Energy Crisis. New York State Department of Transportation, Albany, Prelim. Res. Rept. 170, Dec. 1979.
8. A Metropolitan Transportation Plan for National Energy Contingencies. North Central Texas Council of Governments, Arlington, Aug. 1977.
9. K. Neels, M. D. Cheslow, R. F. Kirby, and G. E. Peterson. An Empirical Investigation of the Effects of Land Use on Urban Travel. The Urban Institute, Washington, DC, Working Paper 5049-17-1, Aug. 1977.
10. M. E. H. Lee and M. F. Glover. Use of Disaggregate Data to Evaluate Gasoline Conservation Policies: Smaller Cars and Carpooling. Michigan Department of State, Lansing, Dec. 1979.
11. Cambridge Systematics, Inc. Analysis of Motor Vehicle Ownership and Household Travel Patterns. Cambridge, MA, Vol. 1, June 1979.

Capacity of Urban Transit Systems to Respond to Energy Constraints

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If gasoline for private automobiles suddenly were no longer available in the quantities to which we have become accustomed, could mass transit systems in the United States absorb the great ridership increases that would inevitably result from such energy shortages?

In order to answer such a question, it is necessary to first examine the problem, its source, and its potential solutions.

The sources and origins of this potential crisis situation are almost too obvious to mention. The U.S. love affair with the automobile has been in full swing for more than 60 years and has become a near obsession over the past three decades. As recently as 1950, there was an average of less than 1.0 automobile/U.S. household. Today, in most parts of the country, that figure is in the range of 1.8-2.0 automobiles/household unit. In many of the more recently developed parts of the country, particularly in the Far West, it is not uncommon for entire communities to average well in excess of 2.0 automobiles/household. Consequently, people have been consuming fossil fuels at a furious rate, while domestic energy reserves have dwindled to alarming levels.

Accompanying this even greater reliance on the automobile has been a series of related results that have had equally detrimental effects on the U.S. energy situation. With the close of World War II, the purchase of a new automobile and a new home became the primary goals of the average U.S. family. Consequently, as housing developments boomed to accommodate this increased demand, residential development was designed with the automobile in mind. Access to public transportation became a secondary consideration as suburban sprawl attacked virtually every major metropolitan area in the country.

The pattern of U.S. growth had changed dramatically. During the first half of this century, it was not uncommon for public transit systems, streetcars, trolleys, and bus lines to be the driving forces behind the residential and commercial development of new communities across the country. In some cases, such as most of Los Angeles County, the mass transit system actually preceded much of the development by several years and, in fact, provided the impetus behind such growth patterns. Accessibility to a mass transit system became a primary consideration when people looked for places to live. Consequently, U.S. use of mass transit actually peaked in 1945 when the systems carried more than 23 billion passengers. From that point on, a steady decrease began in transit ridership that was inversely proportional to the steady increase in the number of private automobiles. Transit patronage finally bottomed out in 1972 when only about 6.5 billion passengers used the service.

Fortunately, since 1972, improved transit services—made possible by the conversion of floundering private bus companies to publicly subsidized operations and the increased availability of federal operating and capital funds—have substantially reversed the trends in transit ridership as significant patronage increases have been experienced in each of the last eight years. Still, mass transit looks forward to achieving the 10-billion passenger mark to which it still has yet to return.

Concurrent with the dramatic fall in transit ridership was an equally dramatic deterioration in the size and condition of the mass transit systems provided across the country. In 1945, almost 250 000 people were employed in the transit industry. By 1972, that figure had fallen to about 138 000; today, it is about 175 000. Of even greater concern is the overall number of transit vehicles available for the provision of transit service. Mass transit systems operate with a total of about 54 000 vehicles. That compares to about 88 000 vehicles that were in service during the late 1940s. Of even greater cause for alarm is the status of new bus construction for transit service. In the 1940s, there were nine major manufacturers of full-sized transit vehicles in the United States. Construction of new buses peaked at more than 12 000 in 1947. Today, the United States can claim only two active manufacturers of full-sized transit vehicles plus a handful of builders of mid- to small-sized buses. Construction of new vehicles in the United States in 1979 totaled less than 6000. Admittedly, that is a significant improvement over 1970 when only 1750 transit vehicles were constructed. However, that is still a long way from the 1940s.

Of equal significance, and perhaps of even greater concern, is the long wait encountered by public transportation systems desiring to buy new transit vehicles. Because of the limited construction capacities of today's manufacturers, coupled with the extensive federal requirements and procedures that must be complied with, it is not unusual for delivery dates to be in excess of 18-24 months after placement of a purchase order. The total procurement process today for a public transit system desiring to expand or improve the performance of its service could well exceed three years.

In order to fully understand the potential severity of the current situation, it is enlightening to look back on the only two experiences that the United States has had with energy-shortage situations that have created conditions severe enough to tax the performance of its mass transit services. From a transportation point of view, this century's first energy crisis was the result of the special resource demands of World War II. With military needs and long-term supplies largely unpredictable, the United States instituted a gasoline-rationing plan on a nationwide basis. Needless to say, use of mass transportation increased dramatically and steadily throughout the war years. The imposition of the rationing plan at that time, however, did not create extreme hardship situations for most citizens. After all, there were still more households without an automobile than with one. Nevertheless, use of private automobiles in those years declined dramatically as the number of transit-dependent individuals increased in direct proportion.

Fortunately, during the two decades prior to World War

II, the United States had built and operated large, efficient, privately run transit systems in most metropolitan areas. Although experiencing their most dramatic increase in ridership ever (48 percent between 1940 and 1945, representing 7.7 billion more riders per year), U.S. mass transit services became extremely crowded but were equal to the task.

In contrast to the apparent adequacy of mass transit to react to increased demands during World War II, the Middle East oil embargo in 1974 presented mass transit with a new challenge. When gasoline lines began to appear in early February of that year, millions of U.S. citizens turned to the much-neglected mass transit system as an alternative to waiting in lines for gasoline. At first, the increased transit patronage was an extremely welcome sight to most of the previously ignored public transit systems across the country. However, as the lines lengthened, near-panic conditions broke out in many parts of the country, and mild transit increases turned into a full-scale transit stampede. With their automobiles rendered useless, people reluctantly turned to the transit alternative for the first time. Mass transit systems were quickly overwhelmed. During February 1974, most urban operations experienced 30-50 percent increases over February 1973 ridership totals. On many routes, particularly suburban commuter services, ridership increases in excess of 100 percent were not uncommon. Transit systems began using every available vehicle to supplement regularly scheduled service. Nevertheless, the general public cried in outrage at not having enough transit seats available to meet their commuting needs. Clearly, mass transportation was not prepared to cope with such a situation. However, after 20 years of public neglect and general apathy, such conditions should not have been totally unexpected.

Almost as quickly as it came, the 1974 gasoline crisis subsided, and transportation habits across the country quickly returned to near normal. Some people attracted to mass transit during the crisis would, in fact, remain as regular transit riders. However, U.S. reliance on the automobile returned to its original intensity. Since 1974, many public transit systems have been greatly improved. The overall capacity of such systems, however, has not greatly increased. Therefore, the possibility of a repeat performance of the 1974 situation remains a distinct possibility (similar situations did in fact occur in April 1979 in selected portions of the country, particularly in southern California). Of greatest concern is the possible consequence of such a shortage--multiplied many times over in both severity and duration. In order to cope with such a possibility, it is important to take a look at the specific elements of the problem that must be addressed and the conditions and capabilities of various public transportation systems across the country to deal with an energy-crisis situation.

KEY ELEMENTS IN SOLVING THE PROBLEM

Perhaps the most important element in the solution to the problem of mass transit is the overall availability of vehicles. Past domestic production rates, particularly through the 1960s and early 1970s, have been clearly inadequate, if urban areas in the United States are to build mass transit services that can be reasonably expected to provide an acceptable alternative to the use of private automobiles during energy-crisis situations. Overall, it should also be remembered that reliance on the automobile must inevitably decrease in direct proportion to dwindling petroleum supplies worldwide. A current plan by the Urban Mass Transportation Administration to increase domestic new bus production to more than 10 000/year would appear to be a good start toward solving this problem. However, the two remaining domestic full-sized coach builders would appear to be unable to meet this goal with existing facilities, and current federal procedures and regulations on bus construction have served as a deterrent to the establishment of new manufacturers or to any expansion of existing providers. Realistically, the most optimistic estimate of 1980-1981 domestic bus production points to 7000-8000 units/year. This will clearly fall well below national demand as is evident from the 18- to 24-month delay in delivery experienced by transit systems that have recently placed orders for new vehicles.

Also, the cost of new buses has proven to be a severe deterrent of massive expansion of transportation systems. Although federal funding can now absorb 80 percent of the cost of a new bus, local authorities are still faced with heavy capital requirements, if substantial increases in fleet size are desired. A full-sized transit coach (47-51 passengers), as recently as 1974, could cost in the area of $45 000 -$48 000/unit. A full-sized advanced design transit bus today (with seating capacity normally reduced to 39-45 passengers because of federally mandated wheelchair provisions and new structural design features) could be expected to cost $120 000-$125 000/unit, if appropriately equipped to meet all federal guidelines. Manufacturers claim this 160 percent increase in price in just six years is justified by spiraling production costs, extensive research and development efforts, and a myriad of federal requirements, restrictions, and guidelines that have been imposed in recent years. Nevertheless, a capital burden of this magnitude has proven to be difficult for many local municipalities to absorb within recently strained budgets.

In order to cope with the vehicle-availability problem, many transit systems, which had previously planned on retiring substantial numbers of old deteriorating vehicles on delivery of newly purchased ones, have decided to retain the old relics for possible emergency use should an energy-crisis situation occur. Several systems have even begun an ambitious program of vehicle rehabilitation designed to restore many older vehicles to more acceptable working condition. Such programs have proven to be an effective means of increasing fleet size and potential system passenger capacity without undertaking extremely costly new bus purchase capital programs.

It should also be remembered that, even if additional vehicles become available, many systems do not have adequate maintenance and storage facilities to accommodate substantially greater numbers of vehicles. Consequently, expanded garage and facility programs must always be considered whenever substantial fleet expansion is contemplated.

Even if more buses are obtained and storage and maintenance facilities are expanded or modified to accommodate them, in order to provide the additional service needed to meet the increased demand, substantial increases in operating subsidies will be required. The cost of providing transit service today far outstrips the ability of the transit rider to pay for it through the farebox. Nationally, only about 40 percent of the costs of transit service is returned through the farebox. Increasing fares may be one solution to this problem. However, transit service has traditionally been most-heavily patronized by those elements of the population who can least afford high payments for such service. Therefore, other sources of local, state, and federal financing appear to be necessary. Current and future operating subsidies available through the Urban Mass Transportation Act appear to be an adequate start; however, such funding still leaves much of the cost to local and state bodies. Recent antitax movements across the country have not helped the situation. Sales, real estate, income, and gasoline taxes have all been levied by local and state authorities to generate enough revenue to maintain effective transit systems. These sources, however, have recently fallen short of the funding levels required to expand and improve transit services. Unfortunately, several referendums in the past year, designed to increase tax support for transit services, have been defeated by local citizens. If additional transit service is to become a reality, new sources of funding the operation must be found.

Finally, even if more buses are obtained, garages expanded, and additional operating subsidies secured, mass transit still may not solve the problems of an energy-crisis situation unless the attitudes and travel traditions of the U.S. public change significantly. It now seems clear that, until people decide to conform with the travel habits of the rest of the world, a mass transit problem will continue to exist. In the future, public transportation systems must be perceived as public services, the same as police and fire protection, garbage collection, and other services that must be supported by the entire community.

CURRENT CASE STUDIES

To analyze the potential ability of public transportation systems to respond to energy-constraint situations, several case studies of transit systems of varying sizes across the country are reviewed in this section.

Long Beach, California

Long Beach Transit (LBT) operates a fleet of 150 urban transit buses and attracts about 15 million patrons annually. LBT recently completed development of a comprehensive emergency energy contingency plan that outlines step-by-step procedures to follow should either a gasoline shortage dramatically increase ridership or the availability of diesel fuel require a cutback in the amount of transit service that can be provided. Development of the emergency plan was felt to be essential to LBT in light of its experiences in April 1979, when gasoline shortages suddenly produced dramatic ridership increases throughout the LBT system. Long Beach Transit has experienced a ridership increase in excess of 40 percent since 1978. Part of this increase can be attributed to energy concerns and related gasoline price increases. LBT has managed to accommodate ridership increases without dramatically increasing the size of its operating fleet by instituting a series of route and schedule modifications. The availability of previously unused seating capacity also permitted absorption of these additional riders.

Only a few years ago, it was LBT policy to try to guarantee a seat for every transit patron during both peak-hour and midday periods. This policy has now reluctantly been abandoned, inasmuch as LBT is now faced with the reality of transit demand in excess of seating capacity during several periods of the day. Unlike many systems, LBT does not experience substantial decreases in ridership during midday hours. Heavy patronage by senior citizens and downtown-bound shoppers traditionally has kept midday ridership at 70-80 percent of peak-hour level. LBT, consequently, has not had great numbers of vehicles available during midday hours that could be used in emergency situations to accommodate higher volumes of riders. The recent gasoline shortage quickly taxed LBT vehicles far beyond their capacity during rush-hour periods. Efforts by LBT at that time to encourage major employers in the area to stagger work hours met with only limited success. As a result, LBT now perceives across-the-board fleet expansion as its only viable means to accommodate increased ridership in the future. Toward that end, the recent purchase of 40 new advanced-design transit coaches, originally destined to serve as replacement vehicles, may well serve as a means of expanding the fleet instead. Several older coaches, originally destined for retirement and eventual sale, are now being placed in mothballs and might be reconditioned in order to improve the ability of LBT to accommodate substantial future increases in ridership.

A more severe problem than vehicle availability for LBT is garage-maintenance capacity. Currently, LBT is operating from a maintenance facility that has been declared wholly inadequate for the existing fleet. Fortunately, plans are well under way for the expansion of the existing facility and the creation of a new satellite maintenance operation. Even so, the new maintenance plans will be based on accommodation of up to 225 vehicles that may or may not be sufficient for future transit demands in the Long Beach area.

Overall, LBT currently appears to accommodate modest ridership increases (5-10 percent) over the next few years by adjusting schedules and routings and encouraging use during less-active periods of the day. However, peak-hour capacity seems to be nearing its maximum, and substantial increases (i.e., 20 percent over an extended period) could clearly not be accommodated.

Memphis, Tennessee

The Memphis Area Transit Authority (MATA) provides local and some regional transit service with an operating fleet of 285 vehicles. The MATA system attracts more than 20 million riders/year. MATA has recently completed the development of its own emergency energy plan designed to accommodate substantial increases in ridership with only moderate increases in vehicle requirement.

The plan outlined by MATA envisions the capability to accommodate ridership increases of 51-52 percent, if standees could be attracted on every route. This additional ridership could be accommodated through the use of a total fleet of about 300 vehicles, only a modest increase over the existing number of vehicles available. MATA officials admit, however, that their available capacity levels (up to 52 percent during peak periods) are somewhat misleading, primarily because of the current distribution of ridership on the MATA route system. The majority of the MATA patronage is currently concentrated on only eight local routes, while much of the remaining system is largely unused. This suggests that some of the less-popular routes are currently displaying capacity use of only 20-30 percent, while the more-popular routes are clearly in the area of 90-100 percent during peak periods. It is more logical to assume that, during an energy crisis situation, several portions of the MATA system could be pressured well beyond its operating capability. It is also important to note that the apparent MATA peak-hour seating availability also includes return-trip service on commuter routes that are difficult or impossible to use to their fullest potential. In a heavily commuter-oriented transit system, such as MATA, it is difficult to generate contraflow travel demand that would be necessary in order to improve trip use.

In order to best accommodate additional riders during emergency situations, MATA has assumed the use of staggered work hours in order to extend the peak-hour demand for transit service. Overall, MATA assumes the expansion of the rush-hour period to 3 h during both morning and afternoon periods.

Under an ultimate-demand situation, with all elements of the emergency energy plan in operation, MATA assumes that it would be able to accommodate a 62 percent increase in ridership during morning peak-hour periods and a 65 percent increase during afternoon peak-hour periods. Substantially greater percentage increases could be absorbed during midday and evening service hours. One problem that has not been confronted, however, is how to and who would pay for these additional hours of operation that would be required in order to accommodate the additional ridership. No emergency local funding provisions have as yet been developed.

Minneapolis-St. Paul

The Metropolitan Transit Commission (MTC) of the Twin-City area serves a population of about 1.5 million with a transit fleet of more than 1000 vehicles. In 1979, MTC attracted more than 63 million riders, the vast majority of them using the service during peak-hour periods for commuting purposes. Transit service has become very popular in the Twin-City area for home-to-work trips, but other trip purposes seem to be still generally reserved for the private automobile. Consequently, MTC peak-hour vehicle demands are almost four times as great as those during midday hours. This presents critical problems for transit providers during emergency situations when ridership may increase dramatically. Inevitably, during a true energy-crunch situation, demand for peak-hour transit service for commuting purposes will show the greatest increases. Consequently, during such a crisis, MTC would be forced to rely on staggered work hours in order to increase capacity to any degree at all.

An emergency energy plan was developed for the Twin-City area several years ago but has not been updated for quite some time. Recent overall ridership increases suggest that problems noted in the original energy plan may become more severe than originally anticipated. Currently, 12 percent of the MTC buses are already severely overcrowded or are filled beyond acceptable service standards during the peak hours. An overall ridership increase of only 5 percent could push another 15 percent of peak-hour trips beyond the maximum-capacity service standard level.

MTC has also considered retaining and rehabilitating some of the older vehicles in its fleet that had been scheduled for retirement and eventual sale; however, no extensive expansion of the operating fleet is contemplated at this time because of limited resources now available to subsidize the operating costs of the system. MTC hopes that, if an emergency situation occurs and ridership increases substantially, additional funding would become available from federal and/or local sources to accommodate the need for additional service. Again, however, no such plan for additional funding now exists.

Nashville, Tennessee

The Metropolitan Transit Authority (MTA) in Nashville maintains an active energy plan on an annual basis. Adjustments are made to accommodate the existing changes and special needs of the system from year to year. The MTA operates a fleet of 140 transit vehicles to transport 8-9 million transit riders annually. Nashville currently is confident that it could absorb a sudden ridership increase of about 36 percent during peak hours through the provision of additional service and the encouragement of staggered work hours by major employers in the area. No massive fleet expansion programs or facility improvements (which were just expanded and modernized a few years ago) are planned for the immediate future.

Although Nashville has experienced consistent ridership increases in recent years, it still feels comfortable with its ability to meet any demands that it can now foresee in the immediate future. Good cooperation from political leaders and the local population is an asset that Nashville will be able to rely on in making the necessary adjustments to accommodate future energy-crisis situations.

Baltimore, Maryland

The Mass Transit Administration (MTA) of Maryland operates what can best be described as a typical large eastern transit system in the Baltimore metropolitan area. The MTA operates a fleet of about 1030 transit vehicles and expects to carry almost 100 million passengers in 1980. This extremely heavy ridership creates considerable and, at times, severe overcrowding during peak-hour periods, as well as fairly heavy patronage on many routes throughout the entire day. Several of the more heavily traveled MTA routes may attract between 25 000 and 30 000 passengers during a typical weekday. Patronage is so heavy that several routes operate with 2- and 3-min headways (including one crosstown route).

Because of the heavy patronage now being experienced by the MTA, its planning department has devoted substantial time and effort to the development of an emergency energy contingency plan. The plan was deemed a necessity by the MTA following the near-crisis situation that developed during the 1974 oil embargo. At that time, the dramatic ridership increases experienced by the system (at one point 30 percent in one month) pushed the already-crowded peak-hour trips near the breaking point. Extra service was hurriedly implemented in a stop-gap fashion to try and alleviate some of the most difficult situations. Fortunately, the additional crowds subsided after a few weeks, and the system gradually returned to normal. Because of that experience, however, the MTA felt that it was imperative to develop a plan to most effectively accommodate an energy-crisis situation by using existing available resources.

Despite all their planning efforts, the MTA admits that its ability to provide for substantially greater numbers of riders with its existing fleet is limited at best. The current system is already so heavily used that an increase in ridership of only 1 percent during peak hours of operation would require almost 30 additional vehicles in order to maintain existing operating standards. With no massive fleet expansion contemplated in the immediate future, alternative means of providing for such additional ridership must be developed.

The Baltimore MTA is now in the process of constructing a rapid transit fixed-rail system for the heavily traveled northwest corridor of the city. Service is projected to begin in 1982, and it is hoped that much of the heavy peak-hour demand on the bus system there will be somewhat alleviated by the operation of the new rail system. However, an extensive feeder-bus network to provide service to the transit stations may well create an overall increase in the demand for transit vehicles rather than a net reduction. The new rapid transit system could eventually serve as a valuable tool in combating the effects of future energy-crisis conditions in that area of Baltimore.

In the short term, the MTA has developed several other measures in its emergency plan that are designed to help cope with future crises. Most are designed to improve vehicle use, such as encouraging staggered work hours, reducing the acceptable level of vehicle spares, and minimizing out-of-service time for each vehicle. Plans have been developed to provide for the additional hours of operating service that would be expected and for a recruitment and training program for additional transit operators.

No specific financial arrangements have been developed yet to accommodate the additional needs of an energy-crisis situation. However, as a department of the State of Maryland, it is anticipated that such future emergency needs could be met by emergency funds allocated through the state's general fund.

Missoula, Montana

In sharp contrast to the transit system operated by the MTA in Baltimore is the bus service provided by Missoula, Montana. The Mountain Line, as the service has been named, operates with a fleet of only 14 vehicles and is expected to carry between 400 000 and 500 000 passengers in 1980. Patronage has tripled since the service was begun less than three years ago. The Mountain Line serves a population of about 40 000.

Despite the difference in operating characteristics, Missoula exhibits similar problems to those of the Baltimore operation. Severe overcrowding is now experienced during certain portions of the day, especially during the winter months when driving in this area can become very difficult. Mountain Line officials report that the service is already operating well above capacity during peak periods of the day and project that any substantial increase in the demand for transit service in the Missoula area could probably not be fully met with existing Mountain Line resources.

Missoula has not developed an emergency energy plan for the transit system largely because they perceive that little could be done to cope with such problems. Because it has a population of less than 50 000, Missoula is not eligible for additional Urban Mass Transportation Administration funding through Sections 3, 5, or 8 of the Urban Mass Transportation Act, which would normally provide for capital, operating, and planning funds for urban transit systems. Missoula's only source of federal funding is Section 18 rural transit funds, allocated on a statewide basis and generally insufficient to meet even the existing transit financial needs of the state. For instance, should Missoula desire to purchase four new transit coaches to expand its fleet capacity, the cost of such vehicles (about $400 000) would almost exceed the entire Section 18 funding allotment for all of Montana for 1980. Consequently, with local funding support already at a comparatively high level, fleet expansion and/or service improvements cannot be contemplated because of financial limitations.

Duluth, Minnesota

Duluth has traditionally been known as a transit-oriented community. Its number of transit rides per capita annually exceeds that of just about every other city of comparable size in the country. Duluth is a city of about 100 000 people and occupies the banks of Lake Superior. Public transportation is provided by the Duluth Transit Authority (DTA), which operates a fleet of 98 transit coaches and attracts about 6 million transit riders annually. DTA also provides service for the adjoining city of Superior, Wisconsin.

DTA has developed an energy contingency plan primarily concerned with providing for fuel needs during shortage situations. It has not given much attention to assessing potential vehicle needs to accommodate substantial ridership increases. DTA currently has a very limited number of vehicles and maintains a very low spare ratio during peak hours of service. Peak-hour demand for commuter operations is extremely heavy and requires all serviceable vehicles now available to DTA to meet that demand. An assessment by DTA personnel noted that little or no additional ridership increase could be accommodated during peak hours of service. However, midday and evening operations have considerable available capacity. DTA could potentially encourage staggered work shifts in order to provide some additional overall system capacity.

Although currently receiving federal, state, and local funding for both capital and operating needs, DTA foresees little additional funding that could be used in emergency situations in order to supplement existing service. Additionally, no massive vehicle expansion is projected in the immediate future. In conclusion, DTA points out that additional service to be provided to accommodate substantial ridership increases would have to be operated with existing vehicles and paid for by additional farebox revenues.

Louisville, Kentucky

Louisville could well represent the typical mid-sized midwestern city. Serving a metropolitan area of about 750 000, the Transit Authority of River City (TARC) operates a fleet of 242 transit vehicles and expects to attract about 15 million riders in 1980. Although TARC has enjoyed steady ridership increases in the past several years, the system still appears capable of absorbing considerably greater numbers of riders in the future. Several years ago, civil disturbances in many portions of the community had a negative effect on transit ridership from which it is only now beginning to fully recover. Consequently, additional capacity does seem to be available on many of the more-popular TARC routes.

TARC has developed an emergency energy contingency plan in which it states that the current system could accommodate an additional 48 percent increase in ridership during peak hours and considerably greater numbers during non-peak hours by using existing resources. Consequently, TARC feels comfortable with the size of its existing service and feels capable of handling future emergency needs, at least during the early stages of such a crisis. TARC also appears capable of implementing new service, should it be necessary, and of financing such service expansion through a trust fund that is available to TARC.

Overall, TARC appears to be one of the more-capable transit systems in the country, given its ability to respond to substantial increases in demand that could result in an energy-crisis situation.

OVERALL ASSESSMENT

In reviewing conditions in the eight cities examined in this report, as well as in examining the literature concerning several dozen other metropolitan areas across the country, it would appear that the least-prepared mass transportation systems and those least able to cope with the demands of an energy problem situation are those operations in either very large metropolitan areas or in very small cities—but for very different reasons.

Large transit systems (those operating 500 vehicles or more) normally assume the responsibility for the provision of public transit service for extremely large masses of people. These systems often serve areas with populations of 1 million or more. The systems in such communities are, more often than not, already fine-tuned to operate at maximum efficiency and, therefore, minimize operating and capital expenditures. Most of these systems have little or no leverage as far as additional available vehicles and other resources needed to dramatically expand transit service operations are concerned. Available seating capacity during peak hours for such systems is almost universally nonexistent. Of even greater signficance, however, is the assessment of the overall potential demand that could be imposed on these transit operations. In some cases, a switch from the private automobile to reliance on public transportation by only 5 percent of the commuting population could mean a daily increase in ridership of 80 000 to 100 000 passengers, or more. Accommodation of such increases appears clearly beyond the existing capabilities of transit services in these communities. Massive increases in the number of vehicles available for service would have to be realized. Unfortunately, procurement and operation of these vehicles seem unlikely.

The very small transit systems serving the smaller communities across the country also appear to be faced with severe problems in dealing with energy-shortage-inspired ridership increases. Their problems, however, are more related to available facilities and the absolute size of the operation rather than to the absolute number of additional patrons. Although an energy-crisis situation in cities (e.g., Missoula, Montana; Columbus, Georgia; or Lima, Ohio) may actually result in an absolute daily increase in ridership of only 1500-2500 new riders, even these small volumes of passengers could not be accommodated because of the extremely limited capacity of existing transit services. Such systems often have less than 30 available vehicles with which to provide transit service for the entire community. Also, maintenance and servicing facilities are usually barely acceptable or already inadequate to meet the needs of the current service levels. These limited physical resources greatly restrict the amount of flexibility that would be needed to accommodate this additional ridership.

Those cities and transit systems that appear to be best able to cope with potential energy crisis situations are cities with populations of 250 000 to 750 000 that have built adequate comprehensive transit systems over the past 10 years. Such systems usually have between 100 and 400 transit vehicles available for service and, more often than not, seem to require only about 80 percent of their total fleet for the provision of current peak-hour service. Increases in ridership during emergency situations in such communities seem to be calculable on a percentage basis of existing ridership that could potentially be accommodated; however, in many cases, this could only be done with substantial difficulty through revision and supplementation of the existing service. Additional daily ridership increases of 10 000 to 20 000 passengers would appear to be a manageable situation for these communities. That, coupled with the apparent availability of federal and state funding (in contrast to many of the smaller operations noted above), also suggests that financing for additional service needed to meet this demand would also be more readily available.

Geographically, the West and Midwest appear to be in a generally better position to accommodate large numbers of new riders than the transit systems operated in the East, Northeast, and Deep South. The traditional poor response to mass transit services found throughout the Far West has permitted the development of several urban transit systems that have previously not been well patronized. Consequently, additional passenger capacity seems to exist on most Western systems. The general exception to this appears to be peak-hour service provided in Los Angeles and San Francisco. The problems associated with eastern, northeastern, and southern transit operations seem to relate to the extremely large numbers of transit-dependent riders that have dominated the operation of these services for several years. Because of these large numbers of transit-dependent riders, many services operating in communities in these parts of the country have been tailored to adequately meet those needs. However, during energy-crisis situations, the greatest increases in ridership would not come from these same well-served communities. Most probably, the greatest increases would be realized by the suburban commuter services. The 1974 gasoline-shortage experience seems to verify that conclusion.

WORKING TOWARD A SOLUTION

It can now be said that, in answer to the question posed at the beginning of this paper, current public transportation systems in the United States would not be able to adequately meet the demands imposed on it by possible future energy-crisis situations. Thus, we must look to what can be done to alleviate this problem.

Clearly, the development of an emergency energy contingency plan for every mass transit provider in the country is a necessity. All systems must be aware of the steps that can be taken to maximize use of their existing resources and to provide for the maximum number of riders possible. Fortunately, many systems across the country have already developed or are in the process of developing such plans. Hopefully, by the end of 1981, energy plans will be a standard part of the planning process of all mass transit systems.

Effective short- and long-range planning will also be a key element toward solving this potential problem. Short-range planning should be directed toward fine-tuning existing routes and schedules so as to meet existing demand in the most efficient and effective manner. Long-range planning should have the foresight to develop appropriate capital programs capable of expanding and maintaining operating fleets in a manner that will most effectively provide for additional service to meet future energy-crisis situations. Long-range plans should also include activities designed to encourage a smoother transition from the private automobile to public transportation so as to alleviate the impact of future energy shortages.

Finally, public awareness of this potential problem must be greatly enhanced. People must realize that their traditional travel patterns and habits may well not be compatible with the availability of future resources. Therefore, an overall program to educate the public more effectively in the area of energy consciousness would appear to be a key element in lessening or ultimately sidestepping future crisis situations.

OUTLOOK FOR THE FUTURE

Despite efforts now under way by urban transit systems to plan for the inevitable problems that will arise from future energy shortages, the overall impact of these situations, nevertheless, will be quite severe and, most likely, will cause extremely difficult times for the average U.S. commuter. Decades of personalized transportation provided by the private automobile have conditioned the United States into thinking that such ease and flexibility in transportation are inalienable rights. The realization that such convenience may no longer be feasible may be difficult for the average citizen to accept. The impact can be substantially lessened, however, if the transportation alternative—represented by the mass transit systems—is substantially upgraded and expanded to an appropriate level capable of absorbing these transition riders with only a minimum of growing pains. In order to accomplish this, planning, growth, and spending must be undertaken now at an unprecedented pace.

Our confrontation with this problem may actually be much closer than anyone expects. Surely, an interruption—even for a limited time—of the petroleum supplies from the Persian Gulf could trigger an energy-related chain reaction that could confront us with the problem in a matter of weeks. Hopefully, this confrontation will materialize more gradually, over a period of several years, which may permit us to adequately prepare for this inevitable occurrence. In either case, the fact remains that public transportation in the United States is not what it used to be and certainly not what it should be. Its overall ability to respond to major energy-constraint situations is only very limited at best and, more likely, wholly inadequate.

The transportation problems experienced by visitors to the 1980 Winter Olympics in Lake Placid, New York, may well have been a sneak preview of what may be experienced on a nationwide basis not too many years from now. If the United States cannot plan or provide for transportation services any more adequately than was done by the Olympic Committee, the same inconvenient and, at times, chaotic conditions that were experienced at the Olympic games may be imposed on an equally transit-dependent U.S. citizenry. To avoid such a situation, adequate measures should have begun yesterday.

Potential Roles for Auxiliary-Paratransit Services in an Energy Shortage

Charles Carlson and Mary P. McShane

There is a variety of specialized transportation services that can and should play an important role both in energy conservation and in the nation's response to future fuel shortages. Described here as auxiliary-paratransit services, these service types include dial-a-ride (DAR), subscription bus, jitney service, shared-ride taxi (SRT), vehicle rental-lease operations, school bus service, privately owned intercity bus operations, and limousine services.

Auxiliary-paratransit services may be open to the general public or they may be restricted to certain user groups (e.g., the elderly, the handicapped, and company employees). Fares and funding approaches vary; public subsidies may or may not be used to cover operating costs.

Auxiliary-paratransit services use a variety of vehicles that may be owned and operated by either public- or private-sector organizations (with or without union labor). These vehicles may include transit buses, over-the-road intercity coaches, school buses, taxis, vans, and regular passenger sedans and station wagons.

Finally, auxiliary-paratransit services may be subject to public regulation. Such regulation may encompass fares, service areas, routes, schedules, and market-entry requirements.

Paratransit modes have tended to be viewed as secondary services, modest in scale but with rather specialized application. The growth of paratransit has been hindered also by the existence of institutional and regulatory barriers, some of them explicitly intended to