Policy Implications of Urban Traveler Response to Recent Gasoline Shortages

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The purpose of this paper is to identify promising urban transportation-planning policy actions to reduce gasoline consumption; it is based on observations of travel behavior during recent periods of gasoline shortage and increases in price. Such policy guidance is important because it is becoming increasingly apparent that the U.S. public is not always altering its travel patterns in ways that planners have predicted. With the broad range of alternative actions recently proposed—some with huge national impacts (such as the rationing of gasoline)—and with the many levels of local, regional, state, and federal government agencies likely to be involved, planners need to develop a coordinated set of actions. These actions must be designed to provide the greatest degree of energy saving possible and, at the same time, be consistent with the travel behavior and preferences of urban travelers.

Considerable discussion has taken place in recent years about ways in which energy consumption, particularly gasoline consumed by automobiles, can be reduced for urban travel. An important and useful distinction between two fundamental concepts, energy contingency planning and energy conservation, was recently noted by Daniel Roos (1) as follows:

> Energy contingency planning [is] "stand-by" or quick-response actions designed to solve immediate energy problems after they occur. This typically involves preparing for sudden increases in transit ridership and enforcement of regulations designed to minimize energy consumption.
> Energy conservation [is] continuous and longer-term actions designed to make reduced energy consumption a permanent characteristic of the urban transportation system. It should be noted that an adequate degree of conservation would make most contingency planning unnecessary.

With these concepts in mind, this paper will review the major findings of prior studies of gasoline shortages, especially those studies of travel behavior during the 1973-1974 gasoline shortage. The discussion will note the important consistent findings between these studies and more recent studies conducted during the 1979 shortages. Based on this review, policy implications for urban transportation planning will be identified for the following time frames:

1. Short-range planning includes both immediate actions, as well as those that could be implemented within three to five years, and is primarily oriented to energy contingency planning.
2. Long-range planning involves actions designed around a concerted conservation effort and planning for more efficient travel.

It should be noted that this paper is concerned with urban travel. The impacts of energy shortages on intercity (vacation) travel, although important from a national energy policy perspective, are not reviewed except to the extent that travelers trade off between urban and intercity travel.

FINDINGS OF PRIOR RESEARCH

In this section, some travel-behavior surveys conducted during and after the 1973-1974 gasoline shortage are reviewed. This review attempts to identify those findings that are of some importance in urban transportation policy decision making. The discussion highlights those findings that recur in different survey techniques and seem to be consistent over time, as shown by more recent research findings. Those actions that relate specifically to potential energy contingency planning and to conservation are identified. For example, the Planning Research Unit of the New York State Department of Transportation has prepared many reviews as part of its continuing research on travel response to energy shortages (2,3). Liff (4) has also reviewed attitudinal approaches to exploring changes in travel behavior. This paper concentrates on the implications of such findings rather than on the techniques used to obtain them. The major travel-behavior findings considered are (a) response to changes in gasoline availability as opposed to increases in price, (b) effect of household income, (c) reluctance to alter work trips, (d) trip chaining, (e) vehicle speed reduction, (f) reluctance to use of public transportation, and (g) automobile occupancy changes.

Response to Changes in Gasoline Availability as Opposed to Increases in Price

Peskin and others (5) in a home-interview survey of Chicago's North Shore residents, observed that respondents were basing travel decisions more on the availability of gasoline than on price. This was confirmed by Skinner (6) in travel diaries recorded by families of Federal Highway Administration employees and by Sacco and Hajj (7) in their household survey in the Dutch Forks, South Carolina, area. This finding has fundamental implications for gasoline-rationing and gasoline tax proposals now being discussed by the U.S. Department of Energy. Further, it identifies an important flaw or omission in analytical tools used in urban transportation planning. To date, no modeling chain has considered the availability of gasoline as an impediment to travel.

Effect of Household Income

Becker and others (8), in a survey of Portland, Oregon, residents, used a disaggregate analysis to identify market segments that responded differentially to the gasoline shortage. They noted that, while higher-income high-automobile-ownership households were more likely to change to more energy-efficient travel behavior in response to a shortage, lower-income households that already changed were more likely to remain changed after the shortage ended. This sensitivity of behavior with respect to income was also observed by Stearns (9), based on a nationwide survey, and partially by Peskin and others (5) to the extent that the upper-middle-income households behaved like those in the other surveys.

It is quite apparent that these findings will be important in considering a gasoline tax as a means to reduce consumption. The fundamental problem, however, is that there has been no opportunity to observe the effects of price increases in the absence of changes in availability. Corsi and Harvey (10) attempted to explore hypothetical price increases by asking Milwaukee area respondents to identify price thresholds at which energy-conserving behavior would occur. Lee (11) explored pricing issues by using California traffic volume data and attempted to include the availability issue by considering the true price, which included a cost of the wait time to purchase gasoline. Both of these studies see pricing as the action necessary to achieve conservation goals. However, they do not address social equity concerns—an extremely important issue to resolve if gasoline tax increases are implemented.

Reluctance to Alter Work Trips

Hartgen (2), in a survey of New York State residents, and Peskin and others (5) showed that the journey to work was the least flexible in responding to periods of gasoline shortage and price increase. Alterations in shopping trips were typically made long before carpooling or modal changes in the work trip were made. Corsi and Harvey (12) noted that vacation travel would be curtailed before the journey to work was altered. Apparently, only in areas with a very good public transportation system was there any observation of change in the journey to work. Lessieu and Karvasarsky (13), for example, noted some decline in peak-period highway volumes in the New York City area.

The general inflexibility of the work trip was confirmed by recent research by Hartgen (14). In a nationwide survey and a survey of New York State residents, both recent behavior and projected behavior with $1.50/gal gasoline or a 20 percent shortage showed that travelers were more likely to alter nonwork travel and driving habits (e.g., reducing driving speed, shopping closer to home, tuning engines, and shopping less often) than to make any alteration in driving to work.

Trip Chaining

Peskin and others (5) observed that linking of nonwork (particularly shopping) trips was common. Kostyniuk and Recker (15) explored this idea further by using unidimensional attitudinal scaling and by ranking the acceptability of alternative modes to and from shopping. They observed some potential for nonautomobile travel for shopping trips during a gasoline shortage depending on automobile availability, prior mode used, employment status, and income. Recent research (2,3,16) notes that this is a fairly easy way to conserve energy and is one of the first techniques to be used.

Vehicle Speed Reduction

Both Neveu (3) and Hartgen (14) have shown that driving at slower speeds is among the most common actions taken to reduce gasoline consumption. Generally, the public has indicated a preference for easily taken actions such as driving slower over punitive or restrictive actions such as gasoline taxes.

Reluctance to Use Public Transportation

Despite surges of transit ridership in some urban areas, survey researchers generally found considerable reluctance to use public transportation in response to gasoline shortages (5,7,9,17). The use of the automobile was modified before travelers changed mode. This was recently confirmed in the nationwide survey concluded by Hartgen (14). It is becoming clear that public transportation will be an important energy-conserving action only for those cities with the largest transit systems.

Automobile Occupancy Changes

Peskin and others (5) observed that carpooling was not an action taken in response to shortages. Beglinger and Behnam (18), in a study of Milwaukee freeways, observed that the general downward travel in automobile occupancy was temporarily reversed during the 1973-1974 shortage but continued to decline after the shortage ended. Trentacost and Milic (19) observed no change except for small automobiles, perhaps indicating that energy-conserving individuals both drove smaller automobiles and carpooled. Recent observations by Hartgen (14) show that carpooling is still far from the most common means used to conserve gasoline.

Summary

Recent research by Meyers (20), Hartgen (14), and Rappaport and Labaw (21) confirms that the public is consistently adjusting its travel by means of small, unobtrusive, frequently taken actions and has avoided altering the automobile trip to work. Neveu (22) and Hartgen (5,14) observe that the public seems to be receptive to policy actions that encourage gasoline conservation by increasing travel options and offering incentives for their use. Punitive or restrictive measures are received less favorably. The finding that changing the journey to work is among the least likely actions to be taken to conserve gasoline is vitally important to urban transportation planners because the bulk of the planning process, particularly long-range planning, is concerned with the work trip.

The following two sections discuss both short- and long-range actions in greater detail based on the findings described above. The discussion is tied closely to two concepts: (a) the need to separate contingency planning from conservation planning and (b) the notion developed by Hartgen (5,14) and other researchers that, for energy conservation actions to work, they must be well-received by the public.

SHORT-TERM POLICY IMPLICATIONS

The time frame for short-term policy actions ranges from immediate actions to those that could be implemented within three to five years. This includes both energy contingency planning and conservation actions. For example, the recent work by the North Central Texas Council of Governments (23) is, in my judgment, among the best in the formulation of short-term policy. Virtually all of the findings noted in the previous section can be applied to short-term policy formulation. The most important observations are (a) for energy-saving actions to work, the public must be receptive and (b) transit is not necessarily the sole or best solution, except in cities with the largest transit systems.

Local- and Regional-Level Short-Term Policy Implications

Various research findings have identified actions that metropolitan planning organizations, transit properties, and municipalities can implement immediately or within several years. Some of these actions are briefly described here.

Actions to Discourage Automobile Work Trips

Changes in automobile work trips were among the least likely actions to be made in response to gasoline shortages. This finding is important because work trips are predictable and essential and because the urban transportation-planning process is driven principally by analyses of the journey to work. Nonwork travel is not as predictable in the response to the actions of transportation planners because of the discretionary and flexible nature of the trips; households can make trade-offs between discretionary trips and other goods. Actions that planners can take to directly affect work trips are the best understood and their effectiveness is easiest to forecast. Such actions would, therefore, have the greatest predictability of reducing gasoline consumption. Unfortunately, it is not possible to directly control gasoline sales for work trips alone (i.e., by either controls on availability or controls on price) because gasoline is purchased for all trip purposes. Other actions need to be taken.

A program of combined automobile disincentives and high-occupancy-vehicle (HOV) incentives is one approach that local and regional agencies can take to directly affect the journey to work. Automobile disincentives include the following:

1. Increase parking costs by increasing rates at municipal garages, imposing a parking tax, or eliminating discounts for all-day parking; and
2. Reduce parking availability by restricting the construction of new parking lots and garages, eliminating on-street parking (perhaps by using a neighborhood parking ban), and discouraging employers from providing free parking.

Potential HOV incentives include the following:

1. Improve the transit level of service by increasing the frequency of service and by reducing peak-period fares, and
2. Implement carpooling incentives by allowing parking privileges (such as reduced parking costs or preferential parking locations) and by emphasizing use of exclusive HOV lanes on freeways.

For these approaches to work, it is important that a combination of incentives and disincentives be implemented together. Hartgen (2) has noted that travelers must be presented with options to the automobile if gasoline saving is to be achieved. Placing disincentives on automobile work trips will not be sufficient, unless alternative means for traveling to work and incentives for their use are provided.

Alternative Work Schedules

Because the public is most reluctant to alter the automobile journey to work, it may be necessary to encourage, or possibly enforce, such approaches as flexible work hours or compressed work weeks. These actions can directly impact on work trips by (a) reducing the total number of automobile work trips and (b) expanding the peak period, thus reducing highway congestion (and improving energy efficiency) and crowding on transit—perhaps encouraging increased ridership.

Better Travel Information to the Public

Hartgen (2,14) has observed that energy-conserving travel will occur when the traveler is presented with alternative favorable travel options and incentives. The public, therefore, needs to know what its options are both in the event of a severe gasoline shortage and for longer-term conservation. Such information includes transit route schedules and maps, assistance in forming carpools, and accurate gasoline-supply information. Some researchers noted that some trips (particularly vacation trips) were foregone due to the uncertainty of gasoline availability. In order for travelers to conserve gasoline and still remain mobile, they must be provided with adequate information to make decisions.

Gasoline Supply and Consumption

The need for planners and decision makers to have accurate real-time information on both gasoline supply and the rate at which it is being consumed is essential. Frequent localized shortages require that more disaggregate information on national energy supplies be available, if the best decisions are to be made. Without such information, planners cannot know when to implement energy-conserving measures or how effective these actions are. Transit operators, for example, have been forced to measure the lines at service stations in order to determine how much additional service to provide.

It is not sufficient for local and regional planners to rely on gasoline-consumption data supplied by state sales tax records. This information is at best collected monthly, takes a long time to become available, and usually does not provide information for a precisely detailed area (e.g., gasoline wholesalers are typically licensed to sell anywhere within a state). The best approach would probably be to sample retail sales within an urban area. Data on both supply (gasoline in storage tanks) and consumption (from meter readings on gasoline pumps) could be collected. Witkowski and Taylor (24) call for a standardized measure of availability. This measure could be an index of supply related to population density.

Expansion of Transit Service

As noted above, the public generally has avoided changing travel modes. However, in those cities with large transit systems, there have been marked increases in ridership. In those specific markets there are many immediate actions that can be taken to increase capacity with current plants. These actions, defined by the American Public Transit Association (25), include longer peak-period service; maintenance of a reserve fleet; maintenance of resource, or stand-by, drivers; use of school buses for corridor or park-and-ride service; and maintenance of adequate fuel reserves. In funding transit actions that respond to gasoline shortages, it is important to note two things. First, the transit system has very limited capacity and probably will have the most influence in reducing gasoline consumption only in cities with the largest systems. Paratransit and other small-scale transit actions intended to solve the gasoline shortage are misguided at best and potentially harmful because they direct funds from more energy-efficient and cost-effective solutions. Second, it must be clear that the public will actually use the additional service. Running empty buses is not a solution to the gasoline shortage.

State-Level Short-Term Policy Implications

Two immediate actions that could be implemented by state governments, according to current research, are the enforcement of speed limits and state assistance for transit operating deficits. Although vehicle speed reduction was one of the first actions taken by the public to reduce gasoline consumption, enforcement of the 55-mph speed limit is still a problem on urban freeways, particularly in the West and Southwest. Vigorous enforcement, as well as public education on the efficiency of driving at lower speeds, may solve this problem. For those cities in which provision of additional peak-period transit service would result in reduced gasoline consumption, states should assist transit operators in paying for the additional operating and maintenance costs. This could be in the form of direct subsidy or through legislation to provide for an earmarked regional tax on fuel or other retail purchases.

Federal-Level Short-Term Implications

Major actions can be taken immediately and in the next few years by the U.S. Departments of Energy and Transportation and by the U.S. Congress. These actions can provide for both quick-response capability and continuous energy conservation.

The most important action that federal agencies can take is to support the actions implemented by local agencies. This support may take the form of

1. Guaranteeing adequate fuel deliveries to transit operators,
2. Allowing transit properties to build reserve fleets (the Urban Mass Transportation Administration now permits operators to retain buses they had previously intended to replace), and
3. Speeding up the grant-approval process.

Related to this is the encouragement of local energy-conserving actions. It must be recognized that many actors in the urban transportation-planning process still do not see energy conservation as a local or regional goal. It is common to have the reduction of energy conservation ranked a poor second to the primary goal of regional economic growth. A potential step toward correcting this

would be for the federal government to provide incentives for reducing energy consumption through the provision of additional funding to cities that reduce energy consumption the most. Of course, such an approach could be counterproductive because cities that are not reducing energy consumption probably would need more funding. Another approach would be to provide planning assistance and guidance in the form of agency staff and funding for consulting services to those cities without adequate staff support.

Research findings have also shown that many serious offsetting advantages and disadvantages to gasoline pricing and rationing exist. Therefore, no clear recommendation is made here. Yet, in terms of a quick-response capability, pricing has a clear advantage. The recently proposed 50-cent/gal federal gasoline tax could be implemented within weeks. A national rationing scheme, on the other hand, has been projected to take 18 months to implement. The income effects of pricing actions may reduce their effectiveness. There is strong evidence that increasing the price of gasoline will not reduce total consumption; rather, it will simply restructure the groups of people who use it. The bureaucracy involved in providing rebates to lower-income families would probably be as burdensome as that in a rationing program. The principal advantage of rationing is that it allows an a priori determination of how much gasoline will be consumed within a given period of time.

LONG-TERM POLICY IMPLICATIONS

Long-term transportation energy policy should be concerned more with the idea of conservation than with that of contingency planning. The emphasis should be on continuous planning for less-energy-intensive travel rather than on planning only for crisis-oriented travel and conservation. Some of the long-term actions suggested here refer to those that can be taken at the local, regional, state, and federal levels.

Local and Regional Implications

Witkowski and Taylor (24) argue that it is not possible to identify long-range planning actions based on observations of the 1973-1974 gasoline shortage because they were too short-term in nature. Recent research has shown, however, that travel behavior noted earlier continues to occur and that travelers are behaving in a rational manner. Thus, it should be possible to forecast behavior during future periods of reduced gasoline supply. Witkowski and Taylor advocate a more flexible approach to long-range planning, with each step allowing options to be taken that depend on gasoline supply and traveler response. Although this sort of incremental planning can be an important part of long-range planning, planners should recognize that there is still a role for large-scale capital investment for transit and for directing urban growth.

Nationally, travelers have avoided using transit, but there have been significant increases in ridership in the top 20 or so markets. Because transit can carry a large portion of travelers to activity centers and can help reduce energy-inefficient congestion on highways, the provision of additional service in these markets should be pursued. This includes both the purchase of new vehicles and the construction of new busways and rail lines.

Restructuring the pattern of land use to make trips shorter will reduce urban transportation energy consumption. Unfortunately, research findings show that changing the place of employment or residence is among the least desirable actions in response to gasoline shortages. Planners, thus, have to assume that current land use patterns will remain unchanged. There is the opportunity, however, to shape additional growth through zoning regulations and the construction of public services and facilities, such as schools, sewers, highways, and transit. Tied to transportation system development, a coordinated land use policy has been shown in theoretical research to result in significant energy savings (26).

State-Level Long-Term Policy Implications

There is some indication in the research findings that people are purchasing smaller automobiles in response to gasoline shortages. The states can accelerate this trend through vehicle registration fees that encourage the purchase of lighter-weight, more fuel-efficient automobiles.

Federal-Level Long-Term Policy Implications

At the federal level, the support of local actions, planning guidance, and the promotion of more energy-efficient travel would be steps in the right direction. For example, the purchase of additional transit vehicles and the construction of additional guideways in those markets to attract significant transit ridership will require massive federal funding.

Research indicates that, despite modest price increases, travelers will continue to consume whatever amount of gasoline is available. In the absence of a truly severe sales tax, rationing must continue to be considered because it allows for direct controls on the amount of gasoline consumed. Two important concerns still remain to be resolved, however: (a) the excessive bureaucracy required and the accompanying cost, delay, and lack of sensitivity to localized problems and (b) the inability to equitably allocate gasoline both within and between urban areas.

The research has also shown that, for the journey to work especially, the automobile will continue to remain the predominant mode of travel. Recognizing this, the federal government should continue to encourage the production of more-fuel-efficient automobiles, promote the development of electric vehicles, and promote the development of gasohol and synthetic fuel plants.

NEED FOR FURTHER RESEARCH

Perhaps the most important finding in recent studies of traveler response to gasoline shortages is that the transportation-planning profession needs to know more about how to plan under energy constraints. The federal government, particularly the U.S. Department of Transportation, can help by supporting additional studies of travel behavior and research on how this behavior will affect the transportation system and influence energy consumption. It is quite possible that some fundamental changes in the urban transportation-planning process will be required if travelers continue to react more strongly to gasoline availability than to price and continue to alter nonwork trips more frequently than work trips.

Some research in the area of travel behavior is currently under way. For example, the National Cooperative Highway Research Program is funding a study of methods to estimate changes in traveler behavior related to gasoline availability. Other avenues of research could include continuous longitudinal surveys of a fixed sample during periods of gasoline availability and price change. This could provide some insight as to the influences of pure price and pure supply, which, to date, have not been evaluated.

There has also been some progress in the development of the analytical tools to do long-range planning under energy constraints. The North Central Texas Council of Governments (27) has greatly refined the capabilities of urban transportation-planning systems programs that compute gasoline consumption on the highway network. Such a technique could be very helpful in evaluating small-scale transportation actions. In the area of modeling land use and energy relations, there has also been some progress. Mouchahoir and Nawrocki (28) have reviewed these efforts and have concluded that further model development and validation are needed. With these refinements, such models could provide useful guidance,

both for national policy and for application in specific urban areas.

A more fundamental direction for further research is the development of an urban transportation-planning process that reflects the major findings of recent traveler response to gasoline shortages. The process, which has evolved over the past 25 years, is based on the journey to work, travel time, and travel cost relations. Recent studies have shown, however, that gasoline saving is much more likely in nonwork trips and that the availability of gasoline, rather than price, is a primary determinant of travel behavior. A process that makes planners and decision makers more cognizant of this fact will result in more cost-effective and energy-efficient transportation investment and more equitable energy policies.

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REFERENCES

1. D. Roos. Efforts in National Contingency Planning for Transportation. Presented at 59th Annual Meeting, TRB, 1980.
2. D. T. Hartgen. Individual Travel Behavior Under Energy Constraints. Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 86, July 1975.
3. A. J. Neveu. The 1973-74 Energy Crisis Impact on Travel. Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 131, Dec. 1977.
4. S. D. Liff. Travelers' Attitudes and Energy Conservation. Proc., ASCE Conference on Transportation and Energy, Washington, DC, May 1978, pp. 89-110.
5. R. L. Peskin, J. L. Schofer, and P. R. Stopher. The Immediate Impact of Gasoline Shortages on Urban Travel Behavior. Federal Highway Administration, Final Rept., April 1975.
6. L. E. Skinner. The Effect of Energy Constraints on Travel Patterns: Gasoline Purchase Study. Federal Highway Administration, Final Rept., July 1975.
7. J. E. Sacco and H. M. Hajj. Impact of the Energy Shortage on Travel Patterns and Attitudes. TRB, Transportation Research Record 561, 1976, pp. 1-11.
8. B. W. Becker, D. J. Brown, and P. B. Schay. Behavior of Car Owners During the Gasoline Shortage. Traffic Quarterly, Vol. 30, No. 3, July 1976, pp. 469-483.
9. M. D. Stearns. The Social Impacts of the Energy Shortage: Behavioral and Attitude Shifts. Transportation Systems Center, Cambridge, MA, Rept. DOT-TSC-OST-75-36, Sept. 1975.
10. T. M. Corsi and M. E. Harvey. Travel Behavior Under Increases in Gasoline Prices. Traffic Quarterly, Vol. 31, No. 4, Oct. 1977, pp. 605-624.
11. W. C. Lee. The Demand for Travel and the Gasoline Crisis. Ph.D. dissertation, Univ. of California at Santa Barbara, 1976.
12. T. M. Corsi and M. E. Harvey. Changes in Vacation Travel in Response to Motor Fuel Shortages and Higher Prices. Journal of Travel Research, Sept. 1979, pp. 7-11.
13. E. J. Lessieu and A. Karvasarsky. Recent Observations on the Effect of Gasoline Price and Supply. In Better Use of Existing Transportation Facilities, TRB, Special Rept. 153, 1975, pp. 214-222.
14. D. T. Hartgen. Changes in Travel in Response to the 1979 Energy Crisis. Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 170, Dec. 1979.
15. L. P. Kostyniuk and W. W. Recker. Effect of a Gasoline Shortage on Acceptability of Modes for the Urban Grocery Shopping Trip. Journal of Environmental Systems, Vol. 6, No. 1, 1976-1977, pp. 1-30.
16. Opinion Research Corporation. Driving and Energy Conservation: Highlight Report, Volume 21. Federal Energy Administration, Rept. FEA/D-76/483, March 1976.
17. C. A. Keck. Effects of the Energy Shortage on Reported Household Travel Behavior Patterns in Small Urban Areas. In Changes in Individual Travel Behavior Patterns During the Energy Crisis, 1973-1974, Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 67, Aug. 1974.
18. R. E. Beglinger and J. Behnam. Effect of Energy Shortage and Land Use in Automobile Occupancy Rate. Urban Mass Transportation Administration, June 1975.
19. M. F. Trentacost and P. L. Milic. Changes in Automobile Occupancy Rates. In Changes in Individual Travel Behavior During the Energy Crisis, 1973-1974, Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 67, Aug. 1974.
20. C. E. Meyers. Factors Affecting Willingness to Conserve Gasoline. Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 167, July 1979.
21. M. Rappaport and P. Labaw; Opinion Research Corporation. Automobile Usage Patterns: Highlight Report, Volume 19. Federal Energy Administration, Rept. FEA/D-75-591, Sept. 1975.
22. A. J. Neveu. Public Opinion Survey on Energy and Transportation. Planning Research Unit, New York State Department of Transportation, Prelim. Res. Rept. 135, Dec. 1977.
23. Proceedings of the Urban Transportation Energy Contingency Planning Seminar. North Central Texas Council of Governments, Arlington, Tech. Rept. 26, Nov. 1979.
24. J. M. Witkowski and W. C. Taylor. Urban Transportation Planning Under Energy Constraints. Department of Civil Engineering, Michigan State University, East Lansing, Aug. 1978.
25. R. J. Hartman. Approaches to Energy Contingency Planning. Planning and Policy Committee, Energy Subcommittee, American Public Transit Association, Washington, DC, 1979.
26. R. L. Peskin and J. L. Schofer. The Impact of Urban Transportation and Land Use Policy on Transportation Energy Consumption. U.S. Department of Transportation, Final Rept., June 1977.
27. Motor Vehicle Fuel Consumption Estimation Procedures. North Central Texas Council of Governments, Arlington, Tech. Rept. 27, Dec. 1979.
28. G. E. Mouchahoir and R. Nawrocki. Transportation/Energy Analyses Methodologies. ITE Journal, Vol. 49, No. 12, Dec. 1979, pp. 28-34.