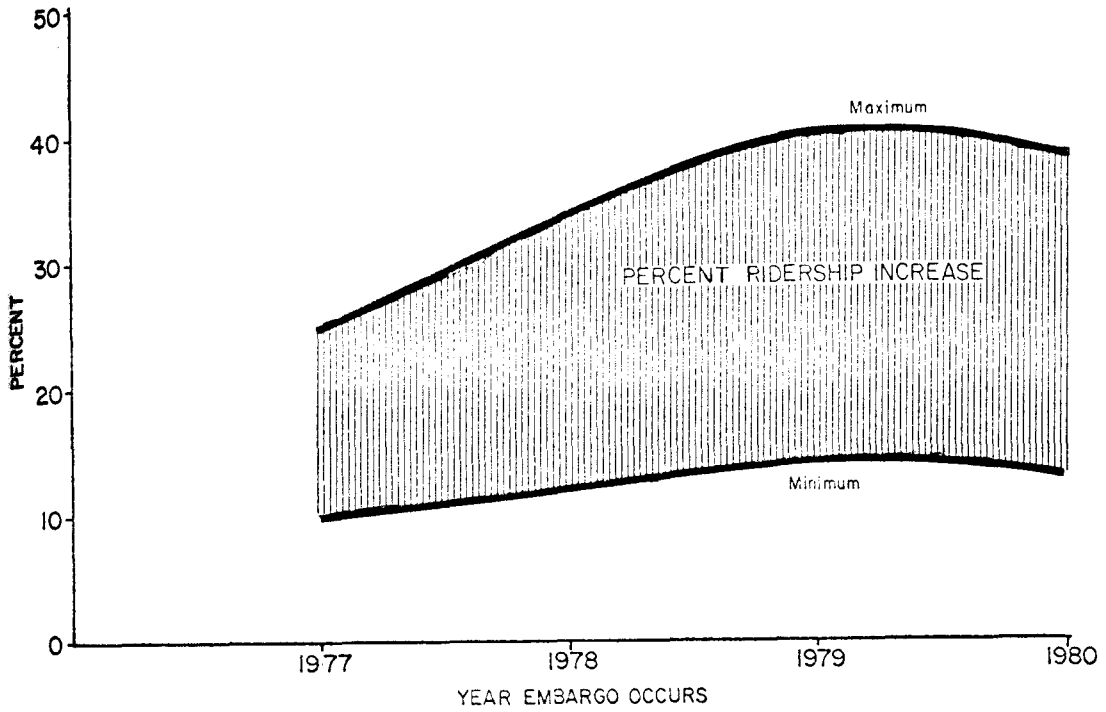
[19] Percent change from corresponding month of the previous year.

[20] Energy, The Economy and Mass Transit, p. 70.

transit ridership may be conservative due to a greater effort on the part of the public to modify travel patterns.

FIGURE V-7

NATIONAL TRANSIT RIDERSHIP CHANGES DUE TO EMBARGO



Source: Adapted from Office of Technology Assessment, U. S. Congress, Energy, the Economy and Mass Transit (Washington, D. C.: December, 1975), p. 70.

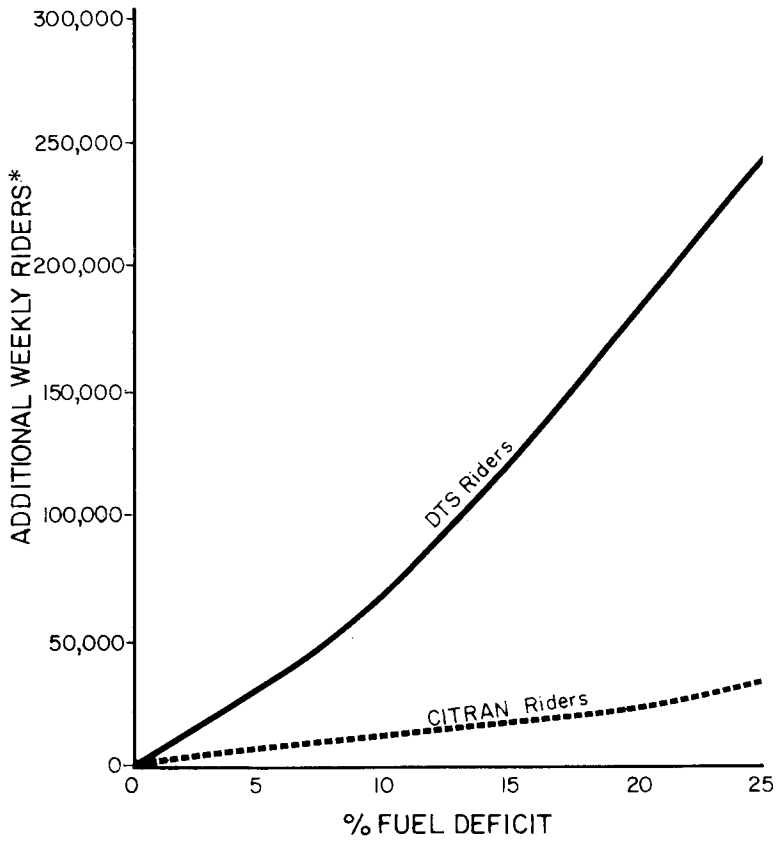
By applying these estimates to local transit systems, as shown in Figure V-8, a 10 percent fuel deficit could mean an additional 65,000 weekly bus riders on DTS and about 10,000 on CITRAN. A 25 percent fuel shortfall could result in over 250,000 more weekly riders on DTS and over 35,000 on CITRAN. Assuming diesel fuel is available, strategies which could be implemented by the transit systems to cope with these anticipated ridership increases include:

- Filling unused capacity
- Spreading peak period ridership

- Increasing the capacity of the existing bus fleet by:
    1) Increasing bus availability by modifying maintenance operations
    2) Decreasing headways by increasing bus speeds
- Temporarily increasing the bus fleet size by:
    1) Renting additional buses from other sources
    2) Utilizing public school buses
- Increasing the current bus fleet prior to contingency

FIGURE V-8

THE EFFECT OF FUEL SHORTAGE ON LOCAL TRANSIT RIDERSHIP



* Increase from 1974 average

Unused Seating Capacity

The initial response of the transit systems to a sudden passenger increase along established lines should be to allow the utilization of reserve transit seating capacity. During the height of the peak rush hour, approximately 10 percent of DTS seats are unused and an even larger percentage of CITRAN's are vacant.[21] There are, however, buses on certain lines in both Dallas and Fort Worth which are currently operating at or above seated capacity. On these lines, it may be necessary to increase service on short notice at the onset of the shortage. Methods of achieving this will be discussed below.

Spread Peak Period Ridership

As discussed in Chapter III, ridership during the peak hours appears to experience the largest increases during a period of energy constraints. Yet, since the maximum utilization of transit vehicles occurs during these times, transit systems have the least potential additional capacity to absorb ridership increases during these times. If a sudden ridership increase were to occur, transit services during these peak times would be overtaxed while earlier or later peak period service would probably remain underutilized. One solution to this problem would be to spread this peak ridership uniformly over the entire period so that no additional buses or drivers would be needed to accommodate ridership increases. This could be accomplished by varying the work hours of transit riders so that they may travel at earlier or later times to avoid the overcrowded buses. In addition, a peak period fare surcharge could be added to discourage commuters from riding during the most congested times.

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[21] Estimates provided by DTS and CITRAN. It should be noted that, as a practical matter, it is impossible to achieve 100% capacity without leaving potential riders at bus stops, unable to get on the buses due to crowding.

A number of different variable work hour systems have been identified.[22] These include:

- Staggered Hours - the starting and quitting times are fixed but vary among employees or businesses. (e.g., some employees work from 7:00 a.m. to 3:00 p.m. while others work from 7:30 a.m. to 3:30 p.m.).

- Shorter Work Week - the number of hours worked are concentrated into a shorter work week with the off day varying among employees or businesses.

- Flexible Work Hours - the employer determines a range of starting and quitting times and a core time during which all employees must work. For example, employees may start between 7:00 - 9:00 a.m. and leave between 3:00 - 5:30 p.m. as long as the total required hours are met.

The flexible work hour plan appears to be the most popular variable work hour option[23] and is perhaps the most likely to alleviate the peak period transit problems. Flexible work times have been introduced in several U. S., Canadian, and European cities and have reportedly reduced absences, raised employee morale and increased employee productivity.[24]

Most importantly, however, flexible work hours would allow considerable individual modifications in travel times. With flexible hours, the transit systems could advise riders which buses on specific routes have seating and which are operating at capacity. Transit patrons could choose to ride at earlier or later than usual times to avoid crowds and still arrive at work at a time acceptable to the employer. Thus while the other variable work hour options would potentially help to distribute transit loads more broadly,

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[22] The Municipality of Metropolitan Seattle, p. 34.

[23] A survey of federal employees conducted by the Region 10 Federal Energy Administration in 1974 indicated that 70 percent of those responding preferred the flexible working hour concept. The Municipality of Metropolitan Seattle, p. 33.

[24] The Municipality of Metropolitan Seattle, p. 33.

flexible time appears to be the most effective because it would allow the employee to adjust to the transit service in his or her area.

The idea of variable work hours to distribute transit loads more evenly has been used in other cities with mixed results. On April 1, 1970, about 50,000 employees from some 50 public and private organizations in lower Manhattan, New York City, voluntarily staggered their work hours in a program to determine whether such changes would help relieve peak hour transportation congestion.[25] A close analysis of this experimental project has shown that the work hour changes did have a significant effect in reducing peak hour congestion of transportation facilities. Transit passenger trips through the Hudson Terminal, for example, declined by 16 percent during the 5:00 - 5:15 p.m. period and increased by 30 percent between 4:30 - 4:45 p.m., a time during which transit had previously been underutilized.[26]

The impact of varied work hours on bus ridership has been examined during a variable work project in Ottawa, Canada.[27] On March 4, 1973, due to a serious overtaxing of the bus system, federal agencies implemented a varied work hour plan for approximately 50 percent of the city's 70,000 CBD workers. The program consisted of a combination of staggered work hour options. As a result of the program, the study concluded that bus ridership was significantly improved and the peak period was dispersed. Figure V-9 shows a before and after comparison of bus ridership along one checkpoint. During the maximum peak 15 minute period, for instance, inbound demand was reduced by 21 percent.

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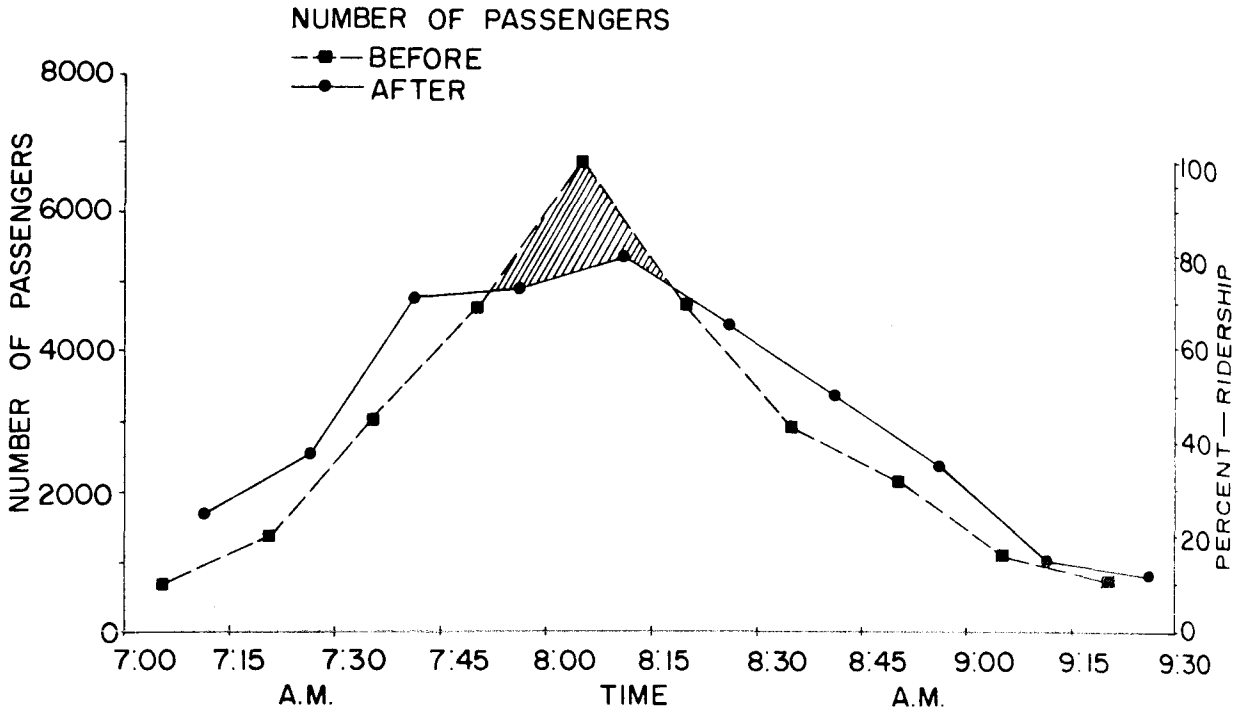
[25] Brendon O'Malley, Staggered Work Hours Project in Lower Manhattan (New York City, N. Y.: The Port of New York Authority, 1970), p. 1.

[26] Ibid., p. 25.

[27] Reza Safavian, and Keith G. McLean, "Variable Work Hours: Who Benefits?", Traffic Engineering, Volume 45, No. 3, March, 1975, p. 17.

FIGURE V-9

BEFORE AND AFTER COMPARISON OF BUS RIDERSHIP,
OTTAWA VARIABLE WORK HOURS EXPERIMENT



Source: Reza Safavian, and Keith G. McLean, "Variable Work Hours: Who Benefits?", Traffic Engineering, Volume 45, No. 3, March, 1975, p. 17.

A less successful staggered work hours project has been introduced in Atlanta.[28] Although the idea was backed by the Chamber of Commerce and funding for the project was obtained, employee opposition to the plan resulted. Reasons given for this were:

- There would be difficulty in adjusting present carpooling arrangements since many people rode with others who were not asked to stagger their hours.
- Bus scheduling problems can arise if certain large employers simply shift their work hours. This can move the peak on particular bus lines without reducing the peak load.

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[28] R. H. Pratt Associates, Inc., Results of a Survey and Analysis of Twenty-One Low Cost Techniques, Volume 1 (Kensington, Maryland: Prepared for U. S. Department of Transportation, January, 1973), p. 42.

In addition, Atlanta has few really large firms to which these work changes would be most applicable. Other reasons given for the opposition include the interference with goods delivery schedules, existence of restrictive national labor contracts and the problems of operating with national headquarters.[29] Thus, the success of a staggered work strategy appears to be highly dependent on employer and employee acceptance of the plan.

A flexible work hour plan could also be applicable locally. The problem of an unbalanced distribution of commuters during peak period times also exists locally. In Dallas, for example, a recent DTS passenger count indicated that during the height of the morning peak period (7:30 - 8:00) at least 13 bus lines experienced capacity or standing-room only crowds.[30] However, during the half hour time periods before and after this time, an excess of seating capacity exists on these lines (Figure V-10). During a gasoline shortage, these problems would be further complicated by sudden ridership increases on most lines, especially during peak periods.

The applicability of a varied work plan is determined to a great extent by the size and type of economic activity groups in the target area. Small employers, for example, may find it difficult to vary their work hours since insufficient manpower would be available to cover for those not at work. In addition, some types of business, especially large government, service, and manufacturing organizations can alter work hours more easily than others such as education, transportation, or utility activities (Table V-4).[31]

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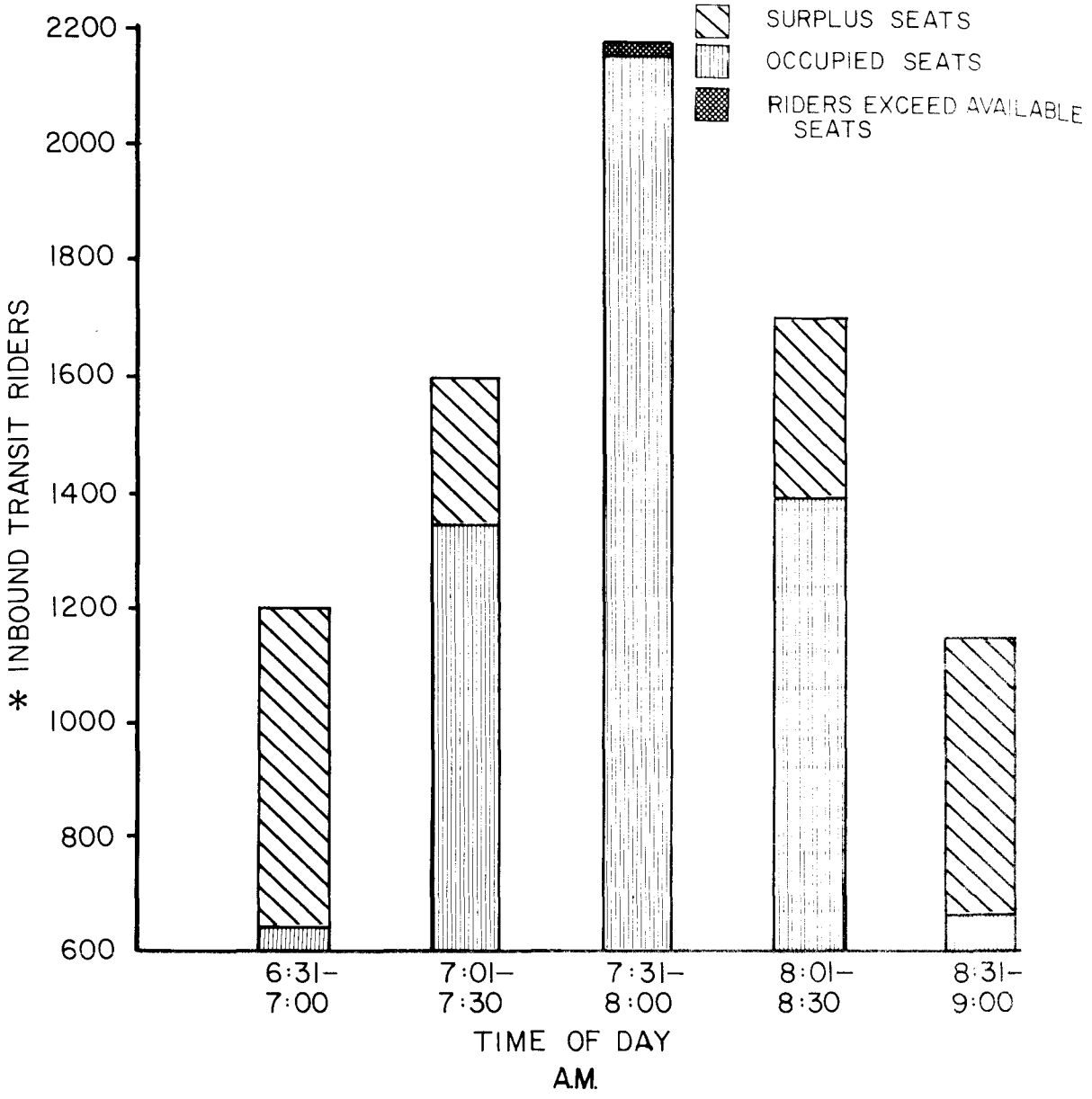
[29] R. H. Pratt Associates, Inc., Results of a Survey and Analysis of Twenty-One Low Cost Techniques, Volume 1 (Kensington, Maryland: Prepared for U. S. Department of Transportation, January, 1973), p. 42.

[30] Dallas Transit System, "Passenger Count," June-July, 1976.

[31] Joint Strategies, p. 2-92.

FIGURE V-10

TRANSIT RIDERS VS. AVAILABLE SEATS
D T S



* for 13 selected DTS lines

Source: Dallas Transit System, "Passenger Count," June-July 1976.

TABLE V-4

Applicability of staggered work hours to basic economic activity groups.

Employment Classification	Schedule Freedom	Staggered Hours Potential
deral Government	Free[1]	Good; many small agencies
ate Government	Free	Good
cal Government	Free	Good
ans-Comm-Util.	Fixed[2]	Poor; transportation (trade oriented)
ucation	Fixed	Poor
rvice	Free	Good; banks (trade oriented)
tail	Flexible[3]	Fair; large firms only
nufacturing	Free	Fair +
olesale	Flexible	Poor

urce: Adapted from Wilbur Smith and Associates, "Staggered Hours Plan, lanta Metropolitan Area," 1970, p. 31

"Free" indicates organizations with considerable latitude to set work ur schedules. In theory, schedules could encompass any period in the day it were not for employee preferences. Shifts of at least one to two urs appear possible.

"Fixed" indicates organizations with no flexibility to change work tterns to any schedule other than existing ones.

"Flexible" indicates organizations which could potentially alter work ur schedules, but only if related firms (i.e., firms in the industry, tomers, suppliers, and so forth) do the same. Since such shifts from tablished economic relationships usually involve a great number of firms business practices, the extent of schedule change acceptable to such anizations is probably one hour or less.

The Dallas-Fort Worth area has a diversity of employment activities. Activities in the downtown areas where the shifting of work times is most critical are, however, largely of the government and service type, making them prime targets for varied work hours. Table V-5 lists the number of large service and government employers in the Dallas and Fort Worth CBD's.

TABLE V-5

LARGE CBD EMPLOYMENT CENTERS
DALLAS AND FORT WORTH
1970

Number of Employees	Dallas CBD		Fort Worth CBD	
	Number of Centers	Approximate Number of Employees	Number of Centers	Approximate Number of Employees
100-250	47	7,000	19	3,300
250-500	33	11,000	7	2,600
500-1000	29	17,000	6	4,500
Over 1000	19	30,000	2	4,000
TOTAL	128	65,000	34	14,400

Source: North Central Texas Council of Governments.

An estimated 20 percent of these employees in downtown Dallas and 10 percent in downtown Fort Worth utilize transit service.[32] Additionally, workers for these largest employers constitute about 50 percent of the peak hour transit riders in Dallas and 40 percent

[32] Alan M. Voorhees & Associates, Inc., Travel Model Calibration, Regional Public Transportation Study, Technical Report No. 7 (McLean, Virginia: Alan M. Voorhees & Associates, Inc., March, 1975). Prepared for the Cities of Dallas and Fort Worth and the North Central Texas Council of Governments, Table II.

peak hour riders in Fort Worth.[33] Therefore, if a program of varied work hours was implemented by each of these employers, approximately half of all peak period transit riders could conceivably modify their travel times.

The success of a varied work program in Dallas or Fort Worth will depend to a large extent on employer and employee cooperation. The emergency conditions which would exist during these "crisis" scenarios would probably encourage a greater public feeling of cooperation which may make this program easier to implement. The support of the local chamber of commerce, city governments, and transportation providers is essential.

The administration and implementation of a local staggered work hour plan could be handled by the city carpool program offices in conjunction with the Chambers of Commerce. These offices already have contacts with local employers and could therefore facilitate the rapid implementation of the program. The costs could be minimal. Most costs are one-time charges for organizational changes. The Downtown-Lower Manhattan Association spent $50,000 to implement the Manhattan project, including surveys, information programs, and before-and-after data collection.[34] Since however, this local program would be a short-term action with voluntary employer support, certain of these expenses would not be necessary.

Increase the Bus Availability and Fleet Size

The ability of the transit systems to accommodate the ridership increases will depend to a large extent on the size of the bus fleet at the time of the emergency. Due to fluctuations in the characteristics of transit demand, and the size of the fleet, the historical number of passengers per bus has varied greatly (Figure V-11). As this figure shows, the existing

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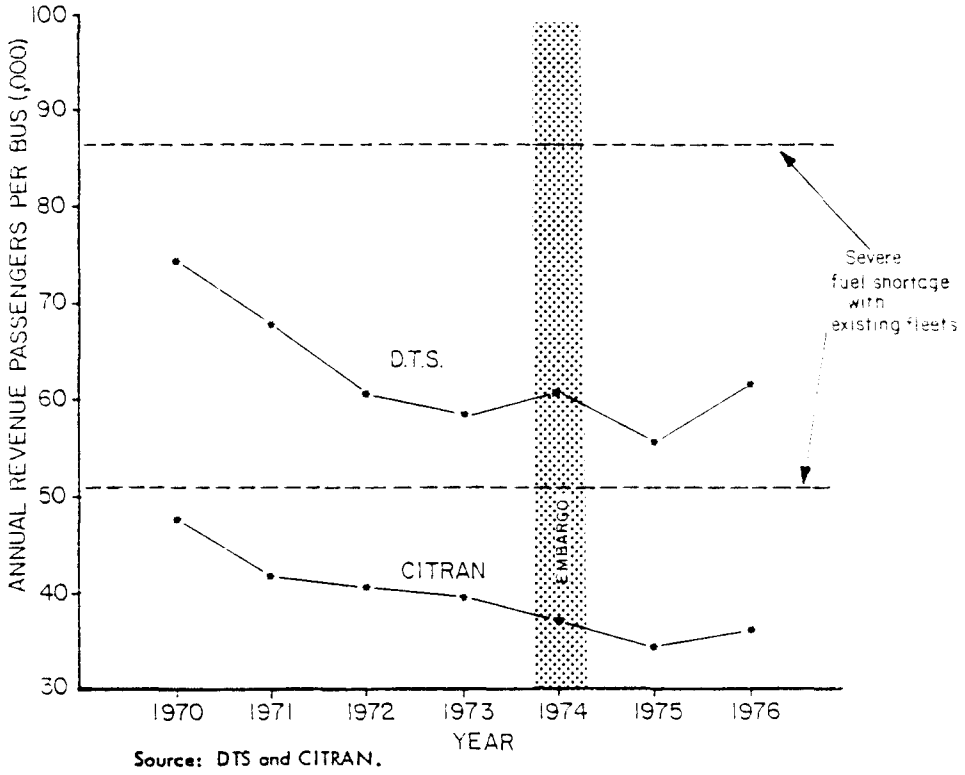
[33] North Central Texas Council of Governments estimates.

[34] Joint Strategies, p. 2-107.

bus fleets would have to accommodate ridership volumes greater than those ever experienced in recent years.

FIGURE V-11

REVENUE PASSENGERS PER BUS



Source: DTS and CITRAN.

Would additional buses be needed by local transit systems? Figures V-12 and V-13 show the effect of ridership increases on the current bus fleets of DTS and CITRAN based on national estimates developed by the U. S. Office of Technology Assessment. By using alternate strategies, such as allowing the seating capacity to full up and staggering work hours, ridership increases under the 10 percent gasoline shortfall could be accommodated. Once, however, it appears that existing bus service cannot accommodate ridership demands and that more buses would be needed, the bus systems could increase their bus availability by placing more of their current fleet into service or by running more trips with operating vehicles. CITRAN would apparently not have to increase its bus availability until approximately a 20-22 percent gasoline shortfall was experienced, and, if measures are taken

ich would increase the efficiency of the existing fleet, no new buses would apparently needed, even during a 25 percent shortage. DTS, by contrast would experience fficulty accommodating ridership demand when the gasoline shortfall reaches approxi-tely 17 percent. If a 20-25 percent deficit is realized, the bus system would possi- have to obtain up to about 40 additional buses to accommodate a ridership increase 30 to 40 percent. It should also be remembered that, since ridership increases will y by line and time of day, it is conceivable that specific lines may require additional vice even if the strategies of allowing the capacity to fill or spreading the peak hour ership are implemented. The close monitoring of ridership changes along each line uld identify these special problem cases and service modifications could be made cordingly. Recording fare buses, such as those now used by CITRAN, could be useful providing this information.

FIGURE V-12

EFFECT OF RIDERSHIP INCREASES ON BUS USE
DTS

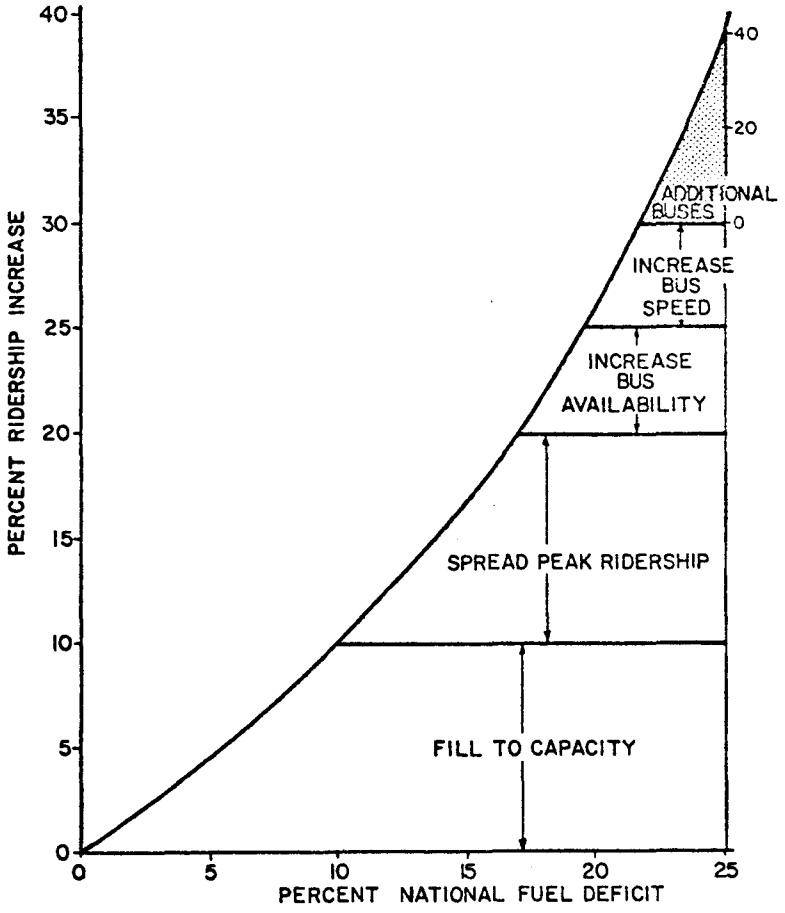
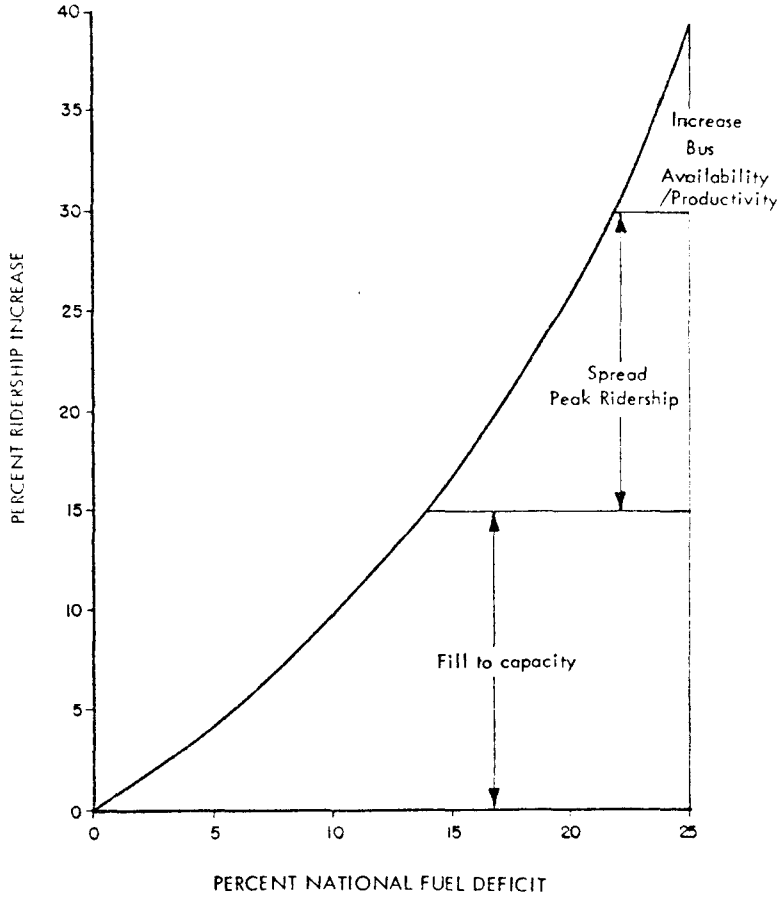


FIGURE V-13

EFFECT OF RIDERSHIP INCREASES ON BUS USE

CITRAN



Bus availability can be enhanced by increasing the utilization of the existing fleet. DTS currently operates approximately 80 percent of its total fleet during peak hours and CITRAN uses about 70 percent. If the number of out-of-service buses (those being repaired or maintained) were to be reduced, it would be possible to increase the number of operable buses available to the system. Also, the number of buses which are chartered out would have to be reduced or eliminated. An estimated 90 percent of a fleet may be operable under such conditions. Therefore, as a contingency strategy, transit operations could increase their shop work to reduce the number of buses waiting for repair. By increasing the number of available DTS buses from 80 percent or 90 percent, an estimated 17 extra buses could be placed in service.

The Seattle Metro Study estimated that by employing 10 percent more mechanics and using swing and graveyard shifts to repair buses, or by jobbing out maintenance, the number of downed buses could be greatly reduced. The initial labor and materials cost, however, would be high, an estimated $5,000 per extra vehicle.[35]

Another method of increasing bus service with the existing fleet would be to increase the speed of the buses to the extent that more trips could be made within a given time period. If, for example, the average daily bus speed for the system were increased by five percent, it would be possible to increase the service by five percent, i.e., run five percent more bus trips. The priority signalization and bus lane strategies mentioned previously could be helpful in increasing service as well as reducing fuel consumption. If bus lanes were established on these identified routes in Dallas, and were utilized by the existing bus routes, a four to five percent increase in speed during the peak period would result. This would be equivalent to placing an additional 15 buses into service during this time.

If the available bus fleet is still insufficient to accommodate ridership demands, extra buses may have to be obtained. Since it would not be possible to order and receive additional new buses within a short-term basis (the normal process takes from one to two years) other avenues of procurement must be considered. An alternative would be to lease some of the area's buses which are not owned by the city transit systems. As can be seen in Table V-6, this non-city transit fleet is nearly six times the size of the city transit fleet. Obtaining the use of the buses, however, presents significant legal and administrative problems.

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[35] The Municipality of Metropolitan Seattle, p. 46.

TABLE V-6

INTENSIVE STUDY AREA BUS FLEET INVENTORY

Public Intra-City Transit	Fleet Size (year of estimate)
Dallas Transit System	407 (1976)
CITRAN	121 (1976)
Subtotal	528
Other Buses	
Texas Motor Coaches	32 (1976)
Surtran	45 (1976)
Continental Trailways (local and regional)	300 (est. 1975)
Church Owned	1,567 (1975)
School	1,023 (1975)
Other	70 (est.)
Subtotal	3,037
Total Intensive Study Area	3,565

For example, the use of school buses for public transportation is now prohibited by Article 16.55 of the State Education Code which states:

> School buses shall be operated to and from school upon approved school bus routes and no variations shall be made therefrom. The penalty for varying from authorized routes and for unauthorized use of buses shall be withholding of transportation funds from the offending county or school district. In the event the violation is committed by a district which receives no Foundation School Program Funds, the penalty provisions of Section 4.00 of this code shall be applied.

Furthermore, school bus funds and/or misrepresentation of local board use of them is a misfeasance considered to be a felony which may be punishable by a one to five year prison term.[36]

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[36] Robert Means, et al., Legal Obstacles to the Use of Texas School Buses for Public Transportation (Austin, Texas: University of Texas at Austin, Council for Advanced Transportation Studies, January, 1975), p. 20.

proposed change to this regulation which was introduced to the State of Texas legisla-
re during the 1977 session would have amended the Texas Education Code to allow
onschool organizations to use school buses. The bill, however was not passed.

he churches of the Intensive Study Area operate a combined bus fleet which is the largest
n the region. However, many of the individual church organizations may be reluctant to
nt their vehicles for outside concerns since they are extensively used for church purposes.[37]
n addition, other bus fleets (Texas Motor Coaches, Continental Trailways, Transportation
nterprises, etc.) will probably experience increased ridership demands and will thus have
w, if any, extra buses to rent to others.

URTRAN buses, however, which operate between the Dallas-Fort Worth Regional Airport
nd the major cities, could possibly make some of their vehicles available for other pur-
oses. Since airport passenger traffic is expected to decline, as during the past embargo,
reduction in the demand for SURTRAN bus service may occur.[38] Since only about
alf of the fleet (about 25 of 45 vehicles) is currently utilized during any one time,[39]
t appears that there are surplus buses which could be used by DTS and/or CITRAN in the
vent of a bus shortage. Allowing for bus maintenance and standby service, SURTRAN
hould be able to provide its present service with 30 buses. This would leave the remain-
ng 15 vehicles available for outside use. In addition, since the current SURTRAN rider-
hip demand in Arlington is low (Table V-7) it is possible for SURTRAN taxicab service to
e substituted there. This would release another two vehicles and result in a total of
bout 17 surplus buses. If, however, ridership on SURTRAN increases, there may be few,
f any extra buses available.

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[37] This opinion was expressed by the majority of churches surveyed by the North Central Texas Council of Governments in July, 1976.

[38] SURTRAN bus service was initiated in January, 1977, so the changes in ridership due to the last embargo cannot be determined.

[39] Information supplied by Mr. Tom Killebrew, SURTRAN, March, 1977.

TABLE V-7

AVERAGE SURTRAN BUS PASSENGERS/WEEKDAY

Terminal	Number of Weekday Passengers (March, 1977)
Dallas CBD	1,000 - 1,500
North Central	600 - 900
Fort Worth CBD	400 - 600
Love Field	200 - 400
Arlington	40 - 80

Source: Data Supplied by SURTRAN.

Additional opportunities for DTS and CITRAN may exist to increase their fleet size by retaining replaced buses after future bus purchases have been made. Between 1977 and 1980, DTS and CITRAN plan to purchase 174 and 10 new buses respectively.[40] Fifty of these new DTS buses will be purchased during 1978. If these old buses can be maintained, placed in reserve and then replaced by subsequent purchases, probably no additional buses would be needed during a severe energy shortage. It is difficult to justify this standby capacity in practice, however, and the efficacy of this alternative is uncertain.

To summarize, numerous short-term opportunities exist to increase bus availability and to expand the local transit fleet size if it becomes necessary to cope with sudden bus ridership increases. Due to the inherent differences of both DTS and CITRAN, both should evaluate each strategy and determine its applicability to their individual situation. Table V-8 lists these mentioned strategies and the estimated impact of each service capability.

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[40] 1977 Transportation Program for North Central Texas, p. VII-18. VII-29.

TABLE V-8

TRANSIT STRATEGIES TO INCREASE RIDERSHIP CAPACITY

Percent Capacity Increase

Strategy	DTS	CITRAN	Remarks
Allow capacity to fill	10 - 15	15 - 20	Some lines already at capacity
Spread peak period Ridership	5 - 10	10 - 15	Employer cooperation essential
Route private buses	Unknown	Unknown	Private owners may not have spare equipment
Use public school buses	Unknown	Unknown	Currently prohibited by State law. School hours would have to be rescheduled
Decrease out-of-service buses	10	20	High costs involved
Increase bus speed through bus lanes and priority signalization	1 - 5	1 - 5	Could be difficult to enforce
Retain replaced buses	10 - 15	2 - 5	Difficult to justify

Reducing Transit Ridership Through Paratransit Alternatives

While the existing transit services may be overloaded during a severe energy shortage, an opportunity may exist to enlist paratransit resources to alleviate these excessive bus demands. Two possible paratransit alternatives are considered here: route taxis and extensive carpooling.

A "route taxi" refers to the usage of taxicabs to transport passenger along fixed transit routes. Such service has been successful in European cities (Munich, West Berlin, Stuttgart) as a replacement for buses along routes with low ridership.[41] A similar type of

[41] "Taxis Replace Buses at Night," Fort Worth Star Telegram, May 7, 1975.

service was attempted in Houston during a recent transit strike.[42] While political and operational problems hindered the Houston program's success, a route taxi service would probably function better in an energy crisis situation than in a transit strike.[43]

Data from the Dallas taxicab companies indicates that approximately 104 surplus taxicabs are available in the City.[44] Assuming that 90 percent of these could be put in route taxi service, it would be possible to provide service to many of the normal transit riders who

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[42] During this transit strike (from November 24, 1976, to January 17, 1977) fixed route, fixed scheduled taxicab service was attempted along four heavily traveled transit routes selected by the City. The routes were from 10 miles to 16 miles one way in length and extended from the CBD into the more affluent residential areas. The City provided placards for the cabs indicating the destination and taxicab supervisors attempted to start, or meter, the cabs so as to provide some kind of regularity to the service. The fare was one dollar. Although no figures are available, the patronage was very low.

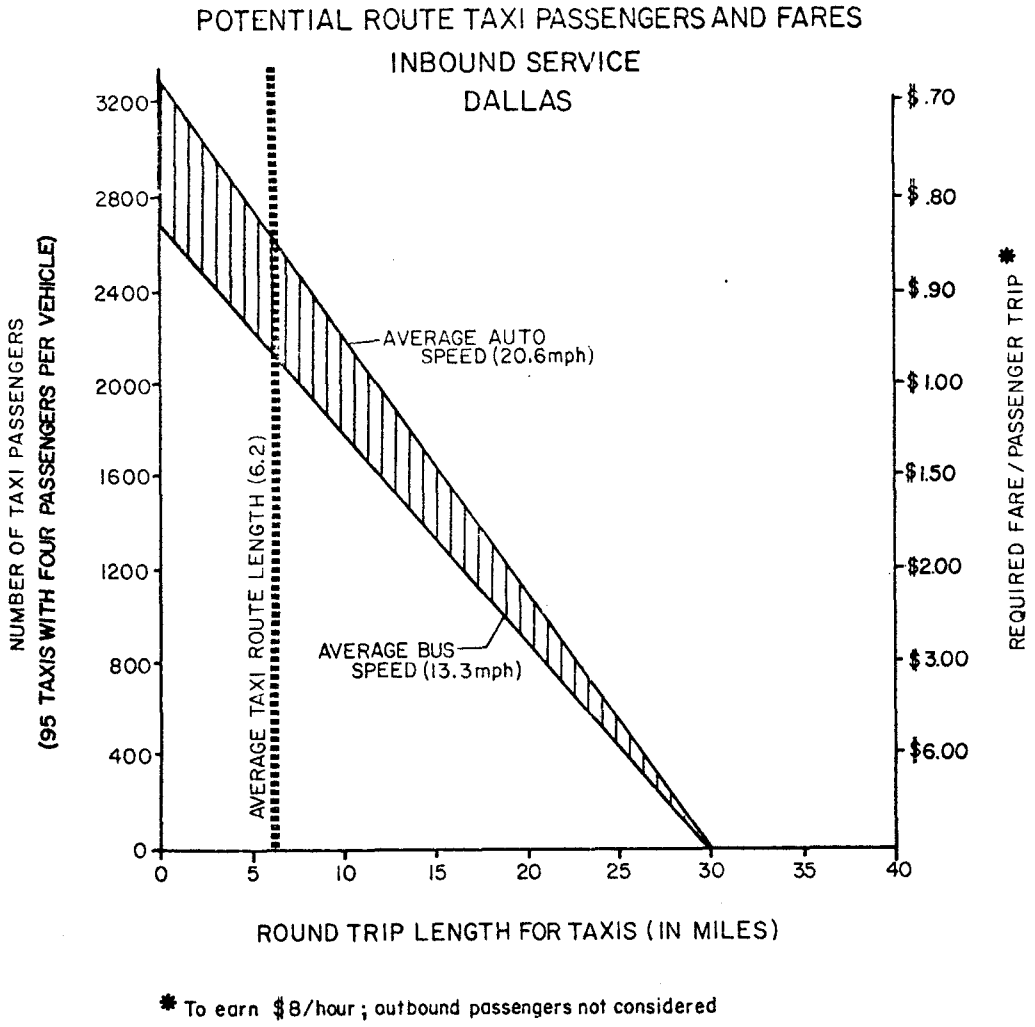
Information obtained during telephone conversation between Mr. William G. Barker, North Central Texas Council of Governments, and Mr. Jerry Wilson of Yellow Cab in Houston on March 17, 1977, and Ms. Linda Cherrington with the City of Houston Public Transportation Office on March 18, 1977.

[43] Reasons offered as causes for the failure of the program were: 1) The routes were extremely long, 2) Since Yellow Cab of Houston has independent owner drivers, there was no way to force the drivers into performing the service, and many often abandoned the route when either (a) they found a customer that wanted to go someplace else off the route or (b) they became discouraged because riders were not standing along the route waiting for service. Of course, the uncertainty of the service under these conditions was a major reason for a lack of response on the part of the public, and 3) Because the route served the more affluent areas, the former transit riders had many transportation options open to them, and the reliable dollar-a-ride route taxi was apparently not the best alternative. Mr. Wilson of Yellow Cab feels that the route taxi concept would have worked in lower income areas. Mr. Wilson feels that the route taxi idea would work much better in an energy crisis situation than in a transit strike situation. This is probably true since the cabs would be interspersed among the buses running the route. Also, people would be turning away from the automobile alternative rather than shifting toward it. The operational difficulties pointed out in the Houston experience are still a possibility, however, and company drivers would probably have to run the routes for the system to work.

[44] Data obtained from Yellow Cab of Dallas and Terminal Cab Company, March, 1977.

would be stranded at their bus stops due to filled buses. As Figure V-14 shows, the number of passengers this surplus taxi fleet can carry will depend on the length of the trip and the speed of the vehicles. Assuming that these taxis would be used only to transport riders between the bus overload points and the CBD, the average one way taxi trip in Dallas would be approximately 3.1 miles, or 6.2 miles round trip. Depending on the speed, the maximum route taxi capacity at this point would be 1800 to 2600 passengers (a 40 percent ridership increase will produce about 50,000 peak period riders in Dallas, or about 5,000 more than the system can carry). As the figure shows, a fare of approximately $1.00 to $1.25 per person would be needed to make the service economically feasible for the taxicab operators.

FIGURE V-14



* To earn $8/hour; outbound passengers not considered

In sum, the route taxi idea may be able to accommodate a good portion of the unmet transit ridership demand. This will depend, however, on other factors such as where the extra capacity is needed and during what times the service is needed. It also appears that such a service would be most successful along short routes and through areas where a relatively high speed can be maintained.

Through the extensive use of carpools by commuters who reside and work in the cities of Dallas and Fort Worth, it may be possible to alleviate some of the possible transit ridership overload expected in these cities. Data from the current Dallas and Fort Worth carpool programs indicates that approximately 90 percent of the program participants living in Dallas and Fort Worth also work in these cities, and that the majority of these individuals work in the CBD's. In addition, data from the Fort Worth carpool program suggests that approximately 80 percent of Fort Worth's participants have been matched.[45]

Although the number of carpools which might be formed through an extensive carpool program is not known nor is the impact that such carpools might have on transit ridership, a tentative forecast of carpooling to the Dallas CBD for example, suggests that an effective carpool program could substantially alleviate transit ridership overloads during an energy shortage (Table V-9). Analysis further indicates that, without carpool incentive, transit ridership would increase the expected 40 percent while, with an aggressive carpool program, this maximum increase may be kept at a more manageable 25 percent rise. The estimated 5,000 new Dallas carpools (with an average carpool size of 2.5 persons) thereby formed from would-be transit riders could eliminate the need for the previously mentioned additional 40 DTS CBD-bound buses required during a severe energy scenario.

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[45] Data based on the City of Dallas and City of Fort Worth Carpool Program information on current participants, May, 1977.

TABLE V-9

IMPACT OF A CARPOOL PROGRAM ON MODAL SPLIT
OF DALLAS WORKERS TO DALLAS CBD

Travel Mode	Percent Modal Split		
	Before Shortage	Severe Shortage With No Carpool Program	Severe Shortage With Carpool Program
Drive Alone	42%	31%	27%
Carpool	38%	41%	48%
Transit	20%	28%	25%

Source: Estimates based on methodology in: Cambridge Systematics, Inc., Guidelines for Travel Demand Analyses of Program Measures to Promote Carpools, Vanpools, and Public Transportation, prepared for Federal Energy Administration, (Cambridge, Massachusetts: Cambridge Systematics, Inc., November, 1976).

Attaining such carpool levels may, however, not be practically possible. Since typically only about 10 % of carpool program participants actually form carpools,[46] the current active participant data base for the Dallas program would have to be increased by three or four times its current size and additional employer incentive measures would be needed to even approach this extent of carpooling. However, it can be concluded that, if the existing carpool program is still in operation at the time of a future fuel shortage, the expected overburdening of the transit system would be at least slightly reduced and a substantial amount of fuel would be saved. The carpool option is, moreover, an alternative which the public fully expects to have available (see following discussion of paratransit) and thus should not be neglected.

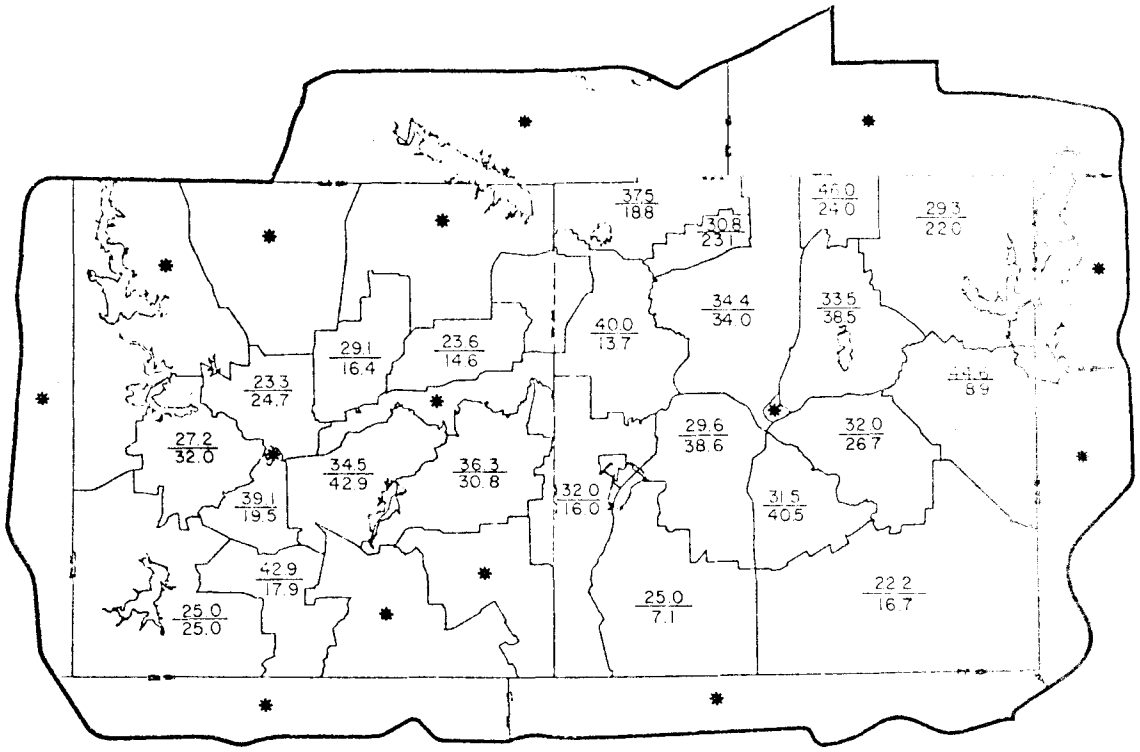
[46] Richard H. Pratt, Neil J. Pedersen and Joseph J. Mather, Traveler Response to Transportation System Changes - A Handbook for Transportation Planners, prepared by R. H. Pratt Associates, Inc. for the U. S. Department of Transportation, February, 1977, pp. 84-86.

Transportation Alternatives in Suburban Areas

Meeting demands for public transportation in areas where such service is not currently provided could become a serious concern for communities. The Urban Panel survey indicates that the demand for travel alternatives to the individually driven auto, especially through modal shifts to carpooling and transit, is likely to be as great in the suburbs as in the major cities (Figure V-15) The following discussion examines the transportation problems likely to develop in suburban areas and suggests the applicability of transit and paratransit solutions to these problems.

FIGURE V-15

PUBLIC RESPONSE TO FUTURE GASOLINE SHORTAGE*
INTENSIVE STUDY AREA



CARPOOL MORE ⟶ 32.2 total
total 28.2 ⟵ PUBLIC TRANSPORTATION MORE

* INSUFFICIENT DATA
* RESULTING IN A GASOLINE PRICE INCREASE OF ONE DOLLAR OR MORE A GALLON. BASED ON PERCENT OF SURVEY RESPONDENTS (N = 2,000).

Source: North Central Texas Council of Governments, Urban Panel Project 1976.

Transit

Table V-10 estimates the potential number of transit riders who could use this service for work trips during a severe energy shortage if it were available in all areas of the Intensive Study Area by 1980. This indicates that a substantial demand for transit service would likely develop in the local suburban communities. Since, however, the anticipated fuel shortage may limit the extent of additional service the existing transit systems (DTS and CITRAN) will be able to provide, they cannot be depended on to extend new service into these suburban areas under the most severe energy shortages.[47] This depends on the extent of the fuel shortage and the success of the previously described actions to accommodate central city transit demand. Each community, therefore, must examine the possible alternate options for meeting this public demand for transit service. Possible solutions would be to:

- Utilize existing available transit equipment (if any) to the maximum extent
- Rent buses from the private sector
- Utilize public school buses

Some cities in the Intensive Study Area currently have preliminary programs aimed at developing a transit or paratransit capability within the near future. Arlington, Garland, Grand Prairie, Irving, Mesquite and Richardson may be in the position to operate their own transit or paratransit vehicles if such projects have been established. In addition, preliminary studies[48] on park-and-ride facilities for these communities have been undertaken and Garland currently provides park-and-ride service to downtown Dallas while

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[47] It is anticipated that the general policy of the cities of Dallas and Fort Worth would be to maintain existing service before any additional service would be considered.

[48] Pinnell-Anderson-Wilshire and Associates, Inc., Transit Operational Studies, Prepared for the Cities of Arlington, Grand Prairie, Irving, Garland, Mesquite, and Richardson (Dallas, Texas: 1975).

park-and-ride service from Irving is currently proposed. If such proposed services are in existence at the time of the gasoline shortage, they could likely meet much of the local demands for inter-city public transportation.

TABLE V-10

ESTIMATES OF POTENTIAL DAILY TRANSIT RIDERSHIP
(WORK TRIPS ONLY)

	Current Situation Workers Using Transit*	Severe Energy Shortage, 1980 Workers Using Transit**
DALLAS COUNTY	40,280	78,000
Dallas	38,000	53,200
Garland	500	5,700
Grand Prairie	210	2,000
Irving	110	4,900
Mesquite	150	4,300
Richardson	60	3,100
Remainder of County	1,250	4,800
TARRANT COUNTY	7,710	15,500
Arlington	460	4,900
Fort Worth	7,000	9,800
Remainder of County	250	800
Total Bi-county	47,990	93,500
Remainder of Intensive Study Area	150	5,000
TOTAL Intensive Study Area	48,140	98,500

*Estimates based on 1970 census data revised to reflect 1977 population and existing transit service.

**North Central Texas Council of Governments estimates assuming transit service is available in all areas.

The potential for renting buses from the private sector has been discussed previously. In smaller suburban communities, however, these may be more feasible alternatives than in Dallas or Fort Worth. Fewer buses would be needed and the spirit of community cooperation which would be likely to exist during this "crisis" period could help persuade the private sector to make their buses available for public use.

The Potential Use of School Buses

Although current State law prohibits the use of public school buses for general transportation purposes,[49] it is conceivable that an extreme emergency created by a fuel shortage could result in a temporary use of these vehicles. If so, how could school buses be used to provide or augment public transportation in a suburban community? A number of potential usage alternatives can be suggested. These include:

- Allowing school buses to serve the general public only during those hours in which they are not in school service
- Allowing the general public to board buses along normal, or slightly modified, school bus routes during school transporting times
- Using school buses as shuttles or a feeder service to fixed transit lines or park-and-ride lots (if in existence)
- Using some school buses to provide special trips, e.g., to transport workers to and from a major employment center
- Appropriating the school bus fleets for general public service during peak morning and afternoon travel periods.

The general public use of school buses during times which they are not in school service (primarily between 9:00 a.m. and 2:30 p.m., and after 4:30 p.m.) would probably be the alternative least disruptive to normal school operations. The obvious disadvantage of this option is that the buses would not be available during the general public's peak travel times. Although some of the afternoon commuters could be accommodated by school buses, no vehicles would be available during the morning peak hours.

By allowing the general public to board school buses along their normal (or slightly modified) routes at usual school times, there would be little disruption of normal operations. In many cities, school children ride public transit buses with the general public

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[49] House Bill 349 permitted the general use of these buses, but it was defeated in the 1977 Texas Legislature.

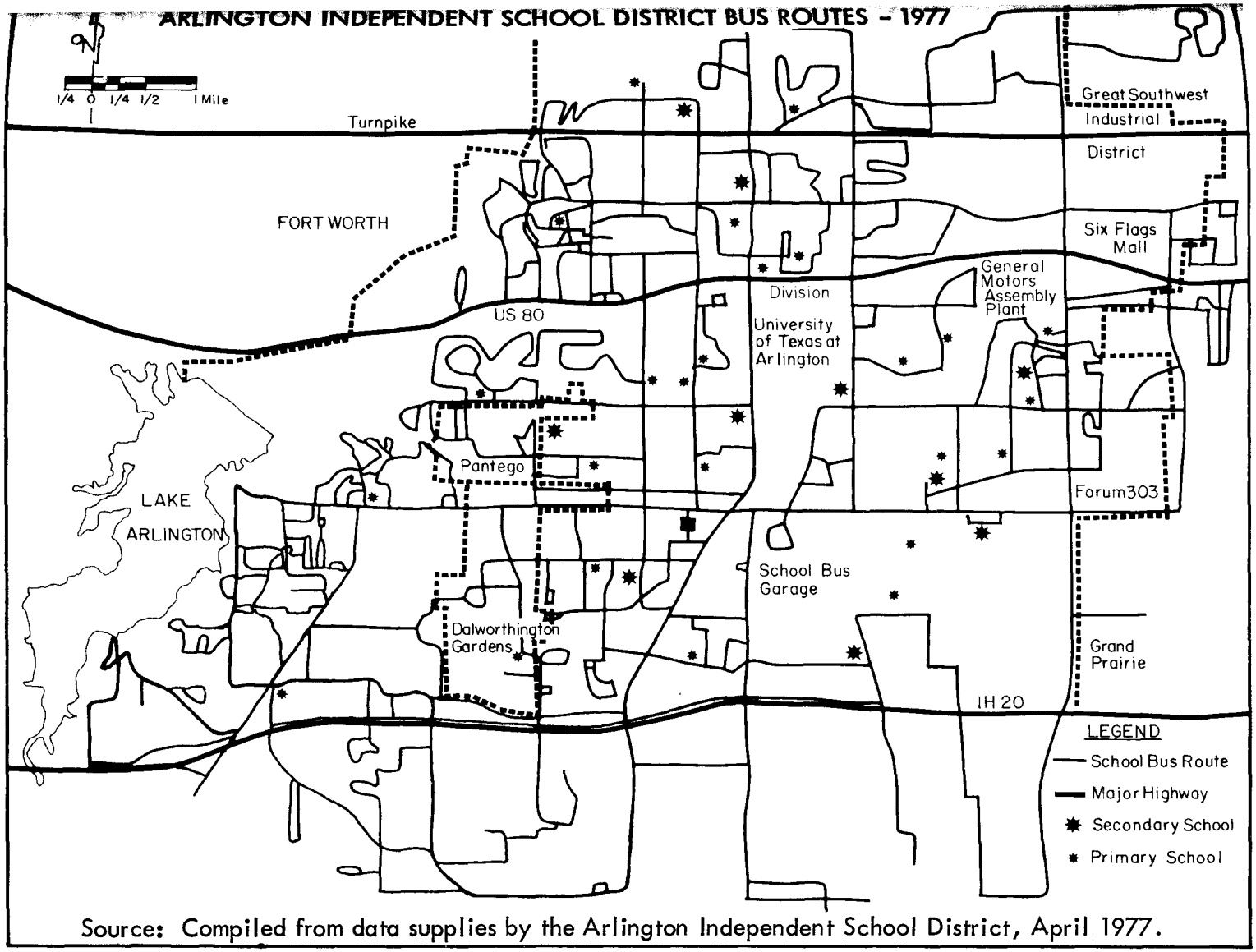
so this would not be an unusual situation. However, since the school buses operate during limited times and along routes which may not be major destination points for the general public, few would be able to take advantage of such a service. Also, buses which are at capacity with students would not be able to transport other passengers. If such a service were initiated in Arlington, as an example, nearly all residential areas would be served by a bus line, however, the major trip destinations such as the Great Southwest industrial district or the Abrams-Division Street commercial areas would be poorly served (Figure V-16).

School buses could also be used to shuttle passengers between residential areas and existing fixed route transit systems or park-and-ride facilities. Such an operation could be established by allowing the public to ride the school buses as they transport the students or by appropriating school buses to be used exclusively for this feeder service. It should be noted that a feeder system of this type is needed to make suburban park-and-ride operation bidirectional, i.e., to serve central city residents who work in the suburbs, some form of transportation is needed to get the worker from the suburban park-and-ride lot to his final destination.

Another alternate use of school buses could be to provide special trip service. Buses taken from school use, for example, might be used to pick-up and transport workers to a major employment center, such as the General Motors plant in Arlington. Trips for special groups, such as the elderly or handicapped could also be provided in this way.

Finally, the school bus fleet could be appropriated from school service and placed into general service throughout the community during the peak travel hours. While this would cause the most extreme disruption of normal school operations, the community would be able to meet a great part of its local transit demand with these fleets at their service.

If school buses are to be utilized in any way during peak travel periods, the school systems would have to adjust to accommodate these transportation changes. School class



Source: Compiled from data supplies by the Arlington Independent School District, April 1977.

FIGURE V-16

hours could be affected. Allowing the general public to board school buses as they transport children along usual routes would probably result in longer travel times which could be accounted for by starting classes at a later time or beginning the bus service earlier.

If some school buses are appropriated for exclusive public transportation service, the school system would have to consolidate existing school routes to account for the reduction in their vehicle fleet. Such accommodation could be in the form of the remaining buses making more and longer trips along established school bus routes or possibly establishing neighborhood school transportation centers at selected existing schools or at new centrally located bus stops.

Under the neighborhood school transportation center concept, each pupil would live within two miles of his or her school or a school bus stop. While Texas law currently provides financial assistance for school bus transportation for students further than two miles from their school, no restrictions are placed on the distance from the residence to the bus stop, and bus riding school children generally walk less than those children within two miles from the school. The neighborhood center would tend to equalize the extent of walking by all pupils by requiring bus-riding children to walk to a neighborhood center for bus service.

In the Arlington case study, depending on the maximum walk distance, the neighborhood center approach would make available from 8 to 18 vehicles for general transportation purposes (Table V-11) or for increased service along the modified routes. It should also be noted that a plan for a local bus system which is being developed by the City of Arlington proposes to use only 12 transit vehicles.[50]

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[50] Pinnell-Anderson-Wilshire and Associates, Inc. and Simpson & Curtin, Transit Implementation Program, (draft), prepared for the City of Arlington, June, 1977, p. 31.

TABLE V-11

IMPACT OF NEIGHBORHOOD SCHOOL TRANSPORTATION CENTER CONCEPT
ARLINGTON CASE STUDY

	Current System	Cases Examined		
Maximum Walk Distance	1/8 Mile	1 Mile	1-1/2 Miles	2 Miles
Number of Bus Routes	50	6	5	4
Number of Transportation Centers	none	21	13	5
Number of Buses Used	50	42	40	32
Number of School Buses Available for General Use	0	8	10	18
Trips Per Route Per Peak Period	2	14	16	16
Total Route Miles	594	74	60	58
Total VMT per Day	1848.6	2072	1920	1856
Seat Trip Capacity Per Peak Period	7160	6100	6000	4800
Passengers Served	Students Only (4,700)	Students, General Public	Students, General Public	Students, General Public
Public Ridership Allowable Per Peak Period	none	1,400 Passengers	1,300 Passengers	100 Passengers

he buses made available through this approach could be used to run additional routes or o provide higher frequency service on a modified route structure designed to service both ublic school children and the general public. Figure V-17 is an example of how a modified school bus route system which incorporates the neighborhood transportation center oncept could appear in the Arlington case study. One system would consist of six bus outes which connect 21 transportation centers with a maximum student walk distance of ne mile. If seven school buses were placed in service along each route during peak avel periods, approximately 1,400 city commuters could be accommodated as well as ie usual number (approximately 4,700) of school children. In addition, a high level f service (bus headways as short as nine minutes) could be provided.

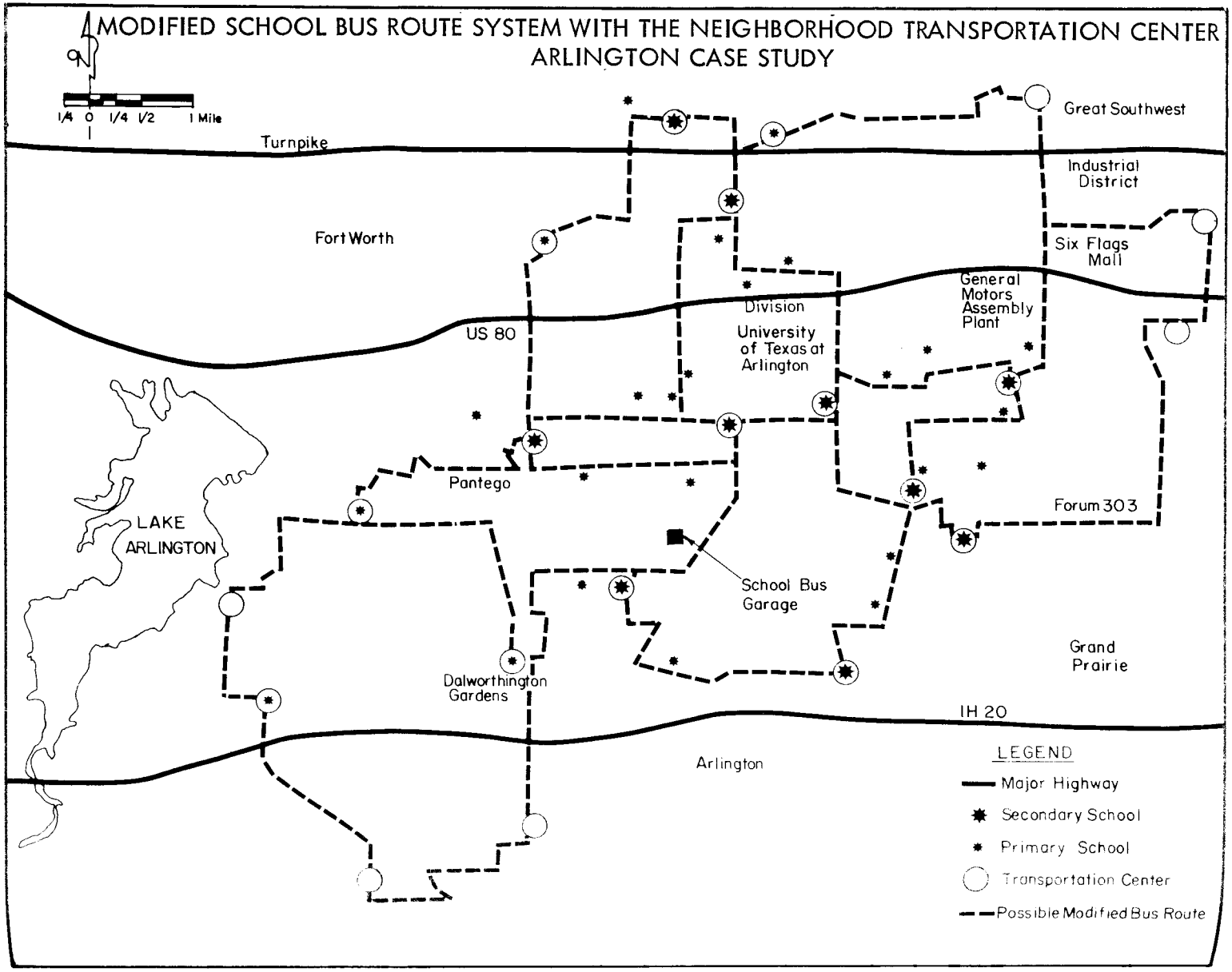
MODIFIED SCHOOL BUS ROUTE SYSTEM WITH THE NEIGHBORHOOD TRANSPORTATION CENTER
ARLINGTON CASE STUDY
1/4 0 1/4 1/2 1 Mile
Turnpike
Great Southwest
Industrial District
Fort Worth
Six Flags Mall
General Motors Assembly Plant
Division
US 80
University of Texas at Arlington
Pantego
Forum 303
LAKE ARLINGTON
School Bus Garage
Grand Prairie
Dalworthington Gardens
IH 20
Arlington
LEGEND
Major Highway
Secondary School
Primary School
Transportation Center
Possible Modified Bus Route

FIGURE V-17

In the most extreme case, where most of the school fleet would be appropriated, it might be necessary to totally restructure school hours or possibly cancel classes totally on a temporary basis. While this may seem to be a drastic step, it should be noted that numerous schools, in Texas and elsewhere, were closed during the natural gas shortage of the winter of 1976-1977. If, however, the fuel shortage were to occur during the summer holiday months, most of these problems would be obviated.

It appears that none of the preceding alternatives will be easy to accomplish. The problems of obtaining drivers, vehicle maintenance and fuel supply[51] will be major obstacles, not to mention the institutional difficulties involved with alterations to the structure and purpose of the public school transportation system. If, however, the demand for public transportation is great enough, the use of school buses provides an alternative which should not be dismissed.

Paratransit

If transit service cannot be provided, the demand for transportation alternatives in suburban areas may be met through existing or new paratransit services. Paratransit alternatives include carpools, taxicabs and elderly and handicapped services.

Auto occupancy and public survey indicators have identified carpooling as one of the major responses to the previous energy shortage. Given the energy restraints of both the allocation and rationing scenarios, it can be expected that this option will become especially attractive to local commuters during this time. Also, an overwhelming 90 percent of local residents surveyed by the Urban Panel Project expect their communities to encourage carpool operations in the event of another energy crisis.[52]

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[1] It should be noted that most school buses use gasoline and, a shortage of gasoline supplies is expected to be more severe than that for diesel fuel which most transit buses use.

[2] Urban Panel Project 1976, p. VIII-13.

The major problem in the formation of carpools during an energy shortage period would probably not be the lack of demand, since most commuters would be searching for ways to save gasoline to avoid service station lines or to conserve ration coupons. Instead, the lack of information on carpool matching programs could possibly inhibit carpool formation and utilization. Most importantly, since the development of a local carpool program at the onset of another embargo would take too long to be effective as a short term solution (The Dallas and Fort Worth Carpool program took over a year from inception to initiation),[53] carpool programs should be in operation prior to an energy shortage to be effective.

The ground work for a regional carpooling effort has already been accomplished by the Dallas Carpool Demonstration Program and the Metropolitan Fort Worth Carpool Demonstration Project, both initiated during the embargo period of 1974.[54] Assuming these programs are in operation during any near-term energy shortage, most requests for suburban carpool information could also be met in this manner. The initial cost of the Fort Worth program was $80,000 for the first year, and the initial Dallas program costs were $170,000 for the first two and one-half years of operation. Current maintenance of the programs is estimated at $30,000 annually in Fort Worth and $50,000 per year in Dallas.[55] Thus, by maintaining the programs, start up costs are avoided, and, more importantly, the annual regional cost savings by participating carpoolers in suburban as well as urban areas would more than offset the cost of the program.[56]

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[53] City of Dallas, Traffic Control Department, "Dallas Carpool Demonstration Program," Project N.M.-9001-(10), Quarterly Report No. 1 (Dallas, Texas: June 1, 1974), pp. 1-3.

City of Fort Worth, Traffic Engineering Department, "Evaluation: Metropolitan Fort Worth Carpool Program Demonstration Project M-9009-(14)" (Fort Worth, Texas: January, 1976), p. 3.

[54] Ibid.

[55] City of Dallas, "Dallas Carpool Demonstration Program."
City of Fort Worth, "Metropolitan Fort Worth Carpool Program Demonstration Project."

[56] Ibid.

The use of carpools in local suburban areas, however, has not been a particularly effective alternative to individual travel in the past due to the lack of public participation. It is anticipated, however that with the emergency conditions which may arise during a severe fuel shortage, suburban commuters may turn to forming carpools in greater numbers. Indeed, approximately one-quarter of all suburban Urban Panel commuters indicated that they would carpool more in the event of a gasoline price increase to one dollar or more.[57] This seems consistent with the preliminary estimate in Table V-12 which indicates that the impact of a severe energy shortage (25 percent shortfall) on local suburban commuter patterns would be that up to one-third of all surburban commuters would carpool if an effective carpool program were in existence at the time.

TABLE V-12

THE MAXIMUM IMPACT OF A SEVERE ENERGY SHORTAGE ON SUBURBAN CARPOOLING IN THE DALLAS-FORT WORTH AREA

	Percent Modal Split		
Transportation Mode to Work	Before Shortage	Severe Shortage With No Carpool Program (Upper Carpool Limit)	Severe Shortage With Carpool Program (Upper Carpool Limit)
Drive Alone	82%	74%	68%
Carpool	18%	26%	32%

Source: Estimates based on methodology in: Cambridge Systematics, Inc., Guidelines for Travel Demand Analyses of Program Measures to Promote Carpools, Vanpools, and Public Transportation, prepared for Federal Energy Administration (Cambridge, Massachusetts: Cambridge Systematics, Inc., November, 1976).

[57] North Central Texas Council of Governments, Urban Panel Project, Micro-Level Data, 1976, p. VIII-10.

Thus, while carpooling may not eliminate the need for the purchase of additional gasoline coupons in suburban areas, it is probably the cheapest and easiest conversation measure to implement. In order for carpool programs to be available at the onset of an emergency period, however, they should be in operation (though they may be relatively inactive) prior to the emergency. If the existing Dallas and Fort Worth carpool programs were not maintained, the time to develop and update the data base alone could take several months[58] and thus would reduce the effectiveness of this program as a short-term strategy.

The need to maintain a taxicab fleet, especially in suburban communities of the Intensive Study Area which have no other form of public transportation, is essential to the mobility of the region. Table V-13 lists the local cities with taxicab service.

TABLE V-13

INTENSIVE STUDY AREA TAXICAB STATISTICS

City	Number of Taxicab Companies	Number of Taxicabs
Arlington	1	10
Carrollton	1	2
Dallas	2	530
Euless	1	3
Farmers Branch	1	2
Fort Worth	2	200
Garland	*	*
Grand Prairie	1	2
Irving	1	21
Mesquite	1	2
Plano	1	2
Richardson	1	3
TOTAL	14	784

* Served by Yellow Cab of Dallas

Source: Texas Municipal League, Taxicab Service in Texas Cities - 1975, June, 1975.

[58] Opinion expressed by Mr. Jim Haven, Dallas Carpool Program, February, 1977.

Major taxicab operation difficulties would probably arise from the reduced availability of fuel and the expected fuel cost increases. The availability of fuel could be managed through individual company actions, such as by enhanced fuel storage capability as was suggested for local transit operation, or by local service station regulations which will be discussed later.

Fuel cost increases would likely result in fare increases and thereby, through the attendent loss in ridership, threaten the continued operation of the smaller taxicab companies in some suburban areas. In addition, large fare increases may put service out of the reach of groups such as the poor or elderly and handicapped who depend on it for a significant portion of their trips. While a detailed analysis of these problems are beyond the scope of this study, they should be considered in the continuing transportation planning of the area.

Specialized taxicab services were tried during the last embargo. One such scheme was attempted by Yellow Cab Company of Houston during the 1973-1974 embargo.[59] This experiment introduced a "taxicab pool" service, similar to transit park-and-ride, which picked up commuters at suburban shopping centers and transported them to downtown Houston. During the first week of operation a fleet of 50 cabs carried about 200 persons from 13 suburban shopping centers to three downtown locations. Commuters who wished to use the service phoned Yellow Cab for a reservation and a computer assigned them to one of the pickup points. With about five persons sharing the costs, round trip fares ran as low as two dollars. The service, however, was not used by sufficient numbers of commuters to be considered successful. This may reflect the difficulty in starting temporary public transportation services in suburban areas or the problems of any new service establishing public acceptance on a short-term basis. The success of such a program could also be highly dependent on public information concerning the program.

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59. "Taxicab Pool Starts for Houston Riders," The Dallas Morning News, 13 December, 1973, p. 37 A.

The problem of increased costs on elderly and handicapped services may be alleviated through the coordination and consolidation of such services and resources. Recommendations to this effect have previously been outlined in Transportation Options for the Elderly and the Handicapped[60] and are very applicable to coping with the rising costs and fuel availability associated with an energy shortage.

To summarize, paratransit solutions to the demand for public transportation in suburban areas seem to be feasible alternatives. However, the higher fuel costs and the unreliability of obtaining sufficient fuel supplies (neither taxicabs nor other paratransit services seating 10 passengers or less would qualify for preferential fuel supplies under either scenario) may discourage the development of these services and may even lead to a cut in the existing paratransit services.

Inequities and Uncertainties of Rationing and Allocation

While perhaps the impact of a future fuel shortage which will affect the greatest number of people is the result of the governmental approach to the distribution of scarce automotive fuel, dealing with this problem area is particularly difficult for local governments. Some measures may have some effectiveness, however, and these are discussed below.

Allocation

The auto user is the primary federal fuel conservation target of both rationing and allocation plans. Under allocation, long lines and difficulty in obtaining gasoline will result in public uncertainty and confusion with regard to fuel purchases. This is because station operators, who can obtain only limited fuel supplies, are free to establish their individual policies of business hours and customer sales policies. Some station operators may decide to allow unlimited fuel sales, some may impose a monetary purchase limit,

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[60] North Central Texas Council of Governments, Transportation Options for the Elderly and the Handicapped (Arlington, Texas: September, 1976).

and some may sell only to regular established customers. The days and hours of business generally may vary at the discretion of the operator. Policies such as these will probably add to the confusion and uncertainty of the period.

One obvious solution would be to coordinate local gasoline station sales policies. During the past embargo, numerous efforts, mostly by other states, were made to coordinate gasoline sales policies by determining who may purchase fuel on which days through such criteria as license plate numbers or letters. New York State, for example, during the past embargo mandated an odd/even gasoline rationing system which required minimum purchases of one-half of a tankful.[61] A system of gasoline station regulations with regard to customer sales, similar to these used by some states during the past embargo, could be implemented on a local city basis.[62] Based on the license plate (possibly State inspection sticker) number distribution in the Intensive Study Area (Table V-14) a system could be developed whereby half of the automobiles will be eligible for gasoline purchases on alternating days, assuming that the State has not already taken this step.

In addition to the above action, it may also be helpful to coordinate retail gasoline sales times so that supplies are available when the demand is greatest and so that each area will be served by at least one station during all times. Another measure may be to place a limit on the amount of gasoline each station should sell per day, thus ensuring a constant fuel supply through each allocation period. The implementation of actions such as these should solicit the voluntary cooperation of service stations since any legislative actions may prove time-consuming and difficult to enforce. In addition, the intent is not to encumber local businesses with extensive ordinances.

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[61] Carol A. Keck, et al., p. 8.

[62] Existing Texas law may not permit counties to establish such measures except on a voluntary basis.

TABLE V-14

LICENSE PLATE DISTRIBUTIONS FOR INTENSIVE STUDY AREA COUNTIES*

County	License Distribution (1975)**
Collin	GQK 925 - GSH 399
Dallas	GSH 400 - JDU 899
Denton	JDU 900 - JFZ 424
Ellis	JFZ 425 - JHC 199
Johnson	CGE 150 - CHL 449
Kaufman	JHC 200 - JHV 174
Parker	CJC 825 - CJW 524
Rockwall	JJP 175 - JJW 449
Tarrant	CJY 350 - DDC 699

*Only Dallas and Tarrant Counties are totally within the Intensive Study Area.

**License plate numbers range from 10 to 999. The letters I and O are not used for legibility purposes, otherwise the lettering uses a sequential lettering and numerical system. For example, after GQK 999 comes GQL 10. Additional numbers have been added through 1976.

Source: Texas State Highway Department, 1975 License Plates Assigned to the County Tax Collectors (Austin, Texas, Motor Vehicle Division, 1975).

Another possible problem will involve the unequal regional allocation of gasoline supplies to local service stations. Since allocations are determined on a historical base year (currently 1972), it is likely that high-growth areas would not receive their fair share of fuel supplies. If adjustments are not quickly made by the individual station operators, suppliers, and the FEA, it is conceivable that all of the gasoline supplies in a community may be depleted well before the end of an allocation period.

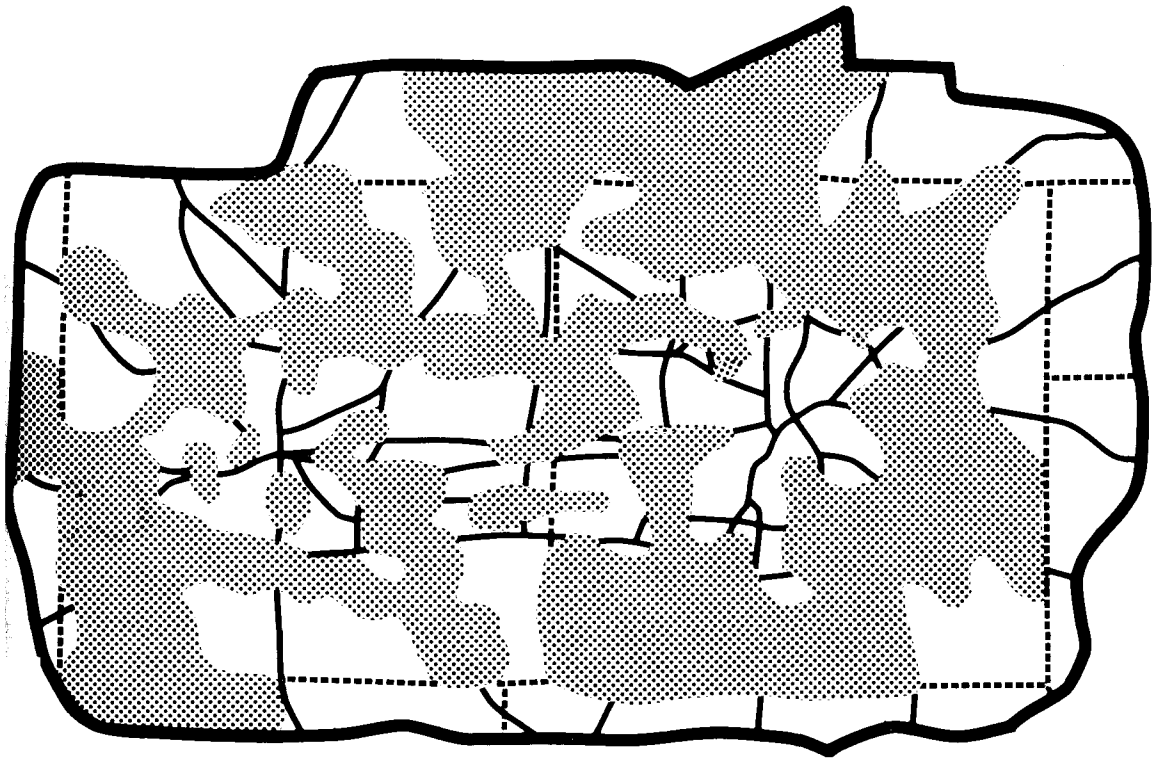
As can be seen on Figure V-18, such high growth areas are mainly in the suburban areas of the Intensive Study Area surrounding the cities of Dallas and Fort Worth. To determine

under-supplied areas, however, gasoline allotments should be carefully reviewed throughout the area should an embargo or other shortage by imminent. While this is currently the responsibility of the individual station owner, local governments may want to offer assistance in this regard.

FIGURE V-18

EXPECTED POPULATION CHANGES

1970 to 1980

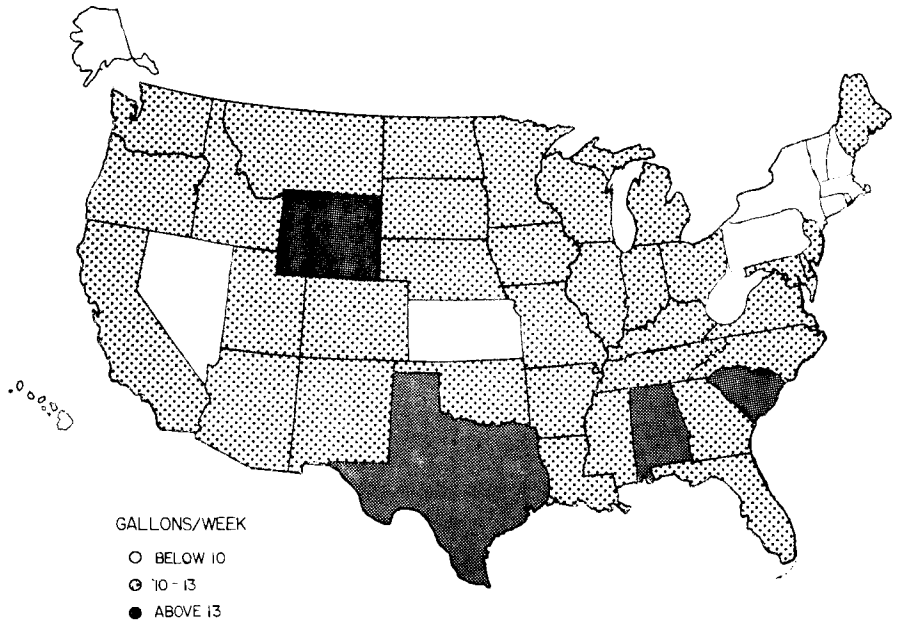


Rationing

As Figure V-19 shows, drivers in the State of Texas are among the largest gasoline consumers in the nation, using an average of over 13 gallons per capita per week. The impact of a rationing program which would limit individual gasoline allotments from seven to ten gallons could thus be considerable.

FIGURE V-19

GASOLINE CONSUMPTION PER LICENSED DRIVER BY STATE



Source: Federal Energy Administration, Proposed Gasoline and Diesel Fuel Rationing Contingency Plan, Economic Impact Analysis (Washington, D. C.: September, 1976) p. 259.

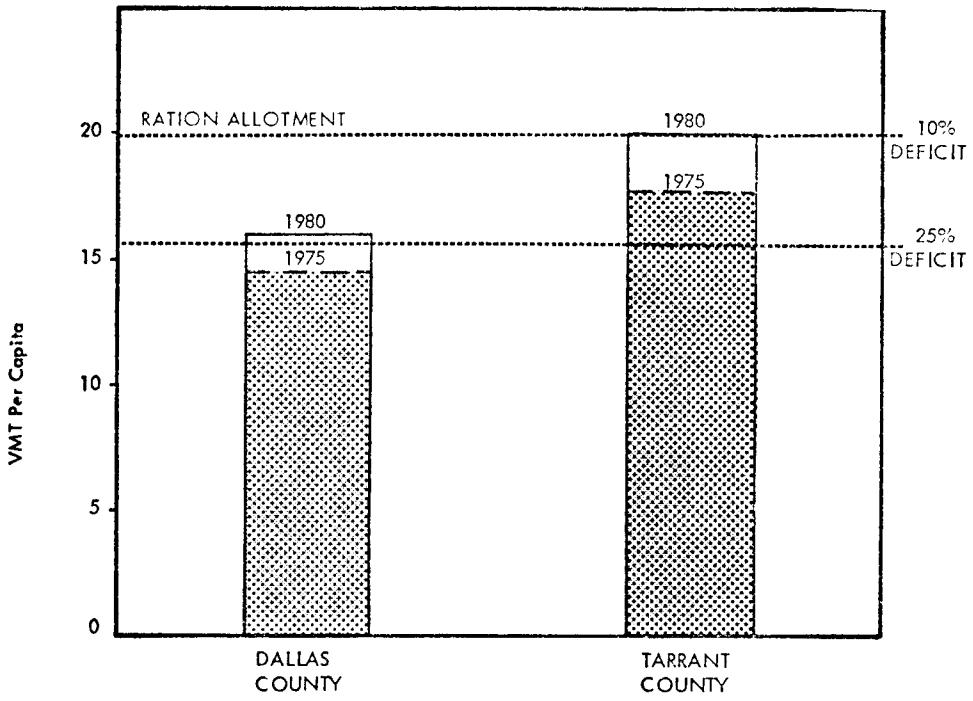
Locally, because of differences in per capita gasoline consumption by county [as estimated by vehicle miles traveled (VMT)], gasoline rationing would probably affect Tarrant County more severely than Dallas County (Figure V-20). While it appears that neither county

uld need to significantly reduce VMT under a 10 percent fuel shortfall (9.2 rationed llons per week), both counties would need to reduce VMT under a 25 percent deficit .2 gallons per week) especially by the 1980 target year.

FIGURE V-20

PER CAPITA COUNTY VMT

1975-1980



Source: VMT estimates provided by the State Department of Highways and Public Transportation.

e imposition of fuel rationing will present a number of unique problems, especially ose associated with the coupon mechanism. Since coupons will be distributed to censed drivers equally, regardless of their needs,[63] it can be expected that some fam-es will have insufficient coupons to maintain their necessary travel needs. This prob-m may be resolved by:

- Using alternate transport modes (transit, carpools)

[63] There are certain need exceptions as noted in Chapter IV.

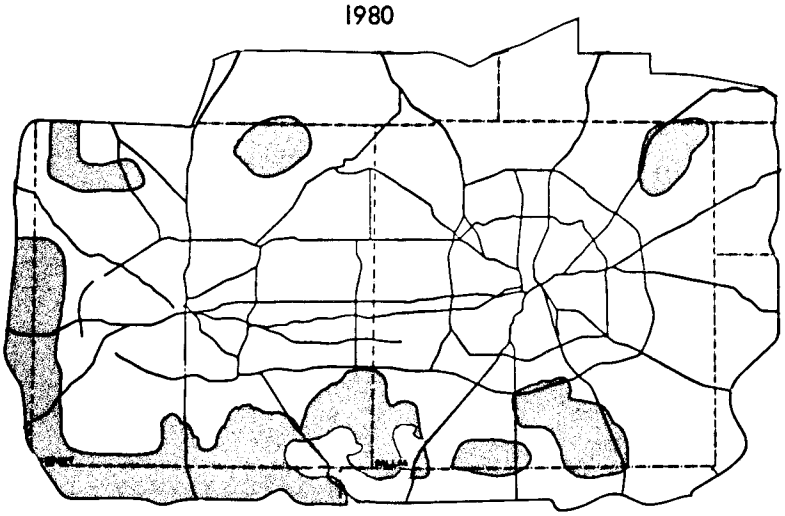
- Purchasing additional coupons
- Increasing the number of licensed drivers per family
- Reducing personal travel

Figure V-21 shows the areas for which the anticipated coupon distribution (9.2 gal/week) would not be sufficient to satisfy the expected 1980 average weekly work trip. Most of these problem areas are located in the southern and western rural parts of the Intensive Study Area due to the high percentage of long distance commuters found here. These areas, however, include only about one percent of the total 1980 Intensive Study Area population. When the total home base travel is considered, however (Figure V-22), it can be seen that an average driver in nearly all areas would be unable to maintain normal travel behavior. These areas include approximately 70 percent of the total population. While much of this gasoline deficit could probably be resolved by eliminating unnecessary trips,[64] many drivers may choose one or a combination of the above alternatives rather than travel less.

FIGURE V-21

AREAS IN WHICH AVERAGE WORK TRIPS USE MORE THAN 9.2 GALLONS/WEEK

1980



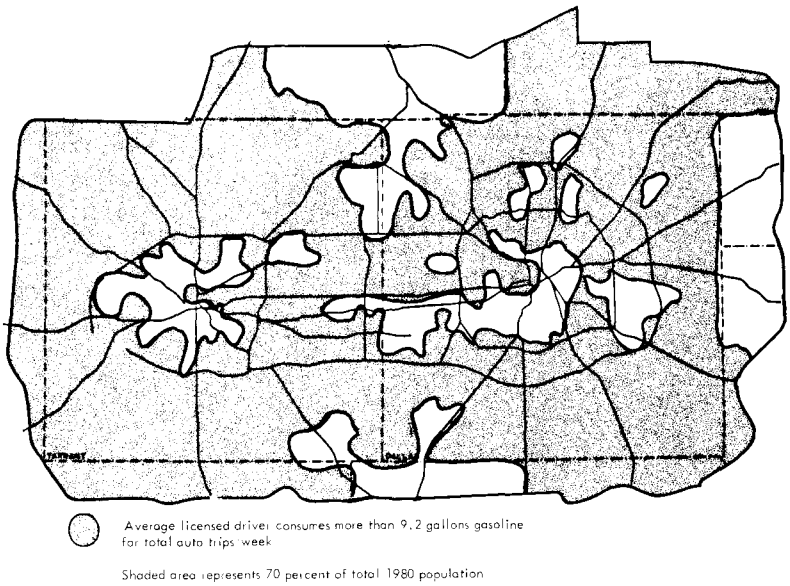
Average worker consumes more than 9.2 gallons gasoline/week commuting
Shaded area represents one percent of total 1980 population.

[64] The American Automobile Association has estimated that the average U. S. family could reduce its gasoline consumption by 25% and still maintain essential travel.

FIGURE V-22

AREAS IN WHICH AVERAGE TOTAL TRIPS USE MORE THAN 9.2 GALLONS/WEEK

1980

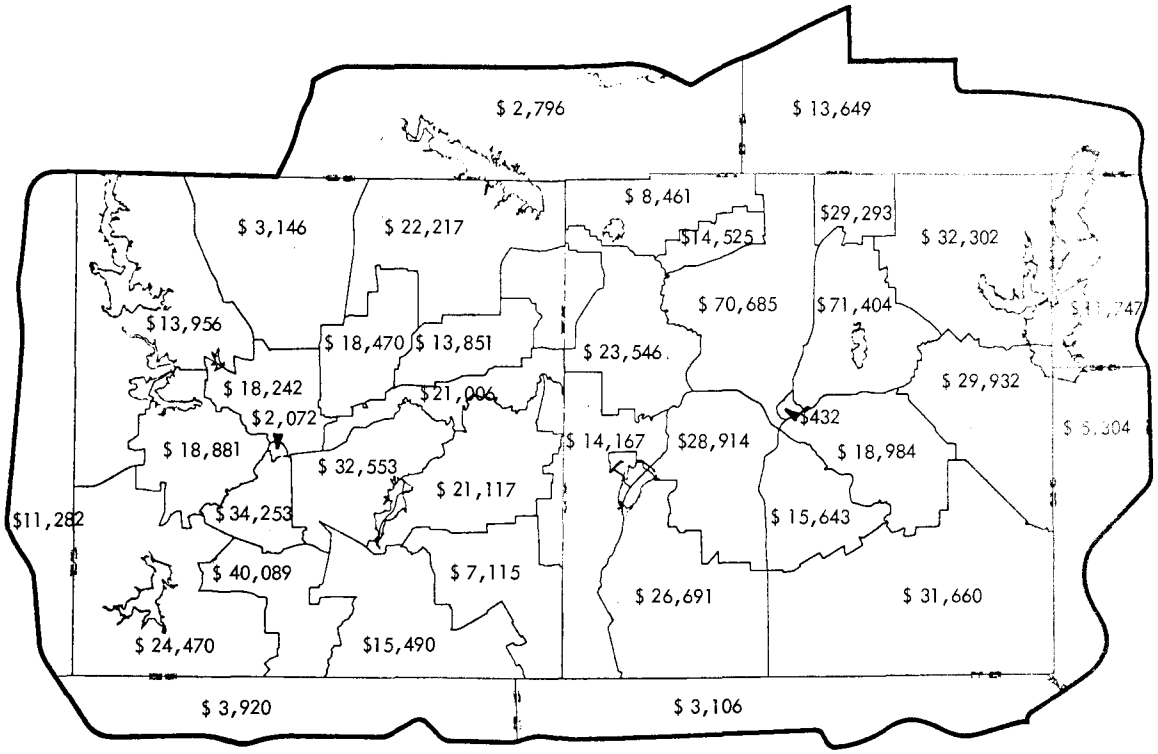


The idea of increasing the number of licensed drivers in each family whenever possible presents a possible solution to the coupon problem for some. By 1980, there will be an estimated 1,900,000 licensed drivers in the Intensive Study Area and approximately 570,000 eligible, but unlicensed persons. If just half of these eligible persons could be licensed, but restrained from driving, this would represent an additional 11,400,000 gallons of gasoline for this area during each ration period. It is questionable, however, as to whether governmental agencies should encourage this "solution" to the problem.

While another possible solution to an individual family's coupon shortage would be to purchase additional coupons on the white market, this may lead to a substantial financial drain on certain communities. Figures V-23 and V-24 show the estimated additional monthly costs which would be incurred by all licensed drivers and the cost per licensed driver by area if additional coupons are bought to maintain normal trip patterns. The total cost of these coupons in the Intensive Study Area would be over $700,000 each month although the average cost per individual worker will be relatively small. Low income, long distance commuters, due to the coupon hardship reserve, may receive additional coupons at no extra expense. (These are not included in these estimates).

FIGURE V-23

ESTIMATED TOTAL COUPON COST PER MONTH FOR ALL LICENSED DRIVERS*
1980



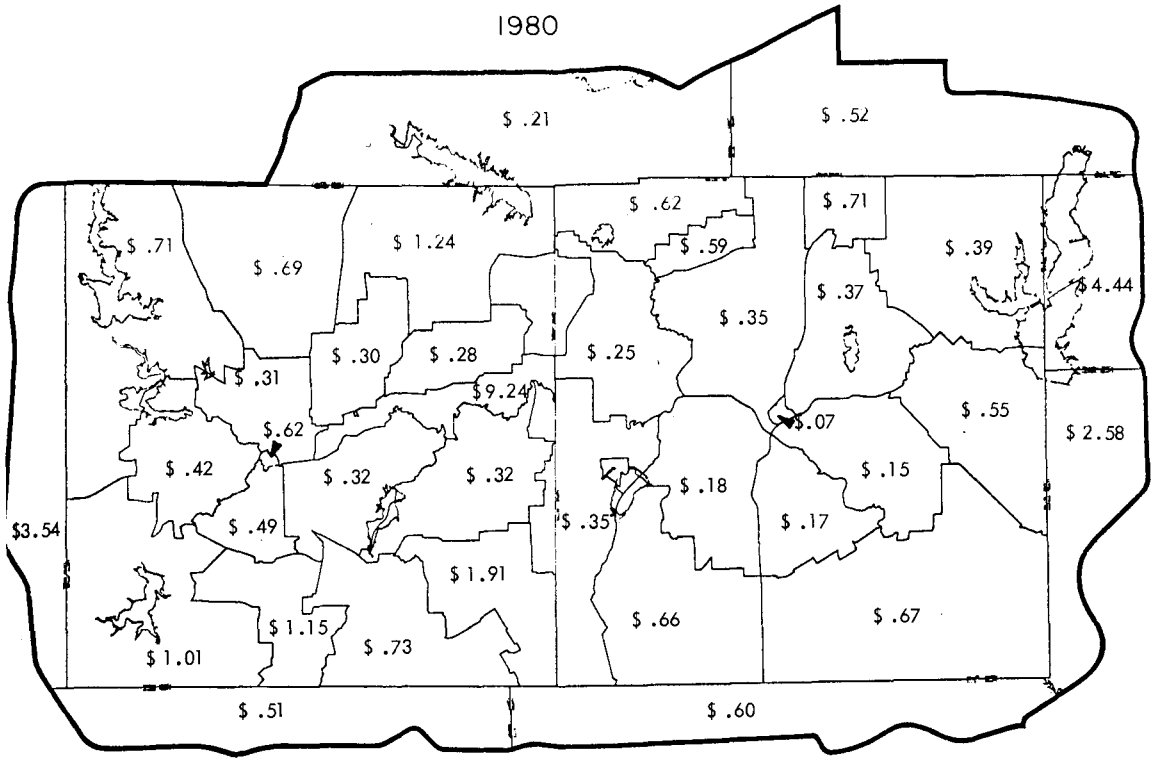
Total Intensive Study Area Cost = $754,365

Coupon Price = $1.20 per gallon

*Based on 28.8 gallon ration per month, 1980

FIGURE V-24

ESTIMATED MONTHLY COUPON COSTS PER LICENSED DRIVER*



Average Intensive Study Area Cost Per Licensed Driver = $ .39

Coupon Price = $1.20 per gallon

* Based on 28.8 gallon ration per month, 1980

While the development of the "white market" for coupon distribution is anticipated by the FEA as being an effective means to redistribute coupons to better correspond to demand, it is possible that, locally, areas will exist in which coupon redistribution centers have not been established. This will lead to inconveniences for those who must drive additional mileage to obtain extra coupons. It would thus be desirable for local communities to monitor the location of coupon redistribution centers and attempt to encourage such centers where needed.

The FEA anticipates that significant coupon cost differences may develop around the nation. To contend with this problem they propose to publish national coupon prices periodically to aid in the equalization of price through an open market. Locally, significant disparities in coupon prices may also develop especially between city and suburban areas. It may therefore be helpful to publish prices from selected locations in local newspapers. This would help to establish a more-or-less uniform local price and provide the public with the information necessary to purchase fuel supplies at the least expense or to sell extra coupons at a maximum profit.

Institutional Arrangements

Since the preceding problems associated with gasoline allocations to service stations and the rationing coupon distribution and redistribution processes will vary within each community, it would not be practical to suggest a regional solution to these problems. It would be appropriate, however, for local governments to appoint a Local Energy Coordinator (LEC) to oversee these specific public energy concerns within each city and/or county. This LEC could be appointed from an existing position on the county, or possibly city level. The LEC's major functions could be to:

- Respond to public inquires regarding local problems of fuel allocation and coupon distribution or redistribution
- Collect and publish local coupon prices
- Coordinate information and policies with other LEC's
- Identify local problems, report these to the respective governing bodies and suggest local solutions to these problems
- Coordinate a local public information program

Most importantly, the LEC would fill the information gap between the public, the media, and local governing bodies. If, for example, numerous public complaints are received

with regard to gasoline outlet sales policies, the LEC may choose to recommend to the County Commissioners or City Council that a program of gasoline sales based upon license plate numbers be instituted or whatever course of action he or she may feel is appropriate.

Conclusions

The preceding problem analysis has identified the local transportation problems which are expected to develop as a result of federally imposed fuel allocation and/or rationing programs. In addition, possible solutions for each of these problems were discussed. The following chapter considers the solutions most applicable to the Dallas-Fort Worth Metropolitan area and outlines specific implementation steps and considerations.

VI. Implementation Considerations

This chapter discusses the issues and practicalities associated with the implementation of actions described in the previous chapter. In addition, the most promising measures are identified from those previously analyzed.

Past Experience

A review of previous energy and transportation-related emergencies in other areas provides valuable insight into the type of program implementation difficulties which may be experienced locally during a future severe energy shortage. An examination of the implementation of an emergency transit plan during a severe flood in Wilkes-Barre, Pennsylvania[1] and the governmental reaction to a utility power shortage in Los Angeles, California[2] during the 1973-1974 embargo are two such cases to be discussed here.

Wilkes-Barre

On June 23, 1972, Hurricane Agnes produced severe flooding in Wilkes-Barre which covered the CBD with up to nine feet of water. City evacuation efforts, directed by the Civil Defense, utilized Wilkes-Barre Transit and White Transit in order to reduce the auto traffic congestion which was occurring on the few remaining open roads. After the flood, the City sponsored free local bus service under contract with the Wilkes-Barre Transit

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[1] Simpson and Curtin, Manual of Transit Operations in Civil Emergencies, Prepared for Luzerne County (Pa.) Transportation Authority and the Urban Mass Transportation Administration (Philadelphia, Pennsylvania: Simpson and Curtin, April, 1974).

[2] U. S., Congress, Senate, Current Energy Shortages Oversight Series, Mayors' Panel-Urban Impact, Hearings before the Permanent Subcommittee on Investigation of the Committee on Government Operations, 93rd Congress, 2nd Session, March 6, 1974, pp. 702-706.

Company. Ridership during this time nearly doubled from normal usage (from 68,000 prior to the flood to 132,500 weekly passengers afterwards). This no fare service was later subsidized by the federal Office of Emergency Preparedness (O.E.P.) from July 10, 1972, until October 18, 1972.

The Wilkes-Barre emergency identified a number of difficulties regarding the local implementation of a transit disaster plan. These lessons suggest that:

- the ultimate responsibility for emergency planning, prevention, response, and relief resides within the local community itself;
- funding of initial transit emergency support should be arranged beforehand to insure an available delivery service;
- a public information plan is important;
- flexible federal support is needed;
- previous transit disaster planning could have identified problems experienced in the areas of:
    - labor
    - extra buses and support vehicles
    - fuel supplies
    - the lack of mutual-aid agreements
    - the lack of two-way radio communications;
- and, that a plan is needed for transition back to normal operations.

Los Angeles

The primary source of electrical power in Los Angeles during 1973 was residual oil of which 48 percent originated from Arab countries. The Arab oil embargo in the winter of 1973, however, resulted in a sudden shortfall in the amount of fuel available for electrical power. This reduction in fuel supply became so critical by December, 1973, that the Department of Water and Power (DWP) in Los Angeles declared an emergency and

notified the Los Angeles City Council of the situation. Mayor Bradley responded to the emergency by appointing an ad hoc committee on energy conservation composed of members from labor, industry and commerce. On December 21, 1973, a two phase emergency energy curtailment program was initiated which required a 10 percent electrical energy reduction by residential and industrial users and a 20 percent reduction by commercial consumers. In addition, DWP was allowed to purchase as much extra oil as it could obtain.

The emergency program was generally successful. While a 12 percent reduction in total electrical consumption was expected, an 18 percent curtailment was actually achieved.

The Los Angeles experience identified the following implementation considerations as being important to similar emergency strategies:

- Local governments often must assume leadership under adverse conditions.
- Emergency ordinances should remain as a standby mechanism for future emergencies.
- The public education and information program should be multi-lingual.
- The long-range plan for local growth patterns should be consistent with energy considerations.

With the Wilkes-Barre and Los Angeles lessons in mind, the following discussion examines the implementation of previously identified strategies in the Intensive Study Area.

Local Strategy Implementation

The actions discussed in Chapter V can be categorized according to their time frame of implementation. Since the exact date of a future emergency energy situation is not known, strategies which require a long lead or those which should be in effect at the onset of the emergency should be initiated as soon as possible. In the case of several

other actions which involve a short start-up time, these can be implemented at the beginning of the emergency or federal contingency. It should also be noted that the preparation for many of these short lead time strategies can be begun now since their present implementation would result in energy conservation.

Strategies for Current Implementation

In view of the long lead time needed and the importance of their existence at the onset of a future oil shortfall, it is recommended that the following measures be implemented as soon as possible:

- the increase or establishment of in-house fuel reserve supplies by large gasoline/diesel fuel users,
- the modification of federal allocation and rationing regulations to assure public transportation fuel supplies,
- the maintenance of local carpool programs, the expansion of their planning capacity, and the incorporation of a flexible work hour program,
- the securing of agreements between local communities and transportation providers as well as mutal aid agreements between cities,
- the appointment of Local Energy Coordinators (LEC's), and
- the modification of the Texas Education Code to permit the use of school buses for public transportation.

Strategies to be Implemented at the Emergency Onset

Due to shorter lead times (less than six months) and unnecessary prior existence, numerous other local strategies would not have to be implemented until emergency energy conditions occur or appear imminent, although planning of such measures at

this time would be desirable as a function of the LEC's. These strategies include:

- the pursuance of all transit and paratransit fuel conservation measures mentioned in this report (Table VI-1),
- the stepwise implementation of transit strategies designed to contend with large ridership increases (Figure VI-1), and
- the initiation and maintenance of a public information program concerning the existing contingency

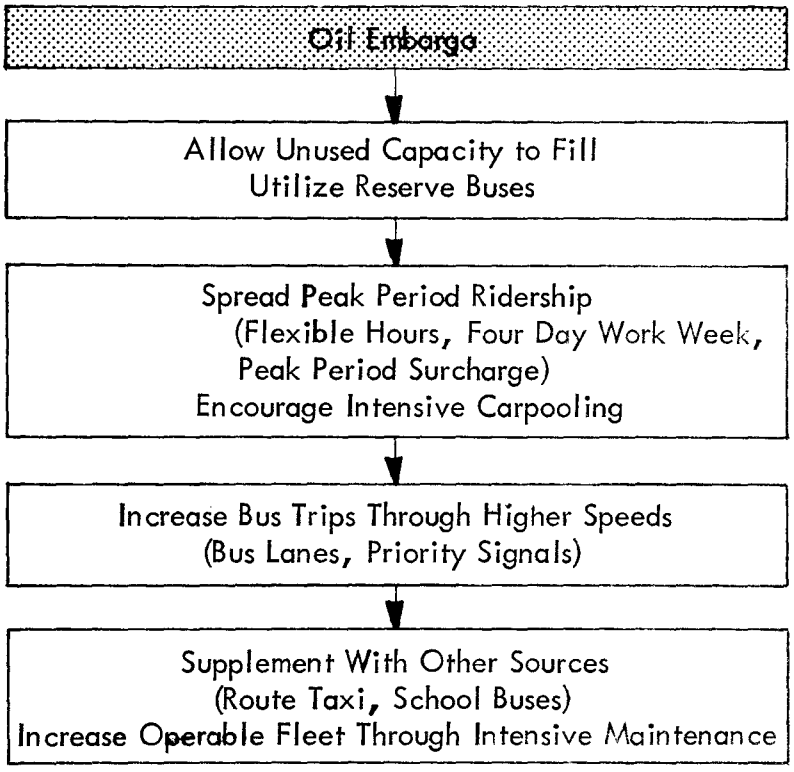
TABLE VI-1

TRANSIT AND PARATRANSIT FUEL CONSERVATION STRATEGIES TO BE IMPLEMENTED AT EMERGENCY ONSET

	Strategies	Potential Fuel Savings Percent
Transit	Increase Efficiency:	
	Bus Lanes	1 - 5
	Priority signals	1 - 4
	Decrease "deadhead" miles	1 - 4
	Modify local to express service	8 - 10
	Decrease Service:	
	Eliminate/reduce night	3 - 12
	Eliminate/reduce weekend	8 - 20
	Eliminate/reduce midday	20 - 25
	Longer bus headways	10 - 25
	Reduce number of stops	10 - 25
Paratransit	Taxicab and carpool use of exclusive bus lanes	uncertain
	Consolidate school bus routes	uncertain
	Coordinate/consolidate elderly and handicapped transportation services	uncertain

FIGURE VI-1

IMPLEMENTATION OF SHORT-TERM TRANSIT STRATEGIES TO CONTEND WITH RIDERSHIP INCREASES



As of this writing some of the previously defined strategies are already in various degrees of local implementation. The Dallas Transit System and CITRAN are both in the process of initiating action to expand their fuel storage facilities. Other measures have been included in the proposed 1978 Transportation Program for North Central Texas as part of the local transportation improvement program. These planned actions include:

- bus and carpool priority systems in Dallas and Fort Worth
- transit data collection programs in Dallas and Fort Worth which could be useful in the speedy monitoring of patronage trends during a crisis

- the proposal of new transit and paratransit service in Arlington, Garland, Grand Prairie, Irving, Mesquite and Richardson

- the continuation and expansion of the Dallas and Fort Worth carpool program

pecial Problem Areas

umerous obstacles to the speedy implementation of these and other suggested strategies main, however, as the experiences in Wilkes-Barre and Los Angeles have indicated. he short-term establishment of transit or paratransit facilities in suburban areas where uch a service is not already in existence could present some serious implementation roblems. Intercity service, such as the proposed park-and-ride facilities from the uburban cities to Dallas and/or Fort Worth, would require the approval of the Texas ailroad Commission (RRC). Such an application process would include a public hearing nd the chance for other passenger carriers in the area to contest the proposal.[3] If the pplication is not contested and all necessary information is filed with the RRC by the pplicant, service may be initiated within approximately one month of its approval. If he application is contested, a new hearing is scheduled and court proceedings may take ix months or longer. In addition, all licensed carriers are required to equip and main- ain all vehicles in use according to safety and performance specifications outlined by he RRC. Any of these regulations, however, may be waived or amended in the event f an "emergency" situation.[4] For any intercity service in existence prior to an energy mergency, RRC regulations now require that any changes in routes, fares, or schedules ust obtain approval by the Commission.

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[3] Information obtained from telephone conversation with Mr. Bill Phillips, attorney to the Texas Railroad Commission, Austin, October, 1975.

[4] Ibid.

To avoid delay in the implementation of intercity public transportation service, it is desirable to secure such agreements prior to any emergency, particularly since a great number of applications may be submitted at the time of a fuel shortage. Agreements for emergency transportation services, which, as an example, could be in the form of the park-and-ride service now provided by the Dallas Transit System for the City of Garland (Appendix D), should be developed between suburban communities and local transportation (both private and public) providers. In addition, neighboring communities should develop mutual aid agreements, such as for fire, emergency medical or police protection, to share reduced service capabilities if sufficient fuel cannot be obtained to maintain these services.

Emergency agreements should be secured between the following parties:

- suburban communities and existing public or private transportation providers (DTS, CITRAN, SURTRAN, churches, Texas Motor Coaches, Transportation Enterprises, etc.)
- neighboring communities to share limited or curtailed municipal services
- transit systems and downtown parking lot owners or other appropriate land owners for emergency parking areas to decrease deadhead bus miles
- transit systems (especially DTS) and local taxicab companies to provide "route taxi" service
- cities and SURTRAN to transfer extra buses (if any) for city or suburban use; SURTRAN may also wish to review its agreement with SURTRAN taxi to replace some bus service with taxi service.

The use of school buses for public transportation presents some of the most difficult implementation problems. Since the legal use of school district-owned school buses for these purposes is prohibited by law (as described previously) and since another

attempt to amend this regulation thrcugh the State legislature must wait until the next legislative session of 1978-1979, an alternate method of obtaining these buses has been suggested. A report[5] on the legal obstacles to the use of school buses for public transportation suggests that an

> .... alternative is for the public transportation authority to own the school buses and to lease them on reasonable terms to the school district for use during the hours when they are required for the transportation of pupils. This second alternative probably is lawful under existing statuatory provisions, but an Attorney General's opinion on its legality should be obtained before embarking on such an undertaking.[6]

This alternative is based on the existing Education Code which would allow school districts to contract with public transportation authorities for service if the cost of such service is less than the cost of maintaining a school bus transportation system. At present (1975), however, no Texas school district is under such a contract and the Texas Education Agency has neither established guidelines for review nor assigned to any official the responsibility for making it. The report on legal obstacles suggested that the condition of providing the school transportation service for less could be met through the following procedures:[7]

- organize and charter a Local Transit Authority under laws applicable to such entities
- sell the school buses and maintenance equipment and transfer all bus-related personnel to the Authority[8]
- negotiate a contract meeting the condition outlined in the Education Code for approval by the State Board

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[5]Robert Means, et al., Legal Obstacles to the Use of Texas School Buses for Public Transportation, prepared for Council for Advanced Transportation Studies, The University of Texas at Austin (Austin, Texas: January, 1975), p. 1.

[6]Ibid, p. 1-2.

[7]Ibid., p. 22.

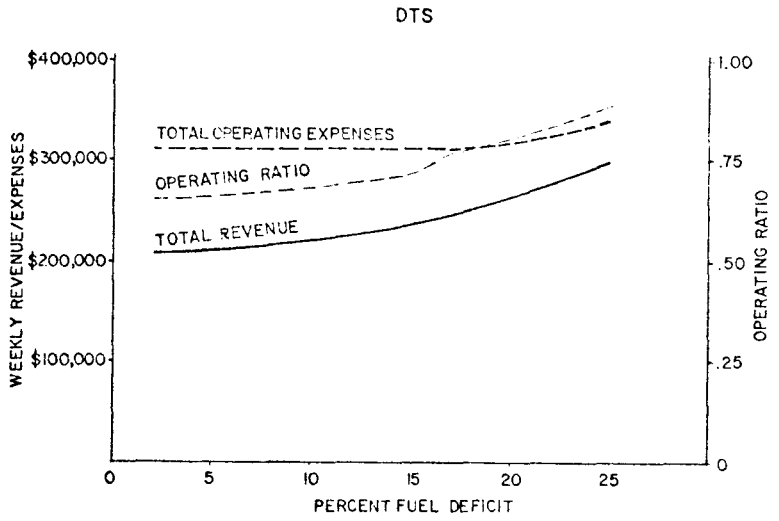
[8]The buses and equipment could be "sold" for a token amount, e.g., one dollar. The geographic scope of authority would be the same as the existing school district. The Board could be made up of schoolboard and city council members with a balance to assure adequate service for schools.

Financial considerations of the suggested strategies will be especially critical in suburban communities attempting to establish new public transportation services. The Cities of Dallas and Fort Worth, meanwhile, should expect increased revenues from the existing transit services to increase the operating ratio and exceed the cost of short-term emergency strategies (Figures VI-2A, VI-2B). Appendix E lists the proposed strategies and the estimated cost or savings which may be expected from each action for DTS and CITRAN.

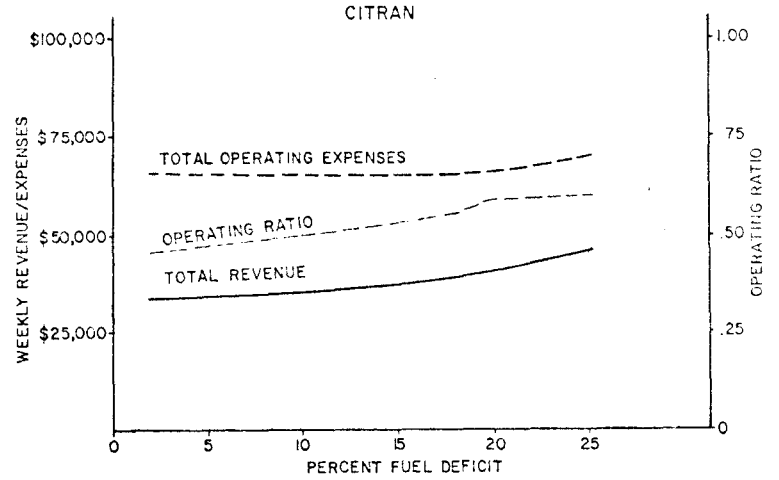
FIGURE VI-2

IMPACT OF FUEL SHORTAGE ON TRANSIT REVENUE/COSTS

A.



B.



While most of these strategies and problems could be resolved by individual local governments, the role of a regional planning organization, such as the existing Steering Committee of the Regional Transportation Policy Advisory Committee, could be significant. Such an organization could be responsible for:

- the exchange and monitoring of information by local communities and transportation interests,
- the development and dissemination of local policy positions and statements with regard to federal and State regulations,
- the provision of a framework through which local communities and organizations can meet on a "neutral ground" to develop appropriate mutual aid and transportation agreements,
- the development of technical plans and information to solve problems common to many local governments or to the region as a whole,
- the execution of a public information program which would make the most efficient use of regional media such as the major newspapers, television, and radio, and
- the establishment of a single point of contact for the region in communications with federal and State agencies.

Finally, a word of caution should be given to the assumption that sufficient fuel will be available to maintain or expand existing transportation services, not to mention the establishment of new facilities in suburban areas. If this problem cannot be resolved through the actions suggested in Chapter V, the options available to maintaining the mobility of the local population could be severely restricted. For example, there would be no reason to establish a new park-and-ride service or to procure the use of school buses if no fuel were available to run these services. While suggested solutions to this problem cannot be proposed until a specific situation is identified, this concern is raised here because the availability of fuel is an essential consideration in any agreements made by individual local government entities in preparation for a fuel shortage.

Local Roles in Strategy Implementation

Table VI-2 lists the major communities and agencies involved in the strategy implementation and suggests the time frame for the initiation of these measures. Page numbers are given with the action items to refer the reader to the discussion of the measures in the report.

TABLE VI-2

LOCAL ROLES IN STRATEGY IMPLEMENTATION

	Strategies to be Implemented Now							Strategies to be Implemented at Emergency																										
										Fuel Conservation Measures													Transit Strategies to Contend with Ridership Increases/Demands (pp. V-17 to V-42)													
										Transit (pp. V-7 to V-16)						Paratransit (p. V-16)			Municipal (p. V-16)																
	Increase/establish fuel reserve* (p. V-4)	Modify federal/state contingency fuel regulations (p. V-3)	Maintain/expand carpool program (p. V-40)	Initiate flexible work hour program (p. V-21)	Secure mutual aid agreements (p. VI-7)	Appoint local energy coordinator/ representative (p. V-66)	Modify state school bus regulations (p. V-34)	Public Information Program (p. V-66)	Exchange and monitor local information (p. VI-11)	Reduce bus stops	Change local to express service	Improve bus flow	Decrease deadhead miles	Increase headways	Eliminate service	Consolidate school bus routes	Allow taxicabs and carpools to use exclusive lanes	Coordinate/consolidate elderly and handicapped services	Reduce service frequency	Limit police cruising	Limit city car use	Allow unused capacity to fill	Utilize reserve buses	Discontinue charter service	Spread peak period ridership: Flexible work hours	Peak period fare surcharge	Bus lanes	Priority signals	Route Taxis	Intensive intracity carpooling	Obtain private buses	Obtain school buses	Intensive Maintenance Program
Arlington	X				X	X		X	X							X		X	X	X	X										X	
Dallas/DTS	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fort Worth/CITRAN	X		X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Garland	X				X	X		X	X			X				X		X	X	X	X				X	X					X	
Grand Prairie	X				X	X		X	X							X		X	X	X	X										X	
Irving	X				X	X		X	X							X		X	X	X	X										X	
Mesquite	X				X	X		X	X							X		X	X	X	X										X	
Richardson	X				X	X		X	X							X		X	X	X	X										X	
RTPAC Steering Committee		X			X		X		X																							

*Transit system fuel storage is specifically addressed in the report, reference here to surburban cities in for any new transit services, taxicabs and other paratransit, as well as to government needs.

VII. Conclusions and Recommendations

The findings of this study indicate that the following major local problems could be experienced during a near-term future energy shortage:

- A 10 percent to 25 percent gasoline and diesel fuel shortfall is expected depending on the nature and time of the supply interruption. Transit systems and other public transportation providers may not be assured sufficient fuel supplies.

- It will be essentially impossible to obtain additional buses when they are needed to meet service increases in the event of a fuel shortage. The existing transit resources in the area at the time must be assured.

- Because a transit ridership increase of 10 percent to 40 percent is expected, existing Dallas Transit System service and transit vehicles will not be sufficient to handle this influx of passengers, especially at the upper level of increase. It appears, however, that through the total combined effects of a carpooling program, taxicab routes, reserved bus/carpool lanes, modified operating procedures, and SURTRAN bus use, that the maximum estimated demand for transit in Dallas could be accommodated in a severe near-term energy shortage. In Fort Worth, CITRAN, on the other hand, apparently can accommodate the estimated transit demand increases but only with certain inconveniences to its passengers.

- Local inequities are likely to develop with regard to allocated gasoline supplies, gasoline availability, coupon prices and coupon redistribution. Although total gasoline supplies available to the area under rationing appear to be adequate, an estimated $750,000 per month will change hands as central city residents sell their coupons to suburban residents.

- Differences in gasoline station sales policies and sales times will produce public confusion and uncertainty in purchasing gasoline.

- Carpool programs and transit park-and-ride services appear to be the best approaches to providing transportation energy conservation options to areas outside the central cities, and such measures are expected of local

governments by the citizens of the region. The provision of such services are expected to reduce, but not eliminate, the purchase of gasoline rationing coupons by suburban residents.

- While federal and State agencies will be better prepared for any future energy problems, it is expected that local governments will still bear the bulk of the responsibilities for contingency actions.

The solutions to these problems, as identified in Chapter V, can be characterized as actions which would (1) secure additional fuel supplies, (2) maintain transportation operations if adequate fuel cannot be acquired, or (3) contend with an increased demand for public transportation. The following is a set of recommendations drawn from these possible solutions which, it is felt, will effectively address the problems at minimal administrative and financial expense. These strategies require actions by transit and paratransit operators, local governments, and segments of the private sector.

Recommendation 1: Establish Public Transportation Priorities in Fuel Allocation

At present, it appears that transit operations and emergency municipal services would fare worse during a period of severe allocation than during rationing because fuel supplies would not be guaranteed to those end users. This may occur because no mandatory priority treatment of these fuel users has been incorporated in the fuel distribution regulations, either at the federal or state allocation levels. In addition, paratransit vehicles (taxicabs, elderly and handicapped services) would be given only 90 percent of their base period needs under rationing. It is, therefore, recommended that local governments, through their elected representatives, pursue the appropriate changes to these regulations at both legislative levels.

Recommendation 2: Maintain the Present Metropolitan Carpool Programs

To save the time and expense of reestablishing the carpool programs at the onset of an energy contingency, it is recommended that the present Dallas and Fort Worth carpool programs be maintained. Although it cannot be precisely determined how effective

these programs are in terms of reducing energy consumption, providing an alternative to the individual automobile, or alleviating central city transit loads, the programs are cost-effective, i.e., more money is saved in travel costs than the cost of the programs, and the public expects such programs to be conducted. A review of the existing programs should also be accomplished to determine whether improvements can be made.

Recommendation 3: Expand or Develop Fuel Storage Capacity

Transit and paratransit operations, as well as municipal fuel users not dependent on retail supplies, should evaluate their fuel use and adequacy of current fuel storage supplies, if any. Wherever feasible, new storage facilities should be constructed to increase each user's reserve to approximately a one month's fuel supply. In addition, fuel users which do not currently have any reserve capacity should examine the feasibility of developing such storage.

More specifically, it appears that current DTS fuel storage would not permit the maintenance of the existing level of service during a fuel shortage. It is, therefore, suggested that DTS seriously consider expanding fuel storage capacity to approximately one month's supply.

Recommendation 4: Designate a Local Energy Coordinator

During another severe fuel shortage, it is expected that each community will be affected in different ways and to varying extents. There will undoubtedly exist an information gap with regard to public inquiries and problems. It is, therefore, recommended that a "local energy coordinator", on the county level and possibly at the city level, be designated from an existing administrative position. Functions of this local energy coordinator would include:

- Responding to public inquiries regarding local problems with fuel allocation and coupon distribution or redistribution.
- Publishing local coupon prices.

- Coordinating a local public information program.
- Reporting problem areas to local governing bodies and suggesting solutions to the problem.

Major private institutions may wish to appoint a coordinator as well.

Recommendations 5: Encourage Flexible Work Hours

The participation of local employers in staggered or flexible work hour programs should be encouraged by local governments. Such an action would diffuse peak hour ridership on transit facilities, thereby reducing the necessity to acquire additional vehicles for peak hour service as well as reducing energy inefficiency caused by downtown congestion during these times. Since this program would require a relatively long lead-in time, it is recommended that it be considered by the Cities of Dallas and Fort Worth for immediate action. It is further suggested that the existing carpool offices, in conjunction with the chambers of commerce of both cities, manage this program.

Recommendation 6: Increase Bus Availability

If transit demand exceeds capacity, transit systems should increase their operable fleet size by accelerating bus repairs and, thus, reduce the number of "out of service" buses. In addition, transit systems should now explore the possibilities of renting buses from other sources as well as the problem of obtaining additional drivers. Shifting SURTRAN buses to regular transit use could accomodate part of this vehicle need.

Recommendation 7: Modify State Law to Permit Public Use of School Buses

When the available options of additional bus procurement on a short-term basis become inadequate to deal with transit demand during a severe energy shortage, it is suggested that public school buses be made available for general transit use. Because the State

Education Code currently prohibits the use of school buses for such purposes, it is recommended that the necessary legislative changes be made to modify these regulations.[1]

Recommendation 8: Investigate Role of and Impact on Taxicabs in Energy Shortage

While taxicabs are a potentially important public transportation resource in an energy crisis, this form of paratransit appears to be particularly vulnerable to increased fuel costs and federal gasoline allocation regulations. It is recommended that a "taxi-route" plan be developed to supplement transit service, particularly in Dallas, should a fuel shortage appear immenent. In addition, a study of the impact of higher fuel prices on area taxicabs should be included as part of future paratransit studies.

Recommendation 9: Develop Regional Park-and-Ride/Exclusive Lane Plan

A detailed regional plan for park-and-ride transit services and exclusive bus/carpool lanes should be developed. This planning effort should produce proposals for both the existing situation with respect to fuel price and availability as well as for possible contingencies.

Recommendation 10: Draft Contingency Agreements

It is recommended that sample contingency agreements be developed for dissemination by the Steering Committee which would be applicable in the following situations:

- the establishing of transit service between local governments and public transit operators,
- the establishing of transit service between local governments and private transit operators,
- the establishing of taxi route agreements between public transit systems and taxi operators, and

[1] On February 15, 1977, the Steering Committee voted to support HB349 in the Texas Legislature regarding the use of school buses for non-school purposes. This bill did not, however, pass the Legislature.

- the securing of land for downtown bus storage by transit operators from landowners.

Recommendation 11: Begin Intergovernmental Dialogue Regarding Energy Contingencies

Local governments should begin dialogue concerning anticipated energy-related transportation problems and possible cooperative solutions. Since fuel availability problems or increased costs may make the existing level of municipal services difficult to maintain, intergovernmental cooperation could develop agreements to share or exchange services. Local governments should also actively participate in State and federal energy conservation programs and plans.

Concluding Remarks

While even the complete execution of these recommended strategies cannot guarantee that transportation problems will not occur in North Central Texas, they will equip the area with a preparedness which few other areas may have. It must be remembered that these are merely temporary short-term solutions to the energy problem. Future study should address the area of long-range energy problems and solutions. And, most importantly, local planning efforts should reflect these long-range implications in their policy decisions and strive to implement them in conjunction with the continued growth of North Central Texas.

PERCENT OF TOTAL RETAIL SALES FOR SELECTED BUSINESS GROUPS

BY COUNTY AND CITY (1972)

Place	Total Retail Sales ($1,000)	Automotive Dealers	Gasoline Service Stations	Dealers and Service Stations
COLLIN COUNTY	$ 116,604	21.3%	9.8%	35.8%
McKinney	47,204	30.3%	(D)	30.3%+
Plano	37,680	11.6%	(D)	11.6%+
Richardson (Part)	2,611	0.8%	(D)	0.8%+
Remainder of County	29,109	21.1%	(D)	21.1%+
DALLAS COUNTY	$3,669,908	22.2%	6.4%	28.6%
Balch Springs	9,290	9.7%	6.2%	15.9%
Carrollton (Part)	48,638	38.3%	8.1%	46.4%
Cedar Hill	3,122	(D)	24.6%	24.6%+
Cockrell Hill	9,634	10.0%	9.2%	19.2%
Dallas	2,541,628	23.1%	5.6%	28.7%
DeSoto	9,466	7.3%	15.8%	23.1%
Duncanville	28,549	8.3%	8.2%	16.5%
Farmers Branch	82,388	23.9%	8.7%	32.6%
Garland	216,159	27.2%	6.6%	33.8%
Grand Prairie (Part)	81,629	24.4%	10.4%	34.8%
Grapevine	1,909	2.5%	12.4%	14.9%
Highland Park	42,653	(D)	5.0%	5.0%+
Irving	219,070	23.4%	7.2%	30.6%
Kleburg	2,883	(D)	23.4%	23.4%+
Lancaster	26,845	35.4%	8.3%	43.7%
Mesquite	157,078	8.7%	8.4%	17.1%
Richardson (Part)	98,451	17.6%	(D)	17.6%+

(D) -- Withheld to avoid disclosure

PERCENT OF TOTAL RETAIL SALES FOR SELECTED BUSINESS GROUPS BY COUNTY AND CITY 1972

Place	Total Retail Sales ($1,000)	Automotive Dealers	Gasoline Service Stations	Dealers and Service Stations
Seagoville	$ 8,577	(D)	7.1%	7.1%+
University Park	58,603	(D)	6.7%	6.7%+
Remainder of County	23,336	12.4%	(D)	12.4%+
DENTON COUNTY	$ 183,172	27.8%	7.8%	35.6%
Carrollton (Part)	740	-	(D)	-
Denton	114,943	27.0%	7.3%	34.3%
Lewisville	41,651	37.5%	7.0%	44.5%
Remainder of County	25,835	16.3%	(D)	16.3%+
ELLIS COUNTY	$ 83,062	26.6%	11.0%	37.6%
Ennis	26,141	27.8%	10.9%	38.7%
Waxahachie	40,751	23.6%	9.7%	33.3%
Remainder of County	16,170	32.1%	14.4%	46.5%
ERATH COUNTY	$ 36,545	20.0%	10.7%	30.7%
Dublin	5,215	(D)	(D)	-
Stephenville	30,786	20.7%	9.5%	30.2%
Remainder of County	544	(D)	(D)	-
HOOD COUNTY	$ 18,216	44.8%	7.0%	51.8%

(D) -- Withheld to avoid disclosure

PERCENT OF TOTAL RETAIL SALES FOR SELECTED BUSINESS GROUPS
BY COUNTY AND CITY (1972)

Place	Total Retail Sales ($1,000)	Automotive Dealers	Gasoline Service Stations	Dealers and Service Stations
HUNT COUNTY	$ 100,528	24.4%	8.9%	33.3%
Commerce	21,037	28.0%	(D)	28.0%+
Greenville	68,939	25.9%	-	25.9%+
Remainder of County	10,552	7.1%	-	7.1%+
JOHNSON COUNTY	$ 89,767	27.1%	10.9%	38.0%
Burleson (Part)	13,510	(D)	16.3%	16.3%
Cleburne	57,703	33.0%	7.0%	40.0%
Remainder of County	18,554	28.7%	19.0%	47.7%
KAUFMAN COUNTY	$ 72,277	31.4%	10.4%	41.8%
Kaufman	13,738	34.6%	7.1%	41.7%
Terrell	37,342	30.4%	10.8%	41.2%
Remainder of County	21,197	31.2%	11.8%	43.0%
NAVARVO COUNTY	$ 76,176	23.7%	11.4%	35.1%
Corsicana	65,040	(D)	11.2%	11.2%+
Remainder of County	11,676	(D)	12.2%	12.2%+
PALO PINTO COUNTY	$ 51,520	31.0%	11.0%	42.0%
Mineral Wells (Part)	42,602	34.8%	7.6%	42.4%
Remainder of County	9,518	14.5%	25.7%	40.2%

(D) -- Witheld to avoid disclosure

PERCENT OF TOTAL RETAIL SALES FOR SELECTED BUSINESS GROUPS BY COUNTY AND CITY (1972)

Place	Total Retail Sales ($1,000)	Automotive Dealers	Gasoline Service Stations	Dealers and Service Stations
PARKER COUNTY	$ 59,204	37.2%	12.9%	50.1%
Azle (Part)	1,913	17.4%	(D)	17.4%+
Mineral Wells (Part)	1,528	-	(D)	-
Weatherford	41,637	(D)	12.4%	12.4%+
Remainder of County	14,126	(D)	27.2%	27.2%+
ROCKWALL COUNTY	$ 13,486	44.6%	20.1%	64.7%
SOMERVELL COUNTY	$ 3,037	11.4%	14.8%	26.2%
TARRANT COUNTY	$1,756,771	22.2%	7.2%	29.4%
Arlington	302,527	25.8%	6.5%	32.3%
Azle	8,096	5.7%	11.6%	17.3%
Bedford	6,749	(D)	22.7%	22.7%
Benbrook	9,215	(D)	10.3%	10.3%+
Burleson (Part)	10,218	(D)	(D)	-
Colleyville	2,476	-	(D)	-
Crowley	2,444	(D)	(D)	-
Euless	24,034	3.1%	18.8%	21.9%
Evermen	5,511	3.4%	8.9%	12.3%
Forest Hill	14,292	16.9%	7.9%	24.8%
Fort Worth	1,022,974	22.8%	6.5%	29.3%
Grand Prairie (Part)	9,347	4.5%	5.4%	9.9%

(D) -- Withheld to avoid disclosure

PERCENT OF TOTAL RETAIL SALES FOR SELECTED BUSINESS GROUPS BY COUNTY AND CITY (1972)

Place	Total Retail Sales ($1,000)	Automotive Dealers	Gasoline Service Stations	Dealers and Service Stations
Grapevine	$ 16,601	34.3%	7.4%	41.7%
Haltom City	57,188	12.4%	9.5%	21.9%
Hurst	93,029	12.9%	7.0%	19.9%
Kennedale	5,196	7.9%	10.4%	18.3%
Lake Worth	15,866	3.9%	7.3%	11.2%
Mansfield (Part)	3,276	5.7%	21.9%	27.6%
North Richland Hills	55,253	(D)	7.5%	7.5%+
Richland Hills	13,641	19.2%	8.4%	27.6%
River Oaks	13,382	18.8%	17.2%	36.0%
Samson Park Village	9,269	11.5%	11.9%	23.4%
Watauga	10,043	-	2.2%	2.2%
West Worth	1,711	-	41.1%	41.1%
White Settlement	24,247	(D)	6.7%	6.7%+
Remainder of Tarrant County	29,186	18.6%	8.8%	27.3%
WISE COUNTY	$ 32,842	21.6%	9.6%	27.2%
Bridgeport	11,327	(D)	11.7%	11.7%+
Decatur	12,539	44.9%	10.8%	30.4%
Remainder of County	8,976	(D)	14.8%	14.8%+

(D) -- Withheld to avoid disclosure

Source: U. S. Department of Commerce, 1972 Census of Business, Retail Trade Area Statistics, (Washington, D. C.: U. S. Government Printing Office, 1976).

APPENDIX B

ACTIONS USED BY SOME CITIES TO CONSERVE MUNICIPAL GASOLINE CONSUMPTION DURING 1973-1974

Community	Actions to Conserve Fuel
Phoenix, Arizona	• City purchasing department bought 40 compact sedans and 55 light duty pickup trucks.
Stillwater, Oklahoma	• Created a bike pool for use by municipal employees for trips in town.
University City, Missouri	• Changed landfill collection from direct haul to a transfer station and trailer system.
Lakewood, Colorado	• Limited police cruising by requiring officer to stop near a major intersection.
Berlin, New Hampshire	• Limited garbage collection to bimonthly service. • To cut down on unnecessary fire department vehicle use, police cars were assigned to each call box to determine if alarm was real or false.
Eugene, Oregon	• Encouraged public transit use by purchasing bus tokens at a discount and reselling them at cost to city employees.
Bellevue, Washington	• Considered allowing city vehicles to be used for commuting purposes by four or more workers who would form carpools.
Virginia Beach, Virginia	• Made city employees plan work route ahead and make one trip do. for two. • Made city employees share city car with someone if possible. • Discouraged use of city vehicle air conditioning equipment except when absolutely necessary. • Used fire and rescue vehicles for emergency purposes only. • Evaluated area assignments for inspectors, etc to insure the elimination of unnecessary across-town trips. • Required approval for all out of town travel by the City Manager's office prior to each trip if a city vehicle was to be used. • No police vehicle was allowed to idle when not essential to the functioning of the dome light. • Every police car was stopped for ten minutes at an inconspicuous road location during every hour of cruising. • Police marine patrol and beach patrol by four-wheel-drive vehicles were discontinued and functioned on a stand-by basis only. • House checks and all escort services by police vehicles including funerals, were discontinued.

[redacted]e: International City Management Association and Public Technology, Inc., Local Governmental Approaches to Energy Conservation (Washington, D. C: December, 1973), pp. 11-22.

FORM SA-30I

INSTRUCTIONS FOR FORM SA-30

Low Income, Long Distance Commuter

I. Who May Qualify

In order to qualify for a hardship allocation of gasoline coupons as a low income, long distance commuter, the applicant must meet the following criteria:

(a) Must have a valid driver's license for this State,

(b) Must be employed and must travel between home and work site(s), at least in part, by automobile [1/].

(c) Must meet the Income Test:

For the household which includes the applicant, the total annual income must not exceed $10,000.00.

The household or family is defined the same as on Federal income tax forms.

(d) Must meet the Home-To-Work Distance Test:

One-way distance between home and place or work (most distant place of work if several employers for applicant) must be 10 miles or more.

(e) Must meet the Weekly Round-Trip Work Travel Test:

Average round-trip (home-to-work-to-home) miles traveled weekly, by automobile [1/], as the driver or a passenger, must be 100 miles or more.

If there is more than one individual in the same household that independently meets the above criteria, they may both receive an extra commuter allocation. In such cases each family member must file their own application.

II. Form SA-30 Line Instructions

Line-1: If you are not a resident of the State for which you apply, you do not qualify for the extra commuter allocation in that State.

Line-2: If you do not have a valid driver's license for the State in which you apply, you do not qualify.

Line-3: Include all household income - even income from other household workers who may separately apply and qualify for an extra commuter allocation.

1/ For the purpose of these instructions and form SA-30, "automobile" includes all 4-wheel, 2-axle, gasoline powered vehicles which are used for private or informal car-pool transportation to and from (but not on) work.

II. Form SA-30 Line Instructions (CONTINUED)

Line-5 & 5a: If you have more than one employer complete Section E and enter **primary** employer information in Line-5a.

Line-6: Estimate and enter the shortest drivable distance between your home and **place** of work. Do not allow for intermediate stops.

Line-8: Estimate your total travel by automobile between home and work, work and **work** (if several jobs), and work and home on a weekly basis.

Line-10a: Locate and enter the value from the table (part III of these instruction **using** the table miles per week which is closest to the Line-8 value.

Line-10b: If you chose to compute the extra commuter allocation directly enter **the** value to the nearest tenth of a gallon. eg. 2.1 and not 2.14 .

Line-11 & 12: Only required if you have and choose to account for more than one **employer.** However, all employers used to compute the average **round-trip** work miles (Line-12 and Line-8) must be listed.

Certification and Signiture: Applicant must sign and date. Authorized persons **or agents** are not permitted.

III. Extra Commuter Allocation Table * Gallons per Week *

Weekly Mileage (From Line-8)	Extra Alloc. (To Line-10a)	Weekly Mileage (From Line-8)	Extra Alloc. (To Line-10a)	Weekly Mileage (From Line-8)	Extra Alloc. (To Line-10a)	Weekly Mileage (From Line-8)	Extra Alloc. (To Line-10a
100	0.5	200	8.0	300	15.6	400	23.1
110	1.3	210	8.8	310	16.3	410	23.8
120	2.0	220	9.5	320	17.1	420	24.6
130	2.8	230	10.3	330	17.8	430	25.3
140	3.5	240	11.0	340	18.6	440	26.1
150	4.3	250	11.8	350	19.3	450	26.8
160	5.0	260	12.5	360	20.1	460	27.6
170	5.8	270	13.3	370	20.8	470	28.3
180	6.5	280	14.0	380	21.6	480	29.1
190	7.3	290	14.8	390	22.3	490	29.8

If weekly mileage (from Line-8) is greater than 494 miles, the formula must be used. If you need help, leave Line-10a and 10b blank and office personel will compute.

DO NOT FORGET TO SIGN AND DATE APPLICATION

FORM SA-40

APPLICATION FOR GASOLINE ALLOCATION

Handicapped

Case Number _____
Case Name _____
Application Date _____
Office No. _____

1. Driving Status: (a) ☐ Do Not Have a Valid Driver's License
(b) ☐ Have a Valid Driver's License 1

2. Applicant's Name _____ Age _____ 2
last first initial

Address _____ Phone _____
street city state zip

3. Social Security No. _____. Driver's License No. (If 1b Checked) _____ 3

4. Briefly Describe Your Handicap _____ 4

5. Briefly Describe Your Gasoline Needs (Trips, Distances or Gallons Required) _____ 5

6. Indicate Gasoline Needs In Gallons or Miles . . . . . Gallons per Week _____ 6
or
Miles per Week _____

**** If Line 1b Is Checked or If Line 6 Exceeds the Basic Weekly Allotment, Then the Supplimental Application Form SA-41 Must Be Completed and Attacned ****

I Attest That the Information Supplied Herein Is Accurate and Complete To the Best of My Knowledge, Under Penalty of Law.

Applicant

Signiture _____ Date _____

If Form(s) Completed By an Authorized Agent

Name _____ Address _____

Signiture _____ Date _____

do not write beneath this line

CASE SUMMARY

Application Received By: ☐ Mail ☐ In-Person ☐ Courier ☐ Other _____

Group _____ Class _____ Date _____

Case No. _____ Case Name _____

Attachments: _____

Coupon Allocation Correcponding To Request:

Ration Quarter No. _____ Start Date _____

Summary By _____ Date _____

Coupon Series	No. of Coupons	No. of Gallons

INITIAL DECISION

☐ Approved Full ☐ Approved Partial ☐ Disapproved

Reasons: _____

☐ SA-100 Attached Officer No. _____ Date _____

Approved _____ Date _____

Approved Allocation:

Check No.	Coupon Series	No. of Coupons	No. of Gallons

APPEAL DECISION

☐ Approved Full ☐ Approved Partial ☐ Denied

Reasons: _____

☐ SA-100 Attached Board No. _____ Date _____

Approved _____ Date _____

Additional Allocation:

Check No.	Coupon Series	No. of Coupons	No. of Gallons

FORM SA-50

APPLICATION FOR GASOLINE ALLOCATION

Special Hardship/Emergency

Case Number _____
Case Name _____
Application Date _____
Office No. _____

1. Applicant's Name _____ Social Security No. _____ 1
last first initial ☐ If None, Check.

Address _____ Phone _____
street city state zip

2. Driver's License No. _____; For State _____. ☐ If None, Check. 2

3. Describe the Special Hardship or Emergency Situation Which Requires a Special Allocation of Gasoline Coupons. 3
Detailed Travel Requirements Should Be Presented At Line-6.

_____

_____

_____

_____

4. Give Information On Individuals or Organizations Who Can Verify Your Claim (Employer, Doctor, Etc.): 4

	Name	Title/Relationship	Address	Phone
(1)				
(2)				
(3)				

5. List Any Supporting Documents That Are Attached and Submitted With This Application: 5
(1) _____ (2) _____ (3) _____

6. Detailed Travel Requirements: To _____ Reason _____ Round-Trip Miles _____ 6a
6d Total Miles ____ Gallons ____ _____ _____ _____ 6b
6e Frequency _____ per _____ _____ _____ _____ 6c

I Attest That the Information Supplied Herein Is Accurate and Complete To the Best of My Knowledge, Under Penalty Of Law.

Applicant Signiture _____ Authorized Agent: Name _____ Address _____

Date _____ do not write beneath this line Signiture _____ Date _____

CASE SUMMARY

Application Received By: ☐ Mail ☐ In-Person ☐ Courier ☐ Other ____ Group _____ Class _____ Date _____
Case No. _____ Case Name _____

Attachments: _____ _____ _____

Coupon Allocation Correcponding To Request:

	Coupon Series	No. of Coupons	No. of Gallons
Ration Quarter No. _____ Start Date _____			
Summary By _____ Date _____			

INITIAL DECISION

☐ Approved Full ☐ Approved Partial ☐ Disapproved
Reasons: _____

☐ SA-100 Attached Officer No. ____ Date ____
Approved ____ Date ____

Approved Allocation:

Check No.	Coupon Series	No. of Coupons	No. of Gallons

APPEAL DECISION

☐ Approved Full ☐ Approved Partial ☐ Denied
Reasons: _____

☐ SA-100 Attached Board No. _____ Date ____
Approved _____ Date ____

Additional Allocation:

Check No.	Coupon Series	No. of Coupons	No. of Gallons

FORM SA-10

APPLICATION FOR GASOLINE ALLOCATION

Government/Non-Profit

Case Number _____
Case Name _____
Application Date _____
Office No. _____

1. Non-Commercial Organization Type: (1a) ☐ Government(Federal, State, County, Etc.). (1b). ☐ Non-Profit 1

2. Organization Name _____ Div./Dept. _____ 2

Address _____
street city county state zip P.O. box

Phone _____ _____ _____ WATS/TELEX/FTS _____
area code number extension

3. NON-PROFIT ONLY: State Registration No. _____. Federal Registration No. _____ 3

4. Is This Application for Volunteers? ☐ No ☐ Yes. If Yes, (4a) No. of Volunteers 4a
(4b) No. of Volunteer Miles per Month _____ 4b

5. Describe Essential Services You Provide _____ 5

6. Gasoline Data: Provide Up To 4 Months of Information Including Current Month Measured From First Day. 6

gallons per month

Month				
(6a) Gasoline Required				6a
(6b) Less: Actual or Expected Federal Allocation				6b
(6c) Net: Gasoline Shortage				6c
(6d) Gasoline Request From State Set-Aside . . .				6d

CERTIFICATION AND SIGNITURE

Application Prepared By: Name _____ Title _____ Date _____

Certified By: Name _____ Title _____ Date _____

Signiture _____

do not write beneath this line

CASE SUMMARY

Application Received By: ☐ Mail ☐ In-Person ☐ Courier ☐ Other ____ Group _____ Class _____ Date _____
Case No. _____ Case Name _____

Attachments: _____ _____ _____

Coupon Allocation Correcponding To Request:

Ration Quarter No. _____ Start Date _____

Summary By _____ Date _____

Coupon Series	No. of Coupons	No. of Gallons

INITIAL DECISION

☐ Approved Full ☐ Approved Partial ☐ Disapproved

Reasons: _____

☐ SA-100 Attached Officer No. ____ Date ____
Approved ____ Date ____

Approved Allocation:

Check No.	Coupon Series	No. of Coupons	No. of Gallons

APPEAL DECISION

☐ Approved Full ☐ Approved Partial ☐ Denied

Reasons: _____

☐ SA-100 Attached Board No. _____ Date ____
Approved _____ Date ____

Additional Allocation:

Check No.	Coupon Series	No. of Coupons	No. of Gallons

APPENDIX D

REVISED TRANSIT SERVICE CONTRACT

STATE OF TEXAS §

COUNTY OF DALLAS §

WHEREAS, Dallas Transit System, a mass transportation agency owned and operated by the City of Dallas, has heretofore entered into a Service Contract with the City of Garland, for the purpose of providing commuter bus service from the City of Garland to the downtown Dallas central business district, which Contract was executed on March 3, 1975; and

WHEREAS, said Contract provided for a minimum hourly rate, subject to increase to reflect increases in operating cost subsequent to October 1, 1975; and

WHEREAS, said Contract further provided that unless written notice to proceed was received from the City of Garland within one hundred eighty (180) days from the date of the Agreement, the Contract would become void; and

WHEREAS, the parties recognize that unexpected delays have occurred which prevent the initiation of service within the time stated; and

WHEREAS, known increases in operating cost have made necessary a corresponding increase in the minimum guaranteed hourly rate from FIFTEEN AND 14/100 ($15.14) DOLLARS per hour to SIXTEEN AND 80/100 ($16.80) DOLLARS per hour; and

WHEREAS, the parties hereto mutually desire to reform the Contract executed March 3, 1975, to effectuate these necessary changes; Now, therefore:

WITNESSETH:

THIS REVISED SERVICE CONTRACT by and between Dallas Transit System, a wholly owned mass transportation agency of the City of Dallas, and the City of Garland, a municipal corporation organized and existing under the laws of the State of Texas, shall be as follows:

I.

For the consideration hereinafter stated, Dallas Transit System agrees to provide commuter bus service to the City of Garland beginning ten (10) days after Dallas Transit System has received a written notice to proceed from the City of Garland. Service shall be provided in accordance with schedules and routes as are subsequently determined by the parties to provide a satisfactory level of commuter bus service between the City of Garland and the downtown Dallas central business district.

II.

In consideration of the commuter bus service provided by Dallas Transit System, the City of Garland hereby agrees to underwrite the cost of said contract service, whereby the City of Garland shall guarantee payment to Dallas Transit System of a minimum sum of SIXTEEN AND 80/100 ($16.80) DOLLARS per hour of bus service for each day that this contract service is operated. This service fee may be increased by Dallas Transit System to reflect increases in direct operating costs which occur after October 1, 1975, by giving the City of Garland sixty (60) days written notice prior to October 1st of each ensuing year that this Contract remains in full force and effect. Said increase, if any, shall be placed in effect on October 1st of the particular year involved. The guaranteed service fee provided herein shall be paid by the City of Garland to the Dallas Transit System on a monthly basis.

III.

Dallas Transit System shall collect regular basic fares, as designated by the City of Garland, from passengers served pursuant to this Contract, in accordance with the usual DTS practices on regular contract lines. All fare revenue derived pursuant to this service shall be credited to the City of Garland against the minimum guaranteed service fee of SIXTEEN AND 80/100 ($16.80) DOLLARS per hour of bus service. The City of Garland is entitled to audit financial records pertaining to this contract service during normal working hours upon reasonable notice.

IV.

DTS shall provide service to Garland pursuant to this Agreement five (5) days a week, Monday through Friday. It is specifically understood and agreed by and between the parties hereto that any changes in routing, headways, or schedule timing shall be subject to the approval of the City of Garland.

V.

The City of Garland shall designate the regular scheduled departure and arrival times and routes, subject to weather conditions and other conditions beyond the control of Dallas Transit System. The City of Garland shall notify Dallas Transit System in writing at least five (5) days prior to the initiation of schedule changes.

VI.

Dallas Transit System agrees to provide all labor, equipment, and maintenance of equipment to operate this contract service. Buses provided for service hereunder shall be equipped with air conditioning and maintained in good operating condition.

VII.

It is understood and agreed by and between the parties hereto that either party may terminate this Agreement upon six (6) months written notice by certified mail.

VIII.

This Contract is entered into subject to all applicable state and federal laws, and the Charter and ordinances of the Cities of Dallas and Garland. This Contract shall be executed in quadruplicate by the duly authorized officials of each party, and each copy so executed shall be deemed an original, with Ellis H. Watkins, General Manager, being authorized to execute this Agreement for and on behalf of the Dallas Transit System and the Dallas Public Transit Board.

EXECUTED this the 19th day of August, 1975.

DALLAS TRANSIT SYSTEM

By: Ellis H. Watkins
General Manager

ATTEST:

Katherine E. Parks, Secretary
Dallas Public Transit Board

APPROVED AS TO FORM:
N. Alex Bickley, City Attorney

By: _____
Galen M. Sparks
Assistant City Attorney

THE CITY OF GARLAND, TEXAS

By: _____
Charles E. Duckworth
City Manager

ATTEST:

_____
Aleta Watson, City Secretary

APPROVED AS TO FORM:

By: _____
Pete Eckert, City Attorney

APPENDIX E

COST/SAVINGS ANALYSIS OF TRANSIT STRATEGIES

The following tables list the transit strategies mentioned in this report (see Chapter V) and estimate the net increase or decrease in costs which CITRAN and DTS could expect from the implementation of each action. The "implementation cost" refers to the approximate one time expense associated with a strategy initiation. These would be largely expenses for materials, minor construction, etc. The "annual operating cost" is the additional operation expense needed to maintain the strategy over a one year period with one exception: the cost of the initial filling of the storage tanks is listed under this column. This also includes labor and maintenance costs of the strategy. The "total annual cost" is the sum of the implementation and operating costs. Since federal and State grants can be used to pay for part of the implementation and/or operating costs, "local costs" refers to the share of capital and operating expense the transit system/city would pay. The local share for the capital costs would be seven percent of the total. For the operating costs, the local share would be equal to one-half of the transit systems operating deficit. Assuming operating ratios similar to those experienced in 1976, Fort Worth would pay approximately 27 percent of CITRAN's operating costs, and Dallas would pay approximately 15 percent of DTS's operating costs.

The "annual revenue change" reflects the maximum annual revenue lost or gained by expected changes in ridership under each strategy. This does not, however, include ridership increases which are expected to result from the energy shortage. The "change in annual operating costs" refers to the impact of each strategy on the total, normal operating cost (1976). Finally, the "total annual local cost or savings" is the net local cost difference between the changes in passenger revenue and operating costs plus the local implementation cost. It should be noted that for most strategies the action results

in a net financial gain or savings for the transit system. The additional costs incurred by establishing new fuel reserves, renting downtown parking lots, implementing an intensive maintenance program or retaining replaced buses could be made up by additional revenue from large ridership increases.

TABLE E-1

Cost - Savings Analysis of Transit Fuel - Savings Strategies

Dallas Transit System

Strategy	Percent Fuel Saved	Implementation Cost	Ammual Operating Cost	Total Annual Cost	Local Cost	Annual Revenue Change	Change in Annual Operating Cost (Based on 1976 Costs)	Total Annual Local Cost or Savings	Comments
Expand/Establish In-House Fuel Supplies	None	$300,000	$120,000	$420,000	$39,000	None	None	$ 39,000 Cost	Additional saving if fuel cost rises after estaglishment cost includes storage tank and fuel only.
Eliminate Night Service	8-12%	None	None	None	None	$1,425,000 Loss (-12.5%)	$1,640,000 Savings (-10%)	$ 32,000 Savings	Operation personnel reduced
Eliminate Weekend Service	16-20%	None	None	None	None	$1,140,000 Loss (-10%)	$2,952,000 Savings (-18%)	$ 270,000 Savings	Operation personnel reduced
Eliminate Midday Service	20-25%	None	None	None	None	$2,394,000 Loss (-21%)	$3,690,000 Savings (-22,5%)	$190,000 Savings	Operation personnel reduced
Increase Bus Headways	10-25%	None	None	None	None	$ 855,000 Loss (-7.5%)	$2,870,000 Savings (-17,5%)	$302,000 Savings	Operation personnel reduced
Reduce Number of Bus Stops	10-25%	None	None	None	None	$3,420,000 Loss (-30%)	$ 196,000 Savings (-17.5%, fuel)	$484,000 Loss	Passengers inconvenienced
Modify Local to Express Service	8-10%	None	None	None	None	Uncertain	$ 100,800 Savings (-9%, fuel)	$ 15,000 Savings	
Establish Bus Lanes	1- 5%	$120,000	None	$120,000	$8,400	$ 285,000gain (+2.5%)	$ 28,000 Savings (-2.5%)	$ 55,000 Savings	Difficult to enforce
Preferential Bus Treatment Measures	1- 2%	Uncertain	Uncertain	Uncertain	-	$ 171,000gain (+1.5%)	$ 16,800 Savings (-1.5%, fuel)	$ 28,000 Savings	
Decrease "deadhead" Bus Miles	1-2%	-	$32,000 (land rental)	$32,000	$4,800	None	$ 16,800 Savings (-1.5%, fuel)	$ 2,000 Cost	

TABLE E-I (Cont.)

Cost - Savings Analysis of
Transit Fuel - Savings Strategies
CITRAN

Strategy	Percent Fuel Saved	Implementation Cost	Annual Operating Cost	Total Annual Cost	Local Cost	Annual Revenue Change	Change in Annual Operating Cost (Based on 1976 Costs)	Total Annual Local Cost or Savings	Comments
Expand/Establish In-House Fuel Supplies	None	0 - $20,000	$6,000 for diesel fuel	$26,000	$3,020	None	None	$ 3,020 Cost	Additional savings if price rises after reserve established
Eliminate Night Service	3- 6%	None	None	None	None	$ 36,200 Loss (-3%)	$149,000 Savings (-4.5%)	$ 30,000 Savings	Operation personnel reduced
Eliminate Weekend Service	8-10%	None	None	None	None	$109,000 Loss (-9%)	$298,000 Savings (-9%)	$ 51,000 Savings	Operation personnel reduced
Eliminate Midday Service	20-24%	None	None	None	None	$326,000 Loss (-27%)	$729,000 Savings (-22%)	$ 108,000 Savings	Operation personnel reduced
Increase Bus Headways	10-25%	None	None	None	None	$ 91,000 Loss (-7.5%)	$580,000 Savings (-17 .5%)	$ 132,000 Savings	Operation personnel reduced
Reduce Number of Bus Stops	10-25%	None	None	None	None	$360,000 Loss (-30%)	$ 49,000 Savings (-17.5%, fuel)	$ 84,000 Loss	Passengers Inconvenienced
Modify Local to Express Service	8-10%	None	None	None	None	Uncertain	$ 25,200 Savings (-9%)	Uncertain	
Establish Bus Lanes	1- 5%	$54,000	None	$54,000	$3,780	$ 30,000gain (+2.5%)	$ 8,400 Savings (-3%, fuel)	$ 6,000 Savings	Difficult to enforce
Preferential Bus Treatment Measures	2- 4%	Uncertain	Uncertain	Uncertain	-	$ 18,000gain (+1.5%)	$ 8,400 Savings (-3%, fuel)	$ 7,000 Savings	
Decrease "deadhead" Bus Miles	2- 4%	-	$6,400 (land rental)	$ 6,400	$1,728	None	$ 8,400 Savings (-3%, fuel)	$ 500 Savings	Parking rental for 45 buses

TABLE E-2

Cost-Savings Analysis of Transit Strategies to Increase Ridership Capacity

Dallas Transit System

Strategy	Ridership Capacity Increase	Implementation Cost	Annual Operating Cost	Total Cost	Local Cost	Annual Revenue Change	Change in Operating Cost	Total Annual Local Cost or Savings	Comments
Allow Capacity to Fill	10 - 15%	None	None	None	None	Up to $1,710,000 gain	None	$1,425,000 gain	
Spread Peak Period Ridership	5 - 10%	None to low	None to low	None to low	None to low	Up to $1,140,000 gain	None	Up to $1,140,000 gain	Voluntary cooperation of employers required could be coordinated by carpool personnel
Route Private Buses	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	
Use Public School Buses	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Currently prohibited by law
Decrease Out-of-service Buses	10%	$205,000	$1,444,000	$1,649,000	$847,000	$1,140,000 gain	$1,444,000	$293,000 Savings	41 Buses - Maintenance cost high
Increase Bus Speed Buslanes & Preferential Treatment	1 - 5%	Uncertain	Uncertain	Uncertain	Uncertain	Up to $473,060 gain	$44,800 fuel savings	$428,000 gain	
Retain Replaced Buses	10 - 15%	None	$ 607,000	$ 607,000	$ 91,000	Up to $1,710,000	$607,000 Cost	$1,619,000 Savings	174 New buses to be purchased up to 1980

TABLE E-2 (Cont.)

Cost-Savings Analysis of Transit
Strategies to Increase Ridership Capacity

CITRAN

Strategy	Ridership Capacity Increase	Implementation Cost	Annual Operating Cost	Total Cost	Local Cost	Annual Revenue Change	Change in Operating Cost	Total Annual Local Cost or Savings	Comments
Allow Capacity to Fill	15 - 20%	None	None	None	None	Up to $242,000 gain	None	$242,000 gain	
Spread Peak Period Ridership	10 - 15%	None to low	None to low	None to low	None to low	Up to $181,000 gain	None	$181,000 gain	
Route Private Buses	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	
Use Public School Buses	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	
Decrease Out-of-service Buses	20%	$120,000 for 24 buses	$260,000	$380,000	$102,600	$241,600 gain	$260,000 Cost	$139,000 Cost	24 Buses
Increase Bus Speed Buslanes & Preferential Treatment	1 - 5%	Uncertain	Uncertain	Uncertain	Uncertain	$ 60,400 gain	$ 16,800 fuel savings	$ 77,200 savings	
Retain Replaced Buses	2 - 5%	None	$107,000	$107,000	$ 28,900	$ 60,400 gain	$107,000	$ 31,500 cost	10 New buses to be purchased to 1980

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